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Competencies of Medical Teachers: An Empirical Study at Southern Medical University

WANG Fei

Doctor of Management

Supervisors:
PhD Álvaro Rosa, Associate Professor,
ISCTE University Institute of Lisbon
PhD XIA Weidong, Professor,
Florida International University College of Business

December, 2025

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Abstract

Objective: Medical teacher competency refers to the professional abilities and qualities demonstrated by instructors teaching medical courses, reflecting the deep-seated characteristics that distinguish exceptional educators. Existing evaluation models, often generic across disciplines, have blind spots for medical education, affecting its quality. The present study aims to develop a model to assess medical teachers' competencies.

Methods: Grounded in competency modeling theory, this study clarified competency concepts through a literature review, constructed a preliminary evaluation framework through semi-structured interviews with 6 faculty members and 8 students, and finalized the model using the Delphi method with 20 experts, resulting in a final model with 7 first-level indicators (professional ethics and conduct, professional competence, general teaching literacy, medical teaching literacy, communication and guiding ability, management ability, developmental ability) and 41 second-level indicators. Subsequently, for validation, a survey was conducted (1,140 distributed, 403 valid responses). Southern Medical University served as a case study to assess overall competency levels and model performance.

Results: The final model demonstrates good reliability, validity, and model fit. Differential analysis showed that having served as a leader in research projects has a positive impact on the professional level dimension, but it has no significant impact on other dimensions or overall teaching competence.

Keywords: Medical Education; Teacher; Competency Model; Empirical Research
JEL: I23, J24

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Resumo

Objetivo: Competência de ensino do professor de medicina refere-se às capacidades e qualidades profissionais demonstradas por instrutores que lecionam disciplinas médicas, representando características profundas que distinguem educadores excecionais. Os modelos de avaliação existentes, frequentemente genéricos entre disciplinas, são incompletos para aferição da competência no ensino da medicina. Este presente trabalho tem por objetivo a construção de um modelo para uma avaliação abrangente das competências necessárias para a formação médica.

Métodos: Fundamentado na teoria da modelação de competências, este estudo clarifica em primeiro lugar os conceitos de competências através de revisão da literatura, constrói um modelo preliminar por meio de entrevistas semiestruturadas a 6 docentes e 8 estudantes e finaliza o modelo utilizando o método Delphi com 20 peritos. Para a validação do modelo, usou-se o método de investigação por questionário, tendo sido distribuídos 1.140 questionários e recuperados 403 questionários válidos. O modelo resultante consiste em 7 indicadores de primeiro nível (Ética e conduta profissional, competência profissional, alfabetização geral de ensino, alfabetização médica de ensino, habilidade de comunicação e orientação, habilidade de gestão, habilidade de desenvolvimento) e 41 de segundo nível. A Universidade Médica do Sul, Cantão, serviu como estudo de caso para avaliar os níveis gerais de competência e o desempenho do modelo.

Resultados: O modelo apresenta bom desempenho tanto na validação externa como na fiabilidade. A análise de diferenças revela que a experiência em liderança de projetos de investigação científica apresenta um impacto positivo na dimensão de nível profissional, no entanto, sem impacto significativo nas demais dimensões e na competência geral.

Palavras-chave: Educação Médica; Professor; Modelo de Competências; Pesquisa Empírica
JEL: I23, J24

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摘　要

目的：医学类教师胜任力是指承担医学类课程的教师在教学过程中展现的职业能力与职业素养，是卓越医学类教师与普通工作者区分开的深层次特征。现行的医学类教师胜任力评价模式面向多种专业，对于医学教育存在一定的盲区，影响医学教育质量。本研究旨在构建医学类教师胜任力评价模型，为医学类教师胜任力量化评价提供依据。

方法：本研究以胜任力模型为理论基础，通过文献回顾，梳理医学类教师胜任力内涵；通过对6名教师，8名学生进行半结构式访谈，构建初步医学类教师胜任力评价模型框架；采用德尔菲法，邀请20位专家进行咨询，确立了7个一级指标（师德师风、专业水平、一般教学素养、医学教学素养、交流和引导能力、管理能力、发展能力），41个二级指标的胜任力模型；开展问卷研究（发放1140份，回收有效问卷403份），并以南方医科大学为例，检测医学类教师胜任力整体水平及模型表现。

结果：最终确立的模型的信度、效度较好，模型的拟合效度较好。差异性分析表明是否主持过科研项目，对专业水平有较大的正向影响，对其他胜任力维度和总体胜任力水平并无显著影响。

关键词：医学教育；教师；胜任力模型；实证研究

JEL: I23, J24

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Chapter 1: Introduction

The work of medical teachers is particularly complex because it involves the triple tasks of teaching, scientific research, and clinical practice. Competencies for medical teachers refer to the vocational abilities and professional qualities demonstrated by teachers during the teaching process and are deep-seated individual traits that distinguish exceptional workers from ordinary ones in the medical education field.

1.1 Innovative development strategy of medical education proposes new requirements on medical teachers

The vocational abilities of medical teachers include not only professional abilities such as medical knowledge, clinical skills, and scientific research capability, but also teaching abilities such as classroom organization, teaching reform, teacher-student communication, and teaching reflection (Antera, 2021). Moreover, medical teachers should not only have the mission of helping the world like doctors, but also have the noble character of teaching and educating others. The General Office of the State Council (2022) proposed to place medical education in an important position in relation to the prioritized development of education and the healthcare industry, and comprehensively improve the quality of personnel training in the *Guiding Opinions on Accelerating the Innovative Development of Medical Education* (Wang, 2021). First-class medical talents are inseparable from the training of first-class teachers, the cultivation of first-class culture and education, and the construction of first-class teaching and research platforms. In particular, the new concept of medical development, featuring a shift from disease-treatment orientation to health-promotion orientation, and the new orientation of medical education development as a “big national plan, big people’s livelihood, big discipline and big major” have put forward new requirements for medical teachers.

1.2 Evaluation of competencies for medical teachers is an inherent need to ensure the high-quality development of medical education

According to the *Opinions on Comprehensively Deepening the Reform of the Teacher Training*

in the New Era released in 2018, it clearly pointed out that teachers are the foundation of education as a great national project with lasting importance (CPC Central Committee and the State Council, 2018). We should comprehensively improve the quality of teachers in higher education and build a high-quality and innovative teaching team. The *General Plan for Deepening Education Evaluation Reform in the New Era,* released in 2020, emphasized the importance of reforming teacher evaluation and advancing the mission of imparting knowledge and educating people (CPC Central Committee and the State Council, 2020). How to conduct scientific and reasonable evaluation of teacher quality has been elevated from an industry demand to a national strategy. Medicine possesses the dual nature of the natural sciences and the humanities, which determines the unique characteristics of medical teachers in terms of their teaching philosophy, content, and methods. A scientific and systematic evaluation of medical teachers is a crucial means of guiding them to dedicate themselves to educating students and ensuring the quality of medical education.

1.3 Research on competency focuses on human resources management in the health industry

In 2010, The Lancet published the report of the Commission on Education of Health Professionals for the 21st Century titled "*Health professionals for a new century: transforming education to strengthen health systems in an interdependent world.*" This report proposed the latest reform direction for global medical education: a system-based, competency-oriented approach that emphasizes establishing a collaborative health service system integrating medical education and practice, with the aim of cultivating medical professionals with comprehensive qualities capable of providing public health services. The competency framework aptly reflects the current objectives of talent cultivation in medical education and directly and urgently identifies the competencies required of medical teachers. In recent years, there has been increasing emphasis on research into the competencies of health professionals, both domestically and internationally, and relatively mature competency models have been developed. With the rapid development of society and medicine, health professionals are not only required to possess extensive professional knowledge and skills but also to meet higher standards in professional ethics, professional qualities, psychological resilience, and interpersonal understanding. The introduction of competency theory has prompted a shift in human resource management from traditional models to a modern "competency-oriented" approach, advancing the evaluation and cultivation of talent to earlier stages (Jian, 2012).

With the comprehensive initiation of China's medical-educational coordinated development strategy, evaluation of competencies for medical teachers and relevant practical research have become increasingly important in the field of medical education (Moynihan et al., 2015). At present, there are still shortcomings in the construction of the competency evaluation system for medical teachers, especially in the formulation of evaluation indices, the allocation of weights, and quantitative evaluation, which require further improvement and in-depth exploration (Görlitz et al., 2015). The Onion Model is a competency model proposed by Boyatzis (1982). The competency model is divided into three layers: core competency, intermediate competency, and surface competency, like the layers of an onion. The deeper the layer, the more important the competency is and the more difficult it is to develop and evaluate (Korthagen, 2017). Therefore, this study aims to construct a competency evaluation system for medical teachers based on the competency model theory and to conduct an empirical study to improve the competencies and teaching quality of medical teachers and promote the continuous development of medical education.

With the reform and innovation of medical education and teaching, competency evaluation of medical teachers has an important impact on the quality and effectiveness of medical education. Medical teachers play a crucial role in training future medical practitioners and providing quality healthcare services. They need not only solid medical knowledge and clinical skills but also teaching, communication, mentoring, and evaluation skills.

At present, the dilemma of competency evaluation for medical teachers lies in the fact that the current evaluation model and indicators have certain blind spots, and the criteria are not sufficiently clear to comprehensively assess teachers' teaching ability, knowledge base, and practical experience (Srinivasan et al., 2011). The evaluation of medical teachers is not comprehensive and accurate enough, which can lead to misjudgment of teaching quality and adverse effects on students' development (Fernández & Manzi, 2022). In addition, inaccurate results of competency evaluation of medical teachers will also affect the direction and level of medical education development, thus directly affecting the quality and speed of medical profession development (Delvaux et al., 2013).

China's traditional competency evaluation system for university teachers has certain limitations in its functional orientation. Its evaluation objectives often focus on teachers' job promotions, professional title assessments, salary adjustments, and various award selections, while relatively neglecting attention to teachers' individual developmental strengths, potential capabilities, and career growth trajectories. This tendency may, in

practice, distort the means of evaluation into an end in itself, leading teachers to center their work around evaluation indicators and fall into a cycle of "working for evaluation." Over time, this not only risks putting the cart before the horse but may also constrain the overall improvement of teachers' professional abilities and teaching quality (Li & Xin, 2022). This deviation in evaluation orientation objectively weakens the emphasis on stimulating teachers' individual potential, cultivating their sense of social responsibility, and shaping their professional ethics and social conscience (Taylor & Tyler, 2012). In terms of evaluation content, the system generally places excessive emphasis on the quantity and level of research achievements, while paying insufficient attention to the systematic cultivation and continuous development of teachers' comprehensive abilities (Chen et al., 2023). Such imbalance can easily lead to a weakening of teachers' sense of social responsibility and educational mission. Consequently, some teachers may lack dedication and professionalism, as well as the motivation for innovation, perfunctorily handling teaching tasks and failing to effectively fulfill the social responsibilities and educational duties expected of university teachers (Chen et al., 2023; Torney-Purta et al., 2015).

Competency for medical teachers is a multidimensional concept involving medical knowledge, clinical skills, teaching ability, communication skills, mentoring ability, and evaluation ability. The evaluation indicators should not ignore the attitudes and values implied by the teachers and the complexity of the clinical medical teaching environment (Görlitz et al., 2015). With the continuous development of medical education and changes in clinical practice, the competency evaluation of medical teachers also needs to keep pace with the times to meet new teaching needs and requirements. Competency evaluation can help colleges select high-quality teaching resources in a targeted manner, improve teachers' practical skills, cultivate medical students' practical abilities, and achieve the purpose of training practice-oriented clinical talents (Nessipbayeva, 2012). In addition, competency evaluation can help teachers understand their own shortcomings, and education administrators can help teachers according to the evaluation results to further strengthen their moral cultivation and educational professionalism, so as to improve the quality of medical education and teaching as well as the quality of medical teachers (Bergsmann et al., 2015). By constructing and improving the job competency evaluation model for medical teachers, forming an evaluation index system, and clarifying job competency requirements, we can improve the quality of teaching in clinical medicine (Fan et al., 2023).

Retrieval of the literature shows that in 2010 there were 24,991 academic theses on

competency, of which only 96 were about competencies for medical teachers, accounting for 0.38% of the whole studies on competency; in 2023, there were 44,6873 academic theses on competency, of which only 670 were about competencies for medical teachers, accounting for 0.15% of the whole studies on competency. The percentages of studies on competencies for medical teachers show a year-by-year decline, which is inconsistent with the steadily increasing teaching needs of medical education.

Competency evaluation of medical teachers is an important part of promoting medical innovation, and it plays a demonstration and leading role. This study aims to address the dilemma of competency evaluation for medical teachers and provide feasible solutions that are significant for promoting medical innovation and improving the quality of medical talent and medical education (Cao et al., 2020).

Therefore, this study will be based on the competency model as the theoretical foundation and will examine the following two aspects:

First, by analyzing the domains of medical teachers' competency, a framework for evaluating their competency will be constructed;

Second, using Southern Medical University as the empirical research site, the overall level of medical teachers' competency at Southern Medical University and the performance of each competency dimension will be tested, and the current situation and differences in medical teachers' competency will be analyzed.

Thus, this study will provide competency evaluation tools and methods for the educational management departments of medical colleges to promote the continuous development of clinical medical education and improve teaching quality.

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Chapter 2: Literature Review

2.1 Medical education based on competency transmission

Teachers, curricula, and regulatory bodies in many countries have embraced competency-based medical education, yet the concept of medical competency itself has proven elusive and "fuzzy" (Ten, 2017a; Van Klink & Boon, 2003). Hodge (2014) demonstrates how the definition of competency can vary across different discourses. However, it is widely accepted that medical competencies must be defined to identify the content and extent of education needed to prepare a new generation of caregivers and determine who may or may not be licensed to practice medicine. Definitions such as "the habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individuals and communities served" are comprehensive and appealing but do not provide an adequate basis to determine when a trainee should be licensed for practice (Epstein & Hundert, 2002). Many attempts to define competence, competency, and competency-based education (Albanese et al., 2008; Gruppen et al., 2012; Harden, 1999; Morcke et al., 2013; Parent et al., 2013) have been criticized for being reductionist and failing to demonstrate the holistic nature of medical competence (Brooks, 2009; Glass, 2014; Grant, 1999; Hodges, 2010; Touchie & Ten, 2016; Whitehead et al., 2011). While the current discussion of what constitutes medical competence may be academically useful and important, it is not very productive for creating curricula and assessing medical trainees. The goal of medical education (to become a competent physician) must somehow be translated into activities that learners need to accomplish tomorrow, next month, or next year. The 2010 Carnegie Report on Medical Education proposed "standardized learning outcomes and personalized learning pathways" (Cooke, 2010; Irby et al., 2010). In addition, standardized educational outcomes must be reconciled with the understanding that ultimately no two practicing physicians are identical and that medical schools are not factories that "produce" identical graduates.

Detailed descriptions of behavioral competencies, such as the descriptions incorporated into the CANMEDS framework (Frank et al., 2015) or the ACGME Milestones Guidebook, may be interpreted as norms, but they actually leave room for individual differences, even if in

an implicit manner (Edgar, 2022). In postgraduate medical education, the term "competence" has taken on a normative meaning, namely, the minimum acceptable level of proficiency appropriate to the practice of medicine. In addition to denoting an intermediate stage of skill development, the concept of competence has a broader meaning. Competence can be high or low, and can be compatible or incompatible with practice. Proficiency, excellence, specialization, and deficiencies all refer to different levels of competence (Carraccio et al., 2008; Dreyfus & Stuart, 1988). However, teaching management needs to conceptualize competence in a way that enables teachers to set an actionable standard and requires graduates of all educational programs to abide by this standard, which is a fundamental principle of competency-based medical education (Carraccio et al., 2002; Frank et al., 2010; Van Melle et al., 2019), and acceptable individual differences are also allowed. Billett (2017, 2018) proposed the normative domain, the contextual domain, and the personal occupational knowledge domain (also known as the occupational competence domain or the specialized knowledge domain) in his elaboration of learning in the workplace, which includes three levels: (1) normative competency level, (2) contextual competency level, and (3) individualized competency level. All three levels make important and necessary contributions to healthcare competence, but they respond differently to standardized requirements and must therefore be assessed and evaluated differently. In addition, the three levels are conceptually hierarchical, but not exactly sequential. Level 1 competency is a must for Level 2 competency; Level 2 competency is a must for Level 3 competency, but can begin to be developed as early as possible. Normative competency can and should still be developed at some point in clinical education, when contextual competency plays a predominant role. Individualized competency may emerge early in a person's professional development but plays a predominant role only in the later period of development. However, distinguishing between these levels is useful and exerts influences on the definition of standards as well as assessment and education.

2.1.1 Level 1 competency: context-independent normative knowledge and skills

It is reasonable to expect that every doctor should master core medical knowledge, understand the general structure and function of the human body, as well as common pathologic mechanisms and treatment principles. About a century ago, obtaining a medical license was sufficient to practice medicine for life. However, in Western countries, a medical degree is now an intermediate step on the path to specialty training (Ten, 2014). Level 1 competency deals with basically unquestionable truths and can be referred to as "norms" (Billett, 2017; Ten & Billett, 2014). Norms (originated from the Ancient Greek κανων, or "reed stick" used to resolve

disputes over product dimensions in the marketplace (Vallejo, 2019); also refers to “rulers”, “measures”, and “guidelines”) are the core principles, rules, or standards that everyone should know. For doctors, “it is the knowledge that all practitioners should master” (Billett, 2017; Ten & Billett, 2014), independent of the context in which that knowledge is applied. The guideline of “incontrovertible truth” does not imply that all medical professionals must master all the biomedical knowledge, nor does it imply that the knowledge remains similar over time. Instead, it encompasses at least those elements that are necessary for a clear understanding of human physiology and pathology as well as the performance of evidence-based diagnosis and treatment. These are truths that are not dependent on any particular context. Although normative competencies are not sufficient for the practice of healthcare, they can be considered as the foundation.

In principle, all practitioners should possess these competencies and be ready to apply and maintain them (Baron & Coleman, 2023). Defining normative knowledge is not an easy task. For the individual doctor, the normative knowledge and skills required are generally mastered early in life, but after they obtain practice certification, there may be more requirements on the knowledge and skills. Therefore, the application of medical practice standards should not only include the knowledge and skills required for licensure to practice medicine, as detailed in national standards, but also take into account the scope of practice to develop specialty-specific standards. Normative competency must also be defined in the context of an era. Knowledge that was considered normative a century ago is not always normative today. The normative knowledge system should be updated periodically, not only because new knowledge is constantly being added, but also because the given normative knowledge may become less useful over time. While biomedical knowledge is the first thing that comes to mind when considering normative knowledge, it can be argued that other knowledge, such as core professional norms and values that are non-negotiable (think of the Hippocratic Oath and its derivatives) or knowledge about the social determinants of health, also belongs to this level. In other words, this knowledge is “what every doctor should know”, independent of any context.

2.1.2 Level 2 competency: contextually relevant knowledge and skills

Standard competencies are necessary but not sufficient to obtain a license to practice medicine. Medical practice requires adaptations to the practice environment, colleagues, local customs and protocols, and specific patient groups (for example, urban and rural patients), as well as the acquisition of additional knowledge and skills (Ten et al., 2010). Adaptation can be on a large scale (for example, after a substantial transition to a very different environment or country) or

on a small scale (working with new colleagues, equipment, protocols, or with patients of different backgrounds). Billett (2017) refers to this as the contextual domain of occupational knowledge. While knowledge is important, this domain must be understood to be a broad one, encompassing both declarative knowledge (knowing what it is) and procedural knowledge (knowing how to do it), with the latter being particularly prominent in Level 2 competency. In addition, interaction with the context creates the conditions for the formation of attitudes. If competency includes knowledge, skills, and attitudes, Level 2 competency will be more dependent on behavioral and attitudinal standards than Level 1 competency. To function adequately in different environments, it is necessary to have not only the skills but also the willingness to adapt to the environment. When assessing whether the trainees and professionals have appropriate practice competencies, professional and humanistic behavioral norms should include not only skills but also habits, dispositions, and willingness (Cruess, 2008; Lee et al., 2016).

Taking on significant healthcare responsibilities often requires Level 1 and Level 2 competencies, which require integrity, pro-activity, reliability, and humility. These traits are summarized from research on, and the definition of, the conditions for commissioning critical healthcare tasks (Ten & Chen, 2020). Bates et al. (2016, 2019) further explored contextual competencies and explained how patterns determined by patients, the physical environment, clinical practice, educational practice, institutions, community and culture, and the geographical environment shape the contexts. They noted that standardization of outcomes, while attractive in terms of accountability, has the potential to oversimplify the complexity of competencies, and thus may create a false sense of security about competencies for graduates. This is because, to some extent, competencies are inextricably linked to the context in which they are formed (Bates et al., 2019). This inseparability is a typical feature of Level 2 competency. They argue that the development of contextual competency, for example, when transferred to a new hospital, occurs in a hierarchy and sequence of need fulfillment, namely, physiological needs, practical needs, legitimacy and belonging, pride and autonomy, which is similar to Maslow's (1943) hierarchy of needs (Teunissen et al., 2021). In 1978, McGaghie et al. (1978) also defined competency-based medical education outcome as "health professionals who are able to practice medicine at a defined level of competency to meet local needs in accordance with local conditions". Clearly, contextual competency is included in its objectives.

2.1.3 Level 3 competency: personalized knowledge, skills, interests, habits and beliefs

Billett (2017) argues that comprehension ability is integral to the third dimension of what he

calls the “personal domain of professional competency”. However, Bates and Ellaway (2016) contend that an individual’s motivation, prior learning, emotions and cultural background should be included in the “context” (namely, the second level). In addition, the personalized domain is a distinct and separate dimension of competency that requires different approaches to assessment. Individual differences among professionals are common, even if they meet similar standards of competency in both Level 1 and Level 2 competencies.

The constructivist view of education holds that learning new knowledge must build on existing knowledge to be meaningful (Schunk, 2011). The core idea of constructivism is that during the learning process, humans actively construct knowledge structures and new knowledge needs to be based on prior learning. This makes learners and professionals unique. No two persons have similar cognitive structures or knowledge bases simply because they have different prior learning experiences. They have knowledge formed ontologically (i.e., through their history) that is dependent on personal experience, mediated through sensory, neural, and cognitive systems, and interactive with the social environment (Billett, 2017). For example, learning in the clinical workplace relies heavily on what Billett (2014) refers to as imitative learning, which involves observing, imitating, and rehearsing through interaction with the work environment. In clinical education, what different learners experience, observe, perceive, learn from others, learn from mistakes, and absorb is unique to each learner (Martin et al., 2023). On this basis, different professional personalities and unique behaviors are formed. For example, Apramian et al. (2015, 2018, 2021) emphasized that surgeons differ in standard surgical procedures and have their own surgical preferences. Surgical trainees must observe the preferences of these attending physicians and develop their own surgical habits. They must learn to distinguish between nonnegotiable surgical principles and negotiable surgical preferences (Apramian et al., 2015).

The Level 3 competency is generated when surgeons develop their own style after completing their training and apply their own methods in accordance with the surgical norms and the context of the time. A deeper understanding of this process can be gained from the different but related theoretical perspectives such as construction of Perezhivanie, cognitive load theory, self-determination theory, and Maslow’s theory of motivation. One of the founders of social constructionism, Lev Vygotsky, has studied the term “perezhivanie” in depth, which is difficult to translate from Russian, but is close to the meaning of life experience. A more detailed explanation can be obtained from the description of Veresov (2017) and Gonzalez-Rey (2016) of subjectivity. It makes an individual’s creative performance unique, and is the result of a combination of cognitive and affective experiences that last throughout an individual’s life,

are retained in long-term memory, and become the individual's frame of reference to view the world. Experience, emotion, and subjectivity are often referred to as the basic elements of Perezhivanie. Lev Vygotsky emphasized that artists generally achieve excellence through mastery of artistic skills (Smagorinsky, 2011), suggesting that individuals must possess a set of fundamental skills before they can make artistic achievements.

Just as artistic painting, theatrical performance, novel writing, and musical expression apply to restaurant chefs, industrial designers, and architects, one's personal experiences and emotions determine the ways in which his or her abilities are manifested in actions and behaviors, and it is also applicable to the art of patient care. Lev Vygotsky explores excellence in the arts, but "excellence" is a much broader concept (Mok, 2017). Lev Vygotsky is a student of Pavlov who views teaching as a mechanical and extrinsic process, while Lev Vygotsky proposes an opposite psychology of learning that focuses on personal development, including personal emotions and experiences (Rieber & Carton, 1999). Lev Vygotsky argues that every concept contains some remnant of an individual's emotional relationship to the aspect of reality he or she represents (Mok, 2017), which indicates that cognition alone is insufficient to explain behavior. The combination of emotion and relation shapes individuality (or subjectivity in Perezhivanie's terminology), and experience continually adds to this subjectivity. As explained by Gonzalez-Rey et al. (2016), once cognitive and intellectual processes are integrated into subjective configurations, they become motivational devices that lead to further actions and new experiences. This sounds very theoretical, but an example may help understand it. A clinician with a good knowledge base, for example, may experience an adverse event in their care of a patient, which can lead to strong emotions and shape a personal style in subsequent clinical judgment and practice (Helo & Moulton, 2017). In any profession, similar subjective experiences may shape personal style. Cognitive load theory presents a different perspective. The cognitive resources required to acquire knowledge and skills are often huge and remain so in the early years of practice. Newly licensed physicians and junior specialty attending physicians are known to have high workloads (Ten & Favier, 2022), because they lack the automaticity to think and act efficiently. Once this automaticity is achieved through repeated, intentional practice, cognitive resources can be used for more individualized professional practice (Leung et al., 2012). In technical terms, when the relevant load required for learning is reduced, there is more room for the intrinsic load required for performance (Sewell et al., 2019).

Level 3 competency is also related to motivation, satisfaction, and enjoyment. Self-determination theory suggests that satisfying needs such as a sense of competence, a sense of personal choice and autonomy, and a sense of trusting connection with others stimulates

intrinsic motivation (Ryan & Molle, 2017; Ryan & Deci, 2000). In patient care, the state of practice requires competency as the foundation, and this competency does not exist when the learner has not yet reached a minimum level of required capability, has not yet gained a minimum level of permission to be autonomous, and has not yet become part of a community with basic mutual trust. However, when these conditions are met, the rewards can be great. Maslow (1943) suggests that self-actualization or the realization of one's potential is a state of peak experience that is reached after other needs (physiological needs, safety needs, love and belonging, self-esteem, competence, and aesthetics) have been met (McLeod, 2024).

These theoretical foundations support the concepts of both individualized performance and high-level performance inherent in the individual that go beyond the general standards that should be met by every professional in a community of similar physicians or specialists. Indeed, as self-determination theory suggests, individuals prefer to do what they are good at to fulfill their intrinsic need for sensory competence (Ryan, 2017). In the majority of the education and training for Level 1 and Level 2 competencies, efforts are directed toward correcting deficiencies related to the standards, while in Level 3 competency, the direction of efforts shifts toward pursuing higher levels of competency in areas in which one is already relatively good at. Level 3 competency is typically characterized by satisfaction based on mastery rather than correction of deficiencies. The focus on learning is no longer on meeting external standards, but on the desire to meet and improve personal standards. Level 3 competency can be understood as the art of personalizing practice. While some may question the qualifications of this level of competency as an "art", it is an expression of the personal charisma that senior professionals add to standard practice. It goes beyond the traditional sense of competency, as it is personalized and enhances the quality of work. The art of medicine (along with the science of medicine) is an old term that has never been completely abandoned (Cameron & Pimlott, 2015). It highlights the intrinsic value of diversity, and allows professionals to express their views and beliefs in their clinical work in a personal, subjective way. These views and beliefs are established based on their life experience, or as Lev Vygotsky puts it, on their perezhivanie. The diversity discussed here goes beyond the diversity pursuit of valuing underrepresented social groups (Deville, 2020).

2.1.4 Application and evaluation of competencies at all levels

The significance of differentiating between the three levels of competencies lies in identifying the criteria for each level and the assessment. In a competency-based model, completion of a fixed number of training hours should not be the main reason for a student's graduation;

therefore, adequate assessment of competencies becomes even more important (Gruppen et al., 2018). Unlike many other fields, assessment of competencies in the health professions serves two purposes. One is to demonstrate whether the student has met the goal of completing his or her studies; the other is to issue a license to practice. Legally speaking, it is designed to protect the public from errors and malpractice; positively, it is designed to provide the public with the highest quality of health care. This dichotomy (qualification to obtain an academic diploma versus preparation for patient care practice) reflects both retrospective and prospective perspectives on the decision to complete training (Ten et al., 2021). Its influences on the standards and assessments related to the three levels of competencies are examined. The utility formula is assessed in terms of reliability, validity, educational impact, acceptability, and cost (Van Der Vleuten, 1996). The normative knowledge and skills, as components of competencies, have been well explained, particularly through standardized tests of knowledge and skills (Level 1) from the 1970s to the 1990s (Schuwirth & Van Der Vleuten, 2020).

Since 2000, workplace-based assessment (WBA) aligned with Level 2 competencies has been increasingly examined using this formula, with methods including direct observation, case-based discussions, objective structured assessments of technical skills, and multi-source feedback (Holmboe & Hawkins, 2008; Setna et al., 2010). More recently, a shift can be seen in the decision to commission clinical tasks (Kelleher et al., 2020; Liebert et al., 2022; Sandhu et al., 2018), and ways to optimize their acceptability and cost are being explored (Marty et al., 2023). If the aim is to commission healthcare tasks, the commission decisions should lead to increased responsibility within the healthcare team, which is a potentially powerful motivator for learning. There will be an impact on education if the commission decision does not have real consequences (Ott et al., 2022; Ten & Jarrett, 2023). Assessment of Level 3 competency is different from that of other levels, because it varies from person to person, with no universal standards, and many utility formulas are not applicable. However, achieving excellence in a chosen area of expertise, even if not formally recognized, can create a powerful developmental impetus to maintain or further expand one's recognized professional skills. This educational influence is highly acceptable, and individuals may be willing to make the effort to achieve it.

The licensing of physicians requires an assessment of their normative competency (primarily in terms of knowledge). The assessment should conform to context-independent standards and methods well conceptualized in the first three levels of Miller's pyramid ("knows", "knows how", and "shows how"), and written tests, online tests, and skills tests should be administered in standardized, often simulated environments (Miller, 1990). Assessment of this level of competency can basically be conducted outside of the healthcare

setting and can be independent of any context and unique characteristics of the individual being assessed, so as to maximize objectivity. The assessment should reflect regularly updated standards to match the development of basic norms of medical knowledge, especially at the graduate level.

The context-dependent level of competency draws heavily on the workplace-based assessment (WBA), because the workplace is the context. The WBA approach has received a great deal of attention and made significant strides over the past 20 years (Holmboe & Hawkins, 2008), but it also has psychometric problems. While workplace validity is strong from a veracity perspective, it is difficult to meet traditional reliability standards (Zaidi et al., 2018). However, unlike standard competencies, assessment of contextual competencies cannot be standardized, meaning that the assessment cannot be generalized and promoted across different contexts. Scoring trainee students for the purpose of ranking them (ranking is inherent in traditional reliability theory) is increasingly recognized as flawed (Bullock et al., 2019; Hauer & Lucey, 2019), so schools have decided to gradually substitute ranking with a simple "pass/fail" (Hanson et al., 2013). In addition, in WBA, the focus has shifted from establishing high reliability and universality to evaluating expert judgment (Schuwirth & Van Der Vleuten, 2020). Clinicians, as experts, can assess whether trainees and professionals are performing well in local settings by asking the following questions. Can they apply what they have learned in our context? Do they perform well within existing teams? Do they know how and when to use local protocols? Do they follow local rules and procedures? As the situation is constantly changing, the criteria for such contextual competency are not easily defined, and we cannot use standardized conditions for assessment. Instead, clinical supervisors can build an idea in their minds about the trainee's readiness for practicum.

Despite the fact that patients, the public, licensing agencies, and accrediting institutions all want to know which physicians are "the best" in practice (not just on written exams), there is a lack of reliability in WBA among the trainees even within the same hospital, not to mention across institutions, jurisdictions, and countries (Govaerts & Van Der Vleuten, 2013; Mcgill et al., 2011). As an example, Crossley (2013) explains that my judgments about the trainee's performance are always highly meaningful based on my understanding of how he or she performs when dealing with a particular patient or client, or a particular problem, in a particular setting. This demonstrates, to a large extent, my trainee's response to the particularities of the patient, the problem, and the environment, and also displays my rigor, values, and biases. All these are worth exploration and discussion. However, another question is equally important. Does this judgment have any relevance to my judgment of the same trainee in a completely

different context, or any other people's judgment of the same trainee in any context? While experts vary in their judgments, this "subjectivity" in competency assessment is not necessarily a disadvantage (Ten & Regehr, 2019). This is because traditional competency scales may force raters to discard important personal judgments when their judgments do not meet the scoring criteria.

Ideally, WBA should retain subjectivity or "meaningful specificity" (Gingerich et al., 2014), while discarding unnecessary bias (Cate, 2022). WBA should capture reasonable subjectivity or merge the judgments of multiple experts (Hauer et al., 2021; Smit et al., 2019). For example, in the case of a clinical competency committee, subjective consensus must be ussed to make defensible decisions. The collective decisions do not need to consider the grades on the scale, as the inherent purpose is to grade the learners, and the focus can be put on preparation for healthcare action. Delegated decision-making is often aligned with the assessment of Level 2 competencies (Ten, 2016; Ten et al., 2016). Summative delegated decision-making exerts an important influence on both patient safety and learner progress and typically focuses on thresholds such as readiness for unsupervised practice (in postgraduate contexts) or readiness for indirect supervision (in the case of medical students) (Touchie et al., 2021), rather than on ranking learners.

While the stakes in Level competency assessment are often dependent on learner progress, patient protection is also a key component in Level 2 competency assessment. Thus, in Level 2, "high-stakes decision-making" has different and broader domains, which is a prospective judgment that must include an estimate of the risk to patient safety (Schumacher et al., 2022). Delegated decisions must be based on factors other than technical skills (Ten, 2017b). Ten Cate and Chen (2020) suggest that in addition to competency (activity-specific knowledge, skills and experience, and adaptive expertise), there are four related general characteristics: integrity (honesty, goodwill, and patient-centeredness); dependability (conscientiousness, predictability, accountability, and responsibility); humility (compliance with restrictions, willingness to ask for help, and acceptance of feedback); and initiative (confidence, proactive approach to work, team, safety, and self-regulation). This set of characteristics requires the observer to be thoughtful in dialogue with the trainees and coordinate with the clinical education team to reach subjective judgments and decisions.

Delegated patient care tasks require a more comprehensive picture than the rating scales can provide. For example, in some cases, humility is a key characteristic, while in other cases, initiative is more important. Level 2 competencies are usually a requirement for adaptation to the environment. The assessment of the ability to adapt to new healthcare settings has not been

extensively studied, but there are promising examples (Gamborg et al., 2022; Kalet et al., 2017; Wijnen-Meijer et al., 2013) and theoretical insights occurring (Cheung & Kulasegaram, 2022; Pelgrim et al., 2022). The binary delegated decision ("yes" or "no") is an integrative decision that combines assessment of competency, measurement of risk, and conferral of autonomy, and can only be made by a reviewer who knows the learner and has the authority to care for the patient in relevant situations (Ten, 2016). Therefore, the information that determines the decision combines contextual and learner characteristics (Hauer et al., 2014). All characteristics can be weighed, but there is no formula that predicts the outcome of the decision.

The Level 3 competency assessment involves individualized knowledge, interests, skills, habits, and beliefs. It can be called the art of medicine, and it focuses on performance beyond the standards that a trainee or physician must meet to practice. At this level, variations in competency occur, which arguably should all be acceptable and render the definition of external standards at Level 3 futile. The external standards that protect the quality and safety of care belong to Level 1 and Level 2. It does not mean that everyone in development must be treated as equal apart from these standards. Ericsson's (2006) theoretical model of professional skills development distinguishes between professionals whose level of automated performance can be maintained at an acceptable level, and those who are constantly seeking increasing complexity and higher levels of control. The former exhibit "stagnant development" while the latter achieve high levels of mastery and expertise. Although Ericsson's model is a unidirectional progressive development model, the development of Level 3 competencies can also be related to new areas of further development. This also illustrates how the continued development of this level of competency can shape an individualized professional identity with a personal epistemology.

Although the development of competencies is not equivalent to identity formation, the two cannot be completely separated (Jarvis-Selinger et al., 2012). Particularly in Level 3, the competency may affect awareness of identity, and identity shapes the dynamics of competency development. The question then arises. How can excellence or valued distinctiveness be assessed if external criteria do not apply to Level 3 competencies? First, it is important to recognize that those who observe and interact with a professional will be directly or indirectly influenced by that person. In other words, the context is shaped by both the individual being assessed and others who establish the context. The objectivity of criteria determined by the local context, even at Level 2, is inherently complex if the trainee is a member of a team that jointly shapes that context (Billett, 2011; Martin et al., 2023). Consequently, the environment certainly does not provide any universally meaningful criteria for Level 3 assessment.

Establishing effective assessment criteria at Level 3, other than recognized work standards, is not an easy task. When personal development goes beyond the minimum requirements of all professionals, rises to the unique potential of the individual, and then becomes a Dreyfus model followed by experts (Carraccio et al., 2008; Dreyfus, 2004), or achieves Ericsson (2006)'s excellence after deliberate practice, it all falls into this field. General surgeons interested in cardiothoracic surgery may specialize and further focus all their efforts on pediatric cardiac surgery. If deliberate practice is consistently devoted to small areas, then other areas of general surgery may remain at an acceptable level. The narrower the field of advanced expertise, the more unique the experts are, to the point where it would be pointless to develop any standards that could be developed and evaluated by a very small group of experts who might be unable to reach a consensus.

While defining and measuring according to standards is futile, recognizing excellence is not impossible. Unlike sports, where superiority comes from ranking and competition, medical professionals are unlikely to engage in a race between experts to see who wins. However, individuals observing and interacting with professionals can still be impressed with their superiority (or lack of superiority) from their own perspectives. All methods used to explain the impact are considered a complete rationalization of unconscious processes (Rey, 2016). Appreciation and judgment may be emotional to some extent, which is not always easy to express in words or scores (Van Enk & Ten, 2020). One way of evaluating excellence is to assess the efforts made by professionals to optimize performance. At this level, the question about standards is not "Is the individual prepared to conduct business in an unsupervised or autonomous manner?", but rather "Is the individual able and willing to pursue individual excellence?" (Richardson et al., 2021). This level of personalized competency can be demonstrated in interactions with colleagues and learners who can explain what and why they do it ("In my experience, X is the best"), led by example ("See how I do it") , and solve problems in a creative and unique manner by treating Level 3 as an art (Weisberg, 2006). It involves conscious choices of action within acceptable practice variation. These choices may be tenable from the perspective of evidence, personal experience, or even beliefs based on intuitions that may be unfamiliar to other professionals. Billett (2017) explains how personal limitations can guide choices in practice (for example, a hairdresser with specific allergies using alternative products). In other words, individualized domains of competency can draw on an individual's strengths and incorporate individual limits to determine the scope and approach of an individual's practice.

The need for autonomous development and self-determination conflicts with reliance on

others' standards (Ten, 2013), and this is particularly true of Level 3 competencies. At this stage of development, it is necessary to set (and be able to defend) one's own standards in addition to those set by patients, peers, and accrediting institutions. Level 1 and Level 2 focus on correcting deficiencies in order to meet external standards, while Level 3 focuses on personal development, so as to excel in a chosen area. In this level of competency, assessment of individuals should focus on developing and recognizing strengths, limitations, beliefs, and creative flexibility in practice. Professionals can achieve excellent development by coordinating practice requirements with personal characteristics. Although assessment is not easy, the environment (colleagues, patients, and employers, namely, natural observers in a natural setting) can identify and value the ways in which the individual has developed and continues to develop in whatever needs to be done to achieve this individualized personal excellence.

Personal accomplishments, as reflected in a portfolio or resume, may help to demonstrate this pursuit. At this level, teachers should motivate, and learners should engage in self-reflection to set their own goals and paths for further growth, rather than having goals and standards set externally. The three-level competency framework is not new (Billett, 2017; Billett et al., 2018), but has not been well articulated in the health profession. The traditional "knowledge-skill-attitude" distinction is not consistent with the hierarchical nature of the model (Bloom, 1956), but the competency-level framework does relate to the conceptualization of the trilogy of "knowledge", "action" and "being" as educational outcomes. Recent internship programs in Ireland have been based on this trilogy (Cameron & Birkett, 2020; Offiah, 2023; Slattery, 2022). The framework helps define "medical skill" by reconciling the need for standardized assessment of knowledge and skills with the need for diversity in the environments in which clinicians practice, and the need to value the diversity of medical professionals as independent-thinking individuals (Sternszus et al., 2023). Diversity among trainees and professionals should not only be viewed merely as a difference that needs to be minimized or as a source of measurement error in assessment, resulting in differences unrelated to the construct. Instead, it should be viewed as an inherent characteristic of a healthy, vibrant medical team.

The three levels of competency should be assessed differently: standardized assessment in the first level, collective judgment by trained experts in the second level, and personalized assessment in the third level. Although a hierarchical and sequential approach to developing competencies at each level is often useful, the sequence is not rigid. In the early stages of professional development, the focus should be on standard competencies. Only after knowledge of established standard "truths" has been acquired can uncertainty in biomedical and other related knowledge be addressed, thus addressing differences in practical application. The

hierarchical nature of the framework suggests a stepwise approach to the acquisition of competencies, but it does not suggest a return to the Flexnerian model of medical curricula, in which all basic science education must precede clinical training. On the contrary, vertical curricular integration, in which early clinical experience is interwoven with basic knowledge acquisition, has significant advantages (Wijnen-Meijer et al., 2020). However, it should also be kept in mind that clinical understanding usually requires prior classical knowledge.

Integration of different levels of competency will be achieved as they are developed in parallel, even if they remain stratified (for example, appropriate clinical reasoning is not possible without prior biomedical knowledge, and training in clinical reasoning may be carried out in stages) (Norman et al., 2017). Clinical reasoning can be trained in the classroom, but in patient care, it needs to be adjusted on a case-by-case basis (Watsjold et al., 2022). Senior medical students may still accumulate new classical knowledge in their evening independent study (Level 1), find that they need to adapt to local rules and customs to contribute to the inter-disciplinary team (Level 2), and they may begin to discover their own strengths, interests, and beliefs (Level 3). The use of standards to assess competency may lead many laypersons to believe that there is an established system of medical knowledge and skills that are sufficient to provide high-quality and safe patient care, and the mission of medical schools and graduate schools is to ensure that learners master these knowledge and skills. However, as is known to any practicing medical professional, this is an oversimplified expression. The biomedical system of knowledge has limitations that lead to constraints in medical education. There is uncertainty inherent in the practice of medicine. Changes cannot be simply categorized into correct practice and errors or mistakes. Tolerance of uncertainty and control of ambiguity are key elements of practice (Ilgen et al., 2022).

It is important to distinguish the limitations of subject knowledge from the limitations of individual knowledge and skills. Learners must build their own knowledge database, and only after the individuals have acquired sufficient classical knowledge can they replace “I do not know” with “we do not know” in conversations with patients. Training students to tolerate uncertainty too early may conflate gaps in one’s classical knowledge with gaps in the biomedical knowledge system in general (Ilgen et al., 2022). Learners must learn to recognize changes in practice, both as principles of good practice and as individual practitioners’ preferences (Apramian et al., 2016). Tolerance of uncertainty also reflects tolerance for acceptable differences in practice and the recognition that others may differ from oneself in habits and beliefs and deserve room for practice autonomy (Ryan & Deci, 2020). Without this room for practice autonomy, Level 3 competencies, or the pursuit of personal excellence and

well-being in professional work practice, they cannot thrive (Ryan & Deci, 2020). As a matter of fact, without this level of competency among professionals, medical science and practice cannot advance beyond the current standards.

2.2 Importance of competencies for teachers in medical education

Medical school teachers are supposed to impart knowledge and educate people, but most of them enter academic positions with insufficient preparation for their roles as medical teachers, even as they assume educational leadership positions (Hatem et al., 2006). The lack of formal training in teaching may be due in part to a lack of awareness of the complex skills (ranging from micro-teaching techniques to meta-skills for program evaluation) necessary for medical teachers to be successful (Armstrong et al., 2004). In the absence of formal educational training, most teachers choose temporary training programs from local/national curricula, hoping to improve their skills after taking on teaching roles. A better understanding of the skills needed to succeed as a medical teacher would be a major advancement in medical education, which can improve teaching quality and learning outcomes.

A decade ago, medical teachers in the United States had been exploring what skills and knowledge a qualified physician must possess to practice independently (Batalden et al., 2002; Carraccio et al., 2002; Frank, 2005). This debate was driven by concerns about patient safety, urges to improve patient outcomes, and a desire to allow for continued regulation of the medical profession. The result of this debate is that nontraditional physician competencies, such as practice-based learning and system-based practice, are considered integral to physician development. These competencies, which were initially controversial, have now been incorporated into physician training programs and have raised attention on the quality of medical training and physician assessment (Holmboe et al., 2010).

Similarly, in terms of medical education, a number of groups have begun to identify competencies for a variety of medical teachers (Pololi et al., 2003) to ensure that teachers responsible for physician education are adequately trained for their roles. For example, Capobianco and Schultz outlined competencies for directors of residency training programs, while Harris et al. (2007) identified comprehensive competencies for teachers, physicians, nurses, research personnel, and administrators. More recently, Sutkin et al. (2008) identified cognitive and non-cognitive characteristics of influential clinical teachers. While these educational paradigms are useful, they are not linked to the broader physician competency movement and are not generalized enough to be applicable to all those involved in medical

education (from nonclinical teachers to educational policymakers).

Despite the rich background in paradigms of teacher skills and the growing number of teacher development programs (Skeff et al., 2007), there is currently no common conceptual framework for the skills necessary for effective medical education. The development of such a framework would help promote common expectations for teacher performance and outcomes and introduce a consistent language that would facilitate dialogue and standard formulation in different places and institutions. There are still problems with competencies for medical teachers as follows.

2.2.1 Education and training of teaching staff

Traditionally, medical education is an apprenticeship system in which individuals receive training directly under old-hand physicians. Physicians are considered qualified to practice medicine upon completion of their apprenticeship. Any physician is considered competent to teach learners. At present, practicing physicians must demonstrate their competency using another more formal (and possibly higher) standard of education. Similarly, medical teachers should also adopt different standards, and they must be able to demonstrate their ability to impart knowledge to learners appropriately and systematically (Irby, 1994; Sloan et al., 1996), set examples (Buchel & Edwards, 2005; Pratt et al., 2009), conduct assessment (Delzell et al., 2005), and provide feedback (Holmboe et al., 2004).

In addition, clinical teachers have to add sources of income (by providing patient care and conducting research) in addition to teaching (Pololi et al., 2003), leaving them even less time for effective teaching and assessment. Many medical teachers are not physicians, and they possess skills that are critical to the development of physician competency, namely, ethics, communication, practice management, and publicity. The increased heterogeneity of medical teachers and the decrease in teacher-learner contact time means that teachers must be able to teach, give feedback, and assess in a more concentrated and accurate manner.

In light of these changes in educational standards, teachers with more incidental interactions with learners should develop core knowledge, skills, and attitudes and provide referrals and counseling to individuals or to small or large groups. Teachers with more significant responsibilities should receive additional training.

2.2.2 Basic principles of medical education

The basic principles of medical education include core values or behaviors that are essential to

the survival of a field. Although teachers may differ in their interactions with learners and professional expertise, all teachers should value, recognize, and practice four principles: learner engagement, learner-centeredness (Laine & Davidoff, 1996; Ludmerer, 2004), adaptability, and self-reflection (Irby, 1994). In the "Teaching as a Competency" framework, learner engagement refers to the ability to establish connection with and intellectually interact with individual learners or groups of learners. Learner-centeredness (similar to patient-centeredness) refers to putting the learners first, assessing the learners' needs, understanding the barriers to learning or practice encountered by the learners, and tailoring the educational plan to the learners' reality. Adaptability refers to the need to change the teaching plan, teaching model, teaching key points, and teaching content over time in response to learners, practice/teaching environment, and even teaching accidents. Self-reflection means that teachers think critically about their educational experiences and outcomes, collect relevant feedback, and design ways to improve their skills (Fragkos, 2018).

2.2.3 Core and specialized skills for different types of education

Given the variety of roles teachers may play, it is believed that core competencies should include skills that are important to anyone who regularly teaches medical learners. Generally speaking, these skills involve directly teaching individuals or small groups of learners (Gibson & Palermo, 2020). It is argued that specialized competencies are necessary for teachers who are required to take on additional responsibilities. For example, core knowledge for all teachers might include content knowledge (expertise in the teacher's specialized field), process knowledge (how to be an effective communicator/teacher within the specialized field), and assessment knowledge (how to ensure that learners understand the textbook) (Herppich et al., 2018). Expertise of the curriculum developers may include an understanding of educational theory; assessment of technical knowledge of the curriculum, teachers, and/or learners; and proficiency in conducting research and using advanced technology. In addition, those responsible for formulation of significant plans may need to possess skills in training and coaching other teachers (Khamis et al., 2016).

2.2.4 Continuity of teacher skill development

Choosing specific language to express a point of view can promote common understanding, but it can also carry biases based on current or previous usage. "Competency," "expertise," "optimal practice," and "role" have been successfully applied in a variety of educational settings.

For example, U.S. teachers use the Dreyfus skill continuum (novice to expert) to develop a "competency" framework for practicing physicians, marking an important milestone necessary for independent clinical practice. "Expertise" refers to the skill level above what is required for a beginning medical teacher to practice independently. "Optimal practice" can be used as a performance benchmark and for appropriate developmental milestones. As part of CANMEDS, the term "role" is widely used in Canada to denote areas where physicians practice their skills. Each term specifies a different aspect of skill development. Because teachers may need competencies that apply to multiple roles (such as supervisor, educational researcher, and clinical instructor), researchers have developed a model that integrates the two sets of terms concerning roles and competencies. The specific role of teachers is identified based on the role of physicians in CANMEDS, but it has been adjusted for direct teaching and medical teachers.

2.2.5 Assessment of teaching and learning

It is argued that the goal of medical education is to facilitate learning by attracting learners. The outcomes of such engaged learning may include better patient care, academic research, community/public service, or improvements in the health system. Ideally, teaching evaluation should point the way to carefully assessing the outcomes of teachers and their learners; however, the teaching process of the teachers and the learning process of the learners may not be linearly related. The necessity to link teaching and learning has been widely recognized, with Cassel (2004) even calling for skilled teachers to align the quality of medical education with that of clinical practice.

Like patient treatment outcomes, learner outcomes are influenced by a variety of factors, including learners, teachers, and the environment. For example, teachers are responsible for creating effective learning environments and using appropriate learning tools and methods. Learners' responsibilities include appropriate preparation, attention, and work habits, which in turn allow them to incorporate new skills into practice. Factors that influence learning include online participation, peer learning, and self-directed learning. Environmental factors include time, facilities, resources, and learning opportunities. In addition, the leader's focus on the school's educational mission shapes the school's implicit culture, which in turn deeply influences teacher competencies. Just as patient outcomes can be used to assess the quality of medical care provided by a physician, learner outcomes can, to a certain extent, be used to assess a teacher's teaching skills.

In an era of increasing resource scarcity, with cost control in healthcare expenditures intensifying, educational programs will undergo stricter scrutiny to ensure the wise use of

resources. A reasonable conceptual framework can help stakeholders at the state and institutional levels prioritize resources more prudently. To implement teaching and development programs for large numbers of learners across multiple settings, it is necessary to build appropriate skills among teachers and administrators so they can tailor learning programs for students and increase efficiency at the institutional level. The "Teaching as Competency" framework is used to discuss teacher development, which can help identify where resources can be best deployed to build teachers' skill portfolios. Programs with insufficient resources, such as community-based programs, and programs in rural or underserved areas may better explain teachers' needs. In addition, it can help medical teachers meet the needs of all stakeholders (learners, administrators, patients, and communities) by fostering better engagement and a clearer understanding of each stakeholder's true needs. Recognizing role-specific teacher competencies may help institutions prioritize their educational funding and use different approaches to recruit, reward, and retain teachers. Perhaps most importantly, the "Teaching as Competency" framework can help teachers think critically about the skill portfolio and resources they need to be successful in their positions.

Once teachers have identified their needs, they can choose to participate in well-designed teacher development programs (Skeff et al., 2007), which are generally role-specific (Fincher & Work, 2006; Hatem et al., 2009; Muller & Irby, 2006; Searle et al., 2006; Simpson et al., 2006; Srinivasan et al., 2007). The majority of national teacher development programs focus on the teaching of a specific skill or specialty. For example, Litzelman et al. (1998) formulated a useful framework and training paradigm for clinical teachers. The Pediatric Academic Society has developed an educational scholar program for pediatric teachers that focuses on educational research methods. National organizations (such as the Association of American Medical Colleges, the Canadian Association for Medical Education, or the American Medical Women's Association) have developed leadership development programs to help educate teachers to survive the rigorous academic medical environment. Programs that offer a master's degree in medical education (such as those at the University of Southern California) have two to three years of courses that teach a variety of educational skills. These courses provide an important foundation for skill development of the teachers. However, to ensure quality and optimize resources, these programs are often limited in enrollment, scope, and/or influence. Adopting a common conceptual skill development framework may encourage the development (expansion or creation) of these programs, as teachers begin to recognize that these programs are critical to the provision of professional training.

2.3 Current status of research on the domains of competencies for medical teachers

Recently, the international community has been promoting the conceptualization and definition of core competencies for health promotion practitioners (Barry et al., 2009) and those engaged in relevant professions such as nursing (Irvine, 2005). Consistent with the viewpoint that considers the development of competencies as an integral part of promoting health professionalization (Howat et al., 2000), we also believe it is necessary to consider the professionalization of health education teachers. Competencies are defined as a combination of attributes such as knowledge, skills and attitudes that enable individuals to perform a series of tasks according to appropriate standards. Competencies provide a shared language for defining the requirements of the profession and can help consolidate the discipline (Barry et al., 2012). Potential uses of health promotion competencies include offering information for health promotion publicity work, training staff in health promotion competencies, developing and revising educational curricula, and providing a framework for health promotion credentialing (Shilton et al., 2008).

The effectiveness of health promotion depends on a team with core, flexible, and adaptive skills (Barry et al., 2009).The recent Core Competencies Framework for Health Promotion (COMPHP Project) (Barry et al., 2012) provides a coherent conceptualization of core competencies for health promotion practitioners. The United States has a rich history of developing professional competencies in health education (Allegrante et al., 2004). The model they currently adopt contains seven areas of responsibility, 34 competencies, and 223 sub-competencies (Doyle et al., 2012). As health promotion is carried out by different types of professionals in different settings, contextualizing the competencies for practitioners is an important step in providing a framework for professional practice.

The focus on teacher competency development originated in the mid-20th century when competency-based (performance-based) models of teacher education became popular (Korthagen, 2004). Decades later, a more humanistic approach was adopted that emphasized the need to focus on the process of becoming a teacher (Watts, 1978), and not just on a list of skills needed by teachers (Korthagen, 2004). However, teaching professionals now face unprecedented challenges. The society's demands on them are evolving, and the understandings of effective learning are also changing. This calls for a reconceptualization of the competencies that teachers should possess in order to be able to respond to these new demands. Core

competencies can provide coherence to health teaching practices (Madsen & Bell, 2012). Core competencies are defined as the most basic capabilities that form a common baseline for all health promotion roles. All practitioners should possess these capabilities before they can work efficiently and effectively.

All teachers must have strong professional competencies. In order for health promotion initiatives in schools to be sustainable, teachers must become capable, competent, and skilled health teachers. It is especially so because they are in the unique position of being able to contribute to the nation's health gains by providing health education to future adults. Many teachers face huge challenges in prioritizing health education on the school agenda (Jourdan, 2011; Nic Gabhainn et al., 2010). With limited time and space in schools, the pressures of assessment and examination tend to overshadow the role of health education (Moynihan & Hennessy et al., 2015). While health education may not be the core business of schools (Jourdan et al., 2008), there is evidence that healthier children have better educational outcomes (Basch, 2011). Therefore, health education teachers need a broader range of competencies that are not only knowledge-based, but also include pedagogical skills and attitudes conducive to health promotion.

The teaching of health issues in schools varies from country to country, depending on political priorities and the organization and goals of each education system (Pommier et al., 2010). In some countries, health education is a discipline under the responsibility of health education teachers (such as Finland and Ireland), while in others, it is implemented across disciplines. Ideally, health education is delivered within the broader framework of Health Promoting Schools (HPS). The HPS framework is a country-specific approach to health promotion in the school environment. It is a whole-school approach that seeks to improve student health and educational outcomes. The HPS approach is made up of six components, including healthy school policies, physical environment of the school, social environment of the school, personal health skills and mobility, community connections, and health services. The concept of health teacher (or health education teacher) refers to any teacher involved in school health affairs. The concepts of health promotion (HP) and health education (HE) are often used interchangeably (Whitehead, 2004), with health promotion defined as any activity undertaken to improve and/or protect the health of everyone in the school community, including activities related to the school's physical and social environments, curricula, school policies, and community connections. Health education is conceptualized as a communicative activity that involves learning and teaching related to knowledge, beliefs, attitudes, values, skills and competencies. From this perspective, health education is understood as a component of more

extensive health promotion activities and is aimed at improving health literacy (Nutbeam, 2000).

Health literacy is a key criterion to measure the outcomes of early childhood development, school curricula, and lifelong learning, and it is necessary to promote health and well-being throughout the whole life course (Kickbusch et al., 2013). Health literacy has been included as one of the themes for developing students' skills in the 21st century to ensure they succeed in work and life (Dadaczynski et al., 2020; Simonds, 2021). Developing students' health literacy is also considered one of the main goals of modern school health programs (Kolbe, 2005). According to Nutbeam (1998), health literacy encompasses the cognitive and social skills that determine an individual's motivation and ability to acquire, understand, and use information to provide and maintain good health. It is also viewed as the ability to change living conditions to support the health of oneself and others (Abel, 2007; Nutbeam, 1998). This perspective is highly applicable to schools, because their goals include cultivating critical and active citizens who promote not only their own health but also the health of others (Paakkari & Paakkari, 2012).

Improving children's health literacy will progressively increase children's autonomy and personal capability (Nutbeam, 2000; Sorensen et al., 2012). The process of achieving health literacy can be viewed as part of personal development, which can promote the quality of life. Schools are targeted environments for improving health literacy (Nielsen-Bohlman et al., 2004). Nutbeam (2000)'s three-dimensional health literacy model is an important theoretical framework in the field of health education and promotion. This model views health literacy as a multi-level and progressively developing competency system, which is specifically divided into the following three levels: 1) functional health literacy; 2) interactive health literacy; and 3) critical health literacy. These three levels are interconnected and progressively deepen, collectively forming a complete competency spectrum ranging from passive acceptance to active application, and further to critical reflection and action. It provides a clear theoretical pathway for systematically assessing and enhancing the health literacy of individuals and groups. In schools, functional health literacy involves disseminating basic information on health topics such as hygiene, nutrition, medication, and interpersonal relationships (Leger, 2001). Interactive health literacy involves opportunities to develop specific personal skills that enable students to take care of their own health and seek health-related information. Critical health literacy, on the other hand, involves offering learning opportunities in classroom and community settings, and developing critical thinking skills (Chinn, 2011; Leger, 2001). Health literacy education in schools can therefore be seen as an outcome of health education (Nutbeam, 2000), and can be delivered within the strategic health promotion framework of HPS (Leger, 2001).

2.3.1 Knowledge-based competency

It is noteworthy that knowledge occupies the dominant role in the ranking of competencies that participants considered most important. This is not surprising, because the primary focus of schools is on children's cognitive development and the resulting performance of students (Boxley, 2003; Eisner, 2003; Flutter & Rudduck, 2004). In recent decades, the promotion of knowledge-economy education has led to an emphasis on the cognitive domain in schools (Robinson, 2001). Knowledge-based competencies accounted for 7 of the 12 competencies identified in the final round, making them the most principal competencies in the analysis. Knowledge-based competencies resonate well with the pioneering thesis of Shulman (1987) on knowledge and teaching and learning. Shulman's work identifies distinctions between content knowledge, general pedagogical knowledge, pedagogical content knowledge (PCK), curriculum knowledge, and knowledge of learners and their characteristics. Content knowledge includes three competencies: "content knowledge about determinants of health", "general content knowledge about health issues" and "knowledge about health education/promotion theories/models".

Other knowledge-based competencies include pedagogical knowledge. General pedagogical knowledge can be defined as "the extensive strategies and principles of classroom management and organization that seem to transcend the scope of disciplines" (Shulman, 1987). Pedagogical content knowledge, on the other hand, refers more specifically to a unique system of knowledge about teaching and learning. It represents the integration of content and pedagogy into an understanding of how to organize, represent, and adjust a particular topic, problem, or issue to adapt to the diverse interests and abilities of learners and present it in teaching" (Shulman, 1987). It is important to note that both personal growth knowledge and general pedagogical knowledge include skill elements, such as "how" to plan, implement, and evaluate pedagogical situations (Shulman, 1986), and that these knowledges are applied knowledge oriented toward action. Therefore, it is believed that personal and general pedagogical knowledge are intertwined with each other in terms of knowledge and skills.

2.3.2 Skill-based competency

Skill-based competency falls into the category of skills, including "communication skills (active listening, interpersonal skills, and empowering conversational styles)", "skills for planning, implementing, and evaluating school-wide health promotion activities", "skills for ethical thinking", and "teachers as researchers". Health communication strategies are at the

heart of health promotion and are actually quite complex. They include intrapersonal, interpersonal, organizational, and community communication skills (Neiger et al., 2005). School-wide health promotion planning, implementation, and evaluation skills have also been identified in the literature as important skills for health teachers (Girvan et al., 2012; Mukoma & Flisher, 2004; Leger, 2001). In fact, McKenzie et al. (2005) argued that health teachers' responsibilities often involve program planning, implementation, and evaluation. Ethical thinking skills define acceptable and unacceptable behaviors in the professional practice of health education (Girvan et al., 2012). Teaching as a profession has been recognized as ethically sensitive because the work targets of the teachers are young students, who tend to be influenced by others and may have weaker ability to assert their rights than adults (Sunnari & Räsänen, 2000). Paakkari and Välimaa (2013) argue that argue that ethical sensitivity becomes more prominent when teaching subjects that focus on students' daily lives, attitudes, and values, especially health-related content. Therefore, the training of ethical thinking skills is appropriate.

"Teachers as researchers" is a competency that overlaps with both attitudinal and skill areas. Over the last decade, the concept of teacher practice has become widely recognized by the public, and it now encompasses a broader professional scope, including research. Teachers are now more commonly expected to engage in research and are described as practicing researchers (Mclaughlin et al., 2006). Mohr et al. (2004) conceptualized teacher research as "intentional, systematic, open, voluntary, ethical, and appropriate exploration", with the explicit purpose of improving teaching and contributing to school development. Teachers must now possess solid pedagogical content knowledge as well as reflective practice and research skills. In fact, it is strongly advocated that teachers value research and use it to improve practice (Tannehill et al., 2013; Trowler & Wareham, 2008). "Teachers as researchers" will become a more prominent competency expected of teachers, regardless of their subject knowledge. Given the need for health teachers to demonstrate flexibility, more experiential pedagogical expertise, and complexity of involvement in the health-promoting school initiative, it is appropriate to view this competency as a key competency.

2.3.3 Attitude-based competency

The effectiveness of health education depends on teachers' commitment and ability to convey enthusiasm to others (Inchley et al., 2007; Jourdan et al., 2010). School teachers have different approaches and different interpretations of their role in health education (Mohammadi et al., 2010). It depends on their discipline and personal epistemology of education (Jourdan et al., 2010). Willingness to participate in school-wide and community health promotion activities is

influenced by a number of factors, the most important of which are school culture and personalities. Teachers' preparation work also plays an important role in this regard (Moynihan & Mcnamara, 2014). It should be noted that teachers' willingness to engage in health and well-being promotion is key to the success of health education in schools (Jourdan et al., 2010; Leger, 2001).

2.3.4 Teaching-based competency

The core competencies for teachers focus on skills that are very different from the competencies for physicians required by the ACGME (Accreditation Council for Graduate Medical Education). For example, it is assumed that teachers are already proficient in their specialized area. Thus, the medical (or content) knowledge competency focuses on how teachers can use their professional knowledge to tailor instruction for learners and assess learners' individual progress. Similar to the ACGME's "patient care" core competency, there is a "learner-centered" core competency that emphasizes a personal commitment to meeting the professional needs of individual learners and treating them with respect. For teachers, professionalism includes not only demonstrating best practices and behaviors in their professional area but also inspiring and modeling those behaviors in others. Communication emphasizes effective problem-solving and adaptability in one-on-one, one-on-group, or intra-group interactions. Practice-based reflective competencies center on accurate self-reflection and the use of all available sources of information to improve educational practice. Finally, system-based practice involves understanding the microsystems of education (the team or service) as well as the large (macro) system in which education is embedded. As for this capacity, it is important to use this understanding to advocate for appropriate change.

Professional competency is a key skill for individuals with more extensive program responsibilities. Program design and implementation are placed together because program development is difficult to achieve without considering the realities of implementation in local places. Learner and program evaluation may require specialized research (Fincher & Work, 2006), methodological and statistical training (including training in test theory and scale construction/validation), and various forms of cognitive and behavioral assessment (including simulations). Importantly, assessment planning should be carried out simultaneously with program development. Leadership is important for prioritizing and flexibly changing or leveraging existing resources, and/or creating new resources within an organization. Within the framework of "Teaching as a Competency", a good leader should be able to establish a shared vision for development, manage the change process, cultivate the next generation of leaders,

and create an organizational culture that is open and responsive to feedback. Finally, the tutorial system is a transversal skill critical to fostering learner growth and professional development, and it involves both learners and teaching faculty. Through program tutoring, the organization can provide resources for group development.

Because teachers' roles shape their needs for different competencies, we refer to the ACGME framework and divide teachers' roles into two categories: those involving direct teaching responsibilities and those involving program development and supervision. There are also less common but important roles, including technology development and institutional leadership (such as a dean of a medical school, a chief administrator of a hospital, or an educational leader of a healthcare organization). Educational policymakers involved in the supervision and financing of national medical education are different from CANMEDS physicians (communicators and collaborators), but they also share similarities. For example, the skills required for the CANMEDS "scholar" role are similar to those required for educational researchers. The "scholar" role requires elements similar to those of project managers or organizational leaders, while the "health advocate" role is similar to that of an educational policymaker.

Teachers taking on direct teaching roles in clinical settings need to have competencies in the core areas. It is also suggested that teachers in these roles do not necessarily need specialized skills but may need to be familiar with these competencies (such as curriculum development and assessment). On the contrary, while the role of specialized teachers may require fewer skills in certain core competencies (such as medical content), they still need to demonstrate learner-centeredness.

2.3.5 Other competencies

The scope of competencies reflects the fact that health education is not a simple task. In fact, some specific competencies involve three domains of teacher expertise, namely, knowledge, skills and attitudes. Important competencies overlap with those identified in the COMPHP project (Barry et al., 2012). For example, the ethical values and health promotion knowledge base are the foundation of the other nine competencies of the COMPHP project (Barry et al., 2012). Ethical thinking competency and knowledge competency are also prioritized by participants. The knowledge category differs from the COMPHP project in that it is targeted toward teachers and includes not only theoretical knowledge of health promotion, but also educational knowledge about students, pedagogy, and curriculum. In Pantic and Wubbels' study of teacher competencies, subject knowledge, pedagogy, and curriculum are also

considered very important by participants. In the European Commission's Teacher Competency Framework, the area of knowledge and understanding includes subject knowledge, personal professional knowledge, student knowledge, pedagogical knowledge and curriculum knowledge. The prioritization of communication skills overlaps with the COMPHP framework (Barry et al., 2012), which also emphasizes their importance. The European Commission also recognizes the importance of communication skills such as negotiation skills and interpersonal skills. The importance of research skills, expressed by "teachers as researchers", is an increasing focus in teacher education. It is also reflected in the "evaluation and research" of the nine competency areas listed by COMPHP. The ability to critically reflect on teachers' own pedagogical practices and take responsibility for their own professional development is recognized as an important competency by teachers and teacher educators in the study of teacher competencies. In the COMPHP program, assessment, planning and implementation are defined as different competency areas. There is no doubt that the skills of planning, implementing, and evaluating health promotion activities are central to the success and sustainable development of health education in schools (Simovska & Mcnamara, 2015).

2.4 Current status of research on the teacher competency evaluation models

2.4.1 Current status of research on the construction and application of education competency evaluation models

The development of competency theory began in the 1970s and gradually deepened and expanded over the following decades, forming a multi-level, multi-dimensional theoretical system that provides an important basis for human resource management and talent evaluation. In 1973, psychologist David McClelland (1973) was commissioned by the U.S. government to use the Behavioral Event Interview method to select Foreign Service Information Officers, thereby constructing the first competency model in history. He also proposed the famous Iceberg Model of Competency, likening human competency characteristics to a floating iceberg: the part above the water includes knowledge and professional skills, which are explicit, easily observable characteristics that can be improved through education and training. These are the basic requirements for performing a certain job and are termed "Threshold Competencies." The part below the water encompasses comprehensive abilities, personality traits, motivations, and values. These elements are deeply hidden, difficult to measure and cultivate directly, yet are key to distinguishing outstanding performers from average ones, and are termed

"Differentiating Competencies." This model reveals that what truly influences long-term performance are often those deep-seated, stable intrinsic traits (Zhang et al., 2023). In 1981, Richard Boyatzis (1982) further proposed the Onion Model of Competency based on McClelland's research. This model describes competency as a layered structure: from the inside out, it consists of motives, personality, self-image, values, social role, attitudes, knowledge, and skills. Elements closer to the core are more stable and harder to change and evaluate; elements in the outer layers are easier to cultivate and identify. The Onion Model is essentially consistent with the Iceberg Model, both emphasizing the predictive role of core competencies on individual performance. However, the Onion Model more intuitively displays the hierarchical relationships and internal connections among the elements, promoting a visual understanding of the competency structure. Regarding the difference between the two, the Onion Model better illustrates the internal relationships among competency elements than the Iceberg Model (Cools & Bellens, 2012).

In 1998, Odd Nordhaug (1998) proposed the classification theory of competencies, further enriching the theoretical dimensions of competency. He categorized competencies from three perspectives: task-specificity, industry-specificity, and organization-specificity, summarizing them into six categories: meta-competencies, general industry competencies, intra-organizational competencies, standard technical competencies, industry technical competencies, and unique technical competencies. This classification framework broke through the relatively static hierarchical view in previous models, emphasizing the variability and applicability of competencies in different contexts and organizations, laying an important foundation for the subsequent specific application and development of competency models in various fields. From the Iceberg Model and Onion Model to the classification theory, competency theory gradually progressed from structural description to systematic classification, and from individual characteristic analysis to a perspective incorporating the interaction between the organization and environment. Together, they promoted the in-depth application of competency research in fields such as human resource management, education, and career development.

The systematic introduction and research on competency models in China began with the soft science project "Assessment of Management Cadres in the Communications Industry and Quantitative Evaluation Methods" established by the former Ministry of Posts and Telecommunications in 1998 (Hu & Zhang, 2012). This research is regarded as the first important practice in China to use the competency model method to establish qualification standards for enterprise managers, marking the formal application of competency theory in the field of organizational management in China (Lin, 2007). Subsequently, related research

developed rapidly in domestic academia. Scholars mainly employed methods such as Behavioral Event Interviews, factor analysis, the Delphi method, and questionnaire surveys to conduct research centered on three core directions: "model construction," "model classification", and "model application" (Chen & Shi, 2023; Tang & Feng, 2023). In terms of model construction, this has been a focus for domestic scholars. Many researchers have dedicated themselves to developing competency models suitable for specific positions or industries. For example, Zhang Qinglong (2013), based on a questionnaire survey of China's internal audit profession, used the competency element method to construct a general competency model containing three dimensions: professional knowledge, professional skills, and professional traits.

Regarding model classification, domestic research has explored localization based on international theories. Feng Ming (2001), drawing on O. Nordhaug's classification theory, divided competencies into six types from three dimensions: task-specificity, industry-specificity, and company-specificity: meta-competencies, general industry competencies, intra-organizational competencies, standard technical competencies, technical industry competencies, and unique technical competencies. Additionally, academia often distinguishes models into "Outstanding Performance Competency Models" and "Average Performance Competency Models" based on performance standards (Fu & Pan, 2018). For instance, Wang (2012) pointed out that behavioral event interviews can be used to extract characteristics differentiating outstanding groups from average groups to construct an outstanding model, while grouping shared characteristics into a general model. In terms of model application, the practical value of competency models has been demonstrated in multiple fields.

In enterprise management, scholars have already used competency evaluation techniques to develop structured interview question banks for recruiting middle and senior management talents in state-owned enterprises. Lu (2008) indicated that in the mid-to-late 1980s, in the field of education, with the expansion of school autonomy and the professional development of teachers, competency theory has been widely applied in the selection, training, performance evaluation, and career development system construction for school administrators and teachers, becoming an important tool for promoting human resource management and professional development. In the field of education, with the expansion of school autonomy and the professional development of teachers, competency theory has been widely applied in the selection, training, performance evaluation, and career development system construction for school administrators and teachers, becoming an important tool for promoting human resource management and professional development.

Research on "competency" is a cutting-edge and hot topic jointly concerned by disciplines such as organizational behavior, psychology, education, and human resource management. The origins of competency thought can be traced back to Frederick Taylor, the "father of scientific management." While conducting time-and-motion studies to improve work efficiency, he initiated early explorations that later became known as the "Management Competency Movement," first introducing the concept of "competency characteristics" into management research (Jörgen, 2000). In 1973, Harvard psychologist David McClelland (1973b) published the landmark thesis "Testing for Competence Rather Than for 'Intelligence'," formally proposing and defining the concept of "competency," marking the beginning of modern systematic competency research After McClelland's formal proposal, competency research rapidly emerged in Western countries such as the United States, Britain, and Canada, and became a fashionable frontier concept in management academia and industry in the 1980s (Boyatzis, 1983). In 1982, McClelland and Richard Boyatzis (1982) co-authored the book The Competent Manager: A Model for Effective Performance, systematically expounding the application of competency models in management, promoting the widespread adoption and practice of this theory in human resource management in enterprises in developed countries (IHRI-International Human Resource Institute, 2005).

With deepening research, academia has developed different understandings of the connotation and composition of competency, mainly forming three representative schools: the trait school emphasizes inherent, stable individual traits; the behavioral school focuses on observable, measurable behavioral performances; and the eclectic school attempts to integrate the former two perspectives (Glaesser, 2019). Despite different perspectives, synthesizing various viewpoints, competency is generally considered to have the following core characteristics: Contextual Relevance: Competency is closely related to specific positions, tasks, and organizational environments; it cannot exist in isolation from specific work contexts (Ali et al., 2021); Individual Internality: It is a collection of knowledge, skills, abilities, traits, motivations, and other elements demonstrated by an individual under specific conditions, possessing both explicit and implicit attributes; Discriminative and Predictive: It can effectively distinguish between outstanding and average performers in a specific position and has predictive utility for an individual's future work performance; Performance Correlation: It has a significant correlation with an individual's actual work performance and is a key factor driving high performance (Lee, 2010). These consensual characteristics lay a solid foundation for the theoretical construction and practical application of competency.

Teacher competency is a multi-dimensional comprehensive concept. Scholars both

domestically and internationally have continuously explored and defined its connotation based on different perspectives. Tigelaar et al. (2004) earlier proposed that teaching competencies are the organic integration of a teacher's personality characteristics, professional knowledge, teaching skills, and attitudes across diverse teaching situations. In 2004, Zeng Xiaodong (2004) from Beijing Normal University emphasized that teacher competency is the specific content of what teachers "know," "can do," and "believe in," namely the unity of knowledge, skills, and values, which directly affects teaching performance. Similarly, foreign research generally views it as the collection of professional knowledge, skills, and values possessed by an individual teacher that are related to successful teaching, considering this a necessary condition for effective teaching and a core goal of teacher training.

Research by domestic scholars has further enriched and refined this concept (Olson & Wyett, 2000). It belongs to the individual characteristics of teachers, is a necessary condition for engaging in successful teaching, and is a primary training objective for teacher education institutions. Li et al. (2018), from a performance-differentiation perspective, proposed that teacher competency refers to the individual traits that distinguish outstanding teachers from average ones, including self-awareness, teaching ability, intrinsic motivation, and professional character, among other aspects. At the evaluation and application levels, Lu (2013) pointed out that teacher competency evaluation should focus on job-related knowledge, skills, abilities, traits, and motivations that can effectively predict and differentiate performance levels. Based on this, she constructed a measurable evaluation index system including professional knowledge, teaching techniques, teaching attitudes, professional values, and personality traits. Deng and Wang (2015), targeting secondary school psychology teachers, proposed a three-dimensional evaluation framework covering personal qualities, work attitude, and work skills. Xu and Guo (2022) emphasized that university teachers' competencies should align with their professional characteristics and job requirements, and that these competencies are the sum of various individual characteristics.

With the development of educational concepts, the connotation of teacher competency is also combined with contemporary requirements. Xiong (2019), in the context of core competencies, stated that secondary school teachers' competencies should encompass knowledge systems, learning abilities, practical experience, teaching models, and personality traits. Wang and Tang (2020) further clarified that the current job competency of teachers is essentially "core competency education competency," an organic whole comprising professional ability, professional knowledge, basic concepts, and professional ethics, in which the elements are relatively independent yet interconnected. In summary, although definitions

of teacher competency vary in emphasis due to different perspectives and contexts, their core consistently points to the dynamic integration of knowledge, skills, values, and personal traits necessary for achieving excellent teaching performance. Furthermore, its connotation is continually integrating with the forefront requirements of educational development.

Overall, teacher competency can be understood as the comprehensive qualities that teachers need to possess to achieve excellent performance in diverse educational contexts. Its connotation typically includes three key points: First, it refers to the overall abilities demonstrated by individual teachers in different environments; second, these abilities manifest as key characteristics such as professional knowledge, professional skills, and professional values, closely integrated with teaching practice; finally, these elements directly affect teaching effectiveness, and their value lies in their content and composition itself, not merely focusing on their ultimate effects. Based on the above definition and considering the measurability of indicators, teacher competency can generally be specifically divided into five observable dimensions: professional knowledge, teaching techniques, teaching attitudes, professional values, and personality traits. These five aspects together constitute the basic framework for evaluating teacher competency (Lu, 2013).

From the perspective of theoretical development, research on competency models has experienced continuous evolution and deepening. From early "Iceberg Models" and "Onion Models" to later "Pyramid Models" and application-oriented models, their core has always revolved around the classification and deconstruction of individual qualities. Generally, these qualities can be categorized into two major types: explicit and implicit qualities (Teglasi et al., 2022). Explicit qualities are like the tip of an iceberg, comprising observable and measurable elements such as knowledge and skills. These can be readily assessed and improved through training. In contrast, implicit qualities form the vast submerged base, encompassing underlying drivers like motivations, values, and personality traits. These are difficult to measure and cultivate directly, yet they are often critical determinants of long-term performance and success (Qiao et al., 2016).

McClelland (1973) used the "iceberg" as a vivid metaphor for implicit and explicit qualities. He compared the part of the iceberg above water to explicit qualities and the part below water to implicit qualities. The Iceberg Model laid the foundation for this distinction with a vivid analogy. Spencer further interpreted the "Iceberg Model," resulting in the famous "Onion Model." The Onion Model further refines the hierarchical structure of qualities, depicting competency as a layered whole from the inside out: the innermost core comprises motives and personality, unfolding outward in successive layers as self-image and values, social role,

attitudes, and finally, the outermost layers of knowledge and skills (Chiang et al., 2019). Development and evaluation are more feasible when proceeding from the core outward layer by layer, rather than the reverse. The Onion Model, an evolution of the Iceberg Model, conceptualizes competency as a layered structure. From the innermost core to the outermost layer, it sequentially encompasses motives, personality, self-image and values, social role, attitudes, knowledge, and skills (Zhang & Fang, 2023). Compared to the Iceberg Model, the Onion Model is essentially the same, both emphasizing core or basic qualities. Assessing core qualities can predict an individual's long-term performance. Comparatively, the Onion Model more prominently highlights the progressive nature and interactive relationships among the layers of qualities, providing a more detailed theoretical perspective for systematically understanding, evaluating, and developing individual competency (Cao & Pan, 2023). Subsequently, the academic community has continually developed competency evaluation models for various positions, thereby promoting the ongoing deepening and practical application of this theory (Cao, 2020).

Regarding the construction of job competency models for teachers, several scholars have explored from different angles. Bisschoff and Grobler (1998) conducted early related research. The model they proposed suggested that teacher competency is mainly composed of two elements: educational competency and collaborative competency, specifically covering teachers' professional competence, basic teaching abilities, learning abilities, collaborative abilities, and professional discipline, among other aspects. Subsequently, Hopkins (1996), through exploratory research on European teacher evaluation systems, summarized six key dimensions that teacher job competency should include: professional commitment, concern for students, outstanding teaching skills, diversified teaching models, teamwork ability, and self-reflection ability. This framework places greater emphasis on the integration of teachers' affective traits and professional practice. Boonsri et al. (2018) further focused on specific teacher groups in vocational and technical education, constructing a comprehensive evaluation model for the knowledge competency of vocational and technical teachers through expert interviews. To validate the model's effectiveness, the research employed a combination of questionnaire surveys and group interviews to survey 138 senior students in related majors. Analysis results showed that the constructed multi-dimensional knowledge competency evaluation model had good validity and model fit, providing empirical evidence for the professional development and evaluation of vocational and technical teachers. Overall, these studies have enriched the theoretical connotation of teacher competency from different perspectives and laid an important foundation for constructing hierarchical and categorical

teacher evaluation systems.

Domestic scholars have conducted diverse and rich modeling research in the field of teacher competency. Their achievements are mainly concentrated at the application level, employing various research methods including quantitative statistics, algorithmic modeling, expert assessments, questionnaire surveys, and focus groups (Xu, 2018). For example, Cheng et al. (2010), focusing on high-level scientific research positions, developed an assessment model to evaluate the job competencies of senior scientific research practitioners through literature synthesis and expert interviews. Lv (2014) combined behavioral event interviews and questionnaire surveys to preliminarily establish a competency model for graduate student supervisors in universities. This model summarized competency characteristics into 17 items, categorized into three levels: personality traits, knowledge and skills, and management ability. With the development of educational contexts, related models have become increasingly refined. Zhao et al. (2019), focusing on smart teaching, constructed a university teacher competency model for the smart-teaching context through behavioral event interviews. The model covers five dimensions: smart teaching concept and motivation, use and construction of smart environments, teaching organization, evaluation and feedback, and teaching enhancement. It includes 15 competency elements and 31 specific indicators, and its effectiveness was verified using questionnaire surveys.

Zhao et al. (2020), in the context of "curriculum ideology and politics" and drawing on both the Iceberg Model and the Onion Model, constructed competency models for university ideological and political education teachers, subject teachers, and counselors in line with the new requirements proposed in this context. Among them, the model for ideological and political education teachers includes personal traits, knowledge literacy, and teaching ability; the model for subject teachers covers personal traits, ideological and political awareness, and knowledge and skills; the model for counselors includes three dimensions: personal traits, theoretical literacy, and educational practice. Comprehensive analysis of existing research finds that the construction of teacher competency models in China still primarily relies on the Iceberg Model or Onion Model as the theoretical foundation, with knowledge, skills, and personal traits being the most frequently adopted evaluation dimensions. These studies provide targeted theoretical frameworks and practical tools for evaluating teachers in different educational contexts and position types (Zhao, 2012).

Regarding the construction and application of teacher competency models, the international academic community has also formed many research results with reference value. Helley (2001) reported that in 2000, Hay/McBer Company, commissioned by the UK Department for

Education and Employment, conducted research on the competencies of high-performing teachers and ultimately submitted a thematic report. The report proposed that teacher competency models could be systematically constructed from five dimensions: professional qualities, leadership, thinking skills, planning skills, and interpersonal relationships. The research further indicated that highly competent teachers typically exhibit the following characteristics: proficiency in curriculum planning, ability to use diverse strategies to motivate students, rational allocation of time and resources, and strong classroom management and student guidance abilities. At the methodological level, Bazsová (2018) used the Analytic Hierarchy Process (AHP) to construct a university teacher competency evaluation model covering five indicators: language ability, general ability, computer ability, management ability, and professional growth. Using this model for actual evaluation revealed that among the various indicators, language ability and professional growth had the highest weights, followed by general ability. Based on the evaluation results, the research also pointed out that related salary incentive measures needed improvement and confirmed that AHP could serve as an effective tool for university personnel evaluation. Furthermore, Bao (2018) focused on open university teachers, developed an initial competency model using Structural Equation Modeling, and empirically tested it using Confirmatory Factor Analysis. The research found that open university teachers still had room for improvement in distance teaching skills, especially in the application of new technologies, providing empirical evidence for targeted teacher training.

2.4.2 Progress of research on competency models for medical teachers in foreign countries

In summary, the field of competency evaluation research abroad has yielded relatively rich results, with diverse evaluation models developed across industries and extensive practical exploration, laying a solid theoretical and methodological foundation for this field (Glaesser, 2019). These mature models and practical experiences can provide valuable theoretical references and practical guidance for Chinese scholars conducting related research (Chen et al., 2022). Focusing on the field of medical education, the construction and application of competency models for clinical teachers has become a research hotspot in recent years. Currently, scholars both domestically and internationally have proposed several influential competency models for clinical teachers (Srinivasan et al., 2011), such as the "CANMED" model from the Royal College of Physicians and Surgeons of Canada and the "ACGME" model from the United States. Research on clinical teacher competency models primarily includes model construction, practical application, current status and influencing factors, mixed-

methods studies on related concepts, and the introduction of practical training experiences, among others (Li et al., 2017). However, current research on clinical teacher competency still has some limitations: the breadth and depth of research need further expansion (Wang et al., 2017); subsequent empirical research remains insufficient; some studies are repetitive; the distribution of research subjects is uneven; and overall innovation needs enhancement. In the future, it is necessary to further strengthen the systematic construction and empirical application of clinical teacher competency models to promote the continuous improvement of the quality and level of medical education (Li et al., 2021).

The ACGME model is a clinical teacher competency model developed by the Accreditation Council for Graduate Medical Education (ACGME) as a standard and guide for standardized residency training in the United States (Chapman et al., 2004). The ACGME model consists of the following six core domains. (1) Medical knowledge, which refers to the clinical teachers' knowledge of the basic science and clinical science and the ability to apply that knowledge to patient care and teaching. (2) Patient care, which refers to the ability of the clinical teachers to provide sound, effective, safe, and high-quality patient care and the ability to supervise residents in patient care. (3) Professional quality, which refers to the ability of the clinical teachers to adhere to medical ethics, respect patients and colleagues, assume responsibility, uphold integrity, and promote self-awareness and self-improvement. (4) Communication skills, which refer to the ability of the clinical teachers to communicate and interact effectively with patients, families, colleagues, residents, and other health care personnel, and the ability to build rapport and teamwork. (5) Practice improvement, which refers to the ability of the clinical teachers to analyze their own practice and the practice of the residents, assess the quality and safety of patient care, participate in quality improvement projects, and apply evidence-based medical principles to promote optimal practices. (6) Systematic cognition, which refers to the ability of clinical teachers to understand the structure, function, resources, and constraints of the health care system, and how to work effectively within the system to provide optimal patient care and develop the residents' ability of systematic thinking (Weng et al., 2022).

The CANMED model is one of the clinical teacher competency models developed by the Royal College of Physicians and Surgeons of Canada. The model is intended to provide a framework for medical education (Frank & Danoff, 2007), to identify and describe the competencies that are required of physicians in clinical practice. The model categorizes the competencies of physicians into seven roles, including medical personnel, communicator, collaborator, leader, health advocate, scholar, and professional. Through these roles, physicians can better understand their roles and responsibilities in clinical practice and provide better care

for their patients (Wang et al., 2018).

Both the ACGME model and the CANMED model are clinical teacher competency models designed to provide standards and guidance for medical education, but they have different origins and regions of application (Chou et al., 2008; Daouk-Oyry et al., 2017). In addition, both the ACGME model and the CANMED model classify physicians' competencies into several core domains or roles, but they are divided and named differently (Mylopoulos et al., 2017). Both the ACGME model and the CANMED model emphasize that physicians should master not only specialized knowledge and skills, but also effective communication, collaboration, leadership, improvement, and systematic thinking to improve the quality and safety of patient care. The main differences between the two models lie in their focus and expression of certain competencies (Palesy et al., 2023). For example, the ACGME model differentiates medical knowledge and patient care, whereas the CANMED model integrates them into one competency (Tay et al., 2020); the ACGME model treats professional quality as an independent domain, whereas the CANMED model disperses it among other roles (Conran et al., 2018); the ACGME model treats practice improvement as a core domain, while the CANMED model subsumes it under the scholar role (Li, 2018). In addition, both the ACGME model and the CANMED model are competency models developed based on the characteristics of foreign medical education and cannot fully meet the assessment needs of medical education and clinical teachers in China (Zhang et al., 2023). Therefore, it is necessary to explore a competency model for medical teachers that meets the needs of China's national conditions.

2.4.3 Progress of research on competency models for medical teachers in China

With reference to foreign competency models and in combination with the actual situation of clinical education in China, Chinese scholars have proposed a variety of clinical teacher competency models, such as the 20 competency factors and the "petal model" (Li et al., 2021), covering aspects such as the clinical teachers' professional knowledge, teaching skills, communication ability, evaluation ability, management ability, innovation ability, and professional ethics (Li, 2016). Chinese scholars have applied the clinical teacher competency model to the recruitment, training, assessment, and motivation of clinical teachers, and explored effective ways and methods to improve clinical teacher competency (Palesy et al., 2023), such as the 360-degree feedback method, behavioral event interview method, and case study method (Bian et al., 2012). Methods such as questionnaire surveys and interviews are used to analyze the current situation and the level of clinical teacher competency in China, and it is found that the overall clinical teacher competency is at a medium level, with certain gaps and deficiencies

(Geng et al., 2018; Liu et al., 2016). Meanwhile, factors affecting clinical teacher competency (Zhang et al., 2023), such as individual factors (age, gender, education, and professional title), organizational factors (work environment, work pressure, and job satisfaction), and social factors (policy support and social recognition), are studied (Qin et al., 2015). Chinese scholars have also integrated research on clinical teacher competency with related concepts, such as clinical teachers' self-efficacy, job burnout, and psychological capital, and explored the relationships and mechanisms of action among these concepts and clinical teacher competency (Li & Xin, 2022).

Liang and Wu (2013) employed methods such as literature analysis, behavioral interviews, audio recording coding, reliability testing, and checklist statistics to establish a competency model for clinical medicine teachers. This model comprises 12 threshold competencies and 8 differentiating competencies, along with the design of corresponding assessment tools and procedures. These 20 competency factors were further categorized into six major clusters: ① Impact and Influence Cluster: Work passion; ② Management Cluster: Developing others, teamwork; ③ Cognitive Cluster: Professional knowledge, analytical thinking, systems thinking; ④ Achievement and Action Cluster: Achievement orientation, innovation, initiative, information gathering; ⑤ Helping and Service Cluster: Responsibility, communication and problem-solving skills, people-centric approach; ⑥ Personal Effectiveness Cluster: Self-reflection, dedication, integrity, adaptability, self-confidence, self-control. A competency-based model for the assessment and introduction of clinical medicine teachers in tertiary medical schools has been built (Zhou et al., 2017), which provides a certain basis for the training and management of clinical medicine teachers (Liu et al., 2018). An empirical study on the assessment and recruitment of clinical medicine teachers has been conducted in a higher medical school, which verifies the validity and feasibility of the competency model and assessment tools and provides a reference for the selection and development of clinical medicine teachers (Liang & Zhang, 2010).

On the other hand, based on the competency requirements for clinical emergency physicians, Chen and Yu (2015) proposed the "Petal Model" for emergency medicine specialist competency. Using the vivid imagery of petals and pistils, this model distinguishes different levels and structures of competency: ① Five Petals: Explicit Competencies. These correspond to the observable and trainable fundamental abilities of clinical physicians, specifically including: diagnostic and treatment service capabilities, professional knowledge and skills, communication and collaboration abilities, management capabilities, and research and teaching abilities. These five abilities exhibit distinct developmental stages and require a prolonged

period of practice to master. Like petals surrounding the core, they collectively form the explicit support of a physician's competency. ② Central Pistil: Implicit Competencies. This represents the intrinsic, stable core qualities of a physician, encompassing personality traits, values, professional ethics, and attitudes, among other deep-seated elements. Although not easily measured directly, these elements are the fundamental drivers of external behavior and sustain professional growth. Like the pistil at the center, they nourish and integrate the peripheral abilities (Qiao et al., 2015). Through its illustrative structural differentiation, the "Petal Model" aligns more closely with the growth patterns and competency essence of clinical physicians and other specialized technical professionals. It not only provides a clear framework for scientifically evaluating emergency medicine specialists but also offers a theoretical basis for subsequent targeted training and management practices (Xiao et al., 2023).

In summary, given the current context of medical education's comprehensive advocacy for competency orientation, it is crucial that teachers themselves possess the corresponding competencies. Competency models serve as effective theoretical frameworks and assessment tools, providing important pathways for conducting systematic evaluations and quantitative research on teacher capabilities. Currently, related research primarily employs methods such as behavioral event interviews, factor analysis, the Delphi method, and questionnaire surveys, focusing on three core directions: the construction of competency models, the classification of competency models, and the practical application of competency models. These studies not only deepen the theoretical understanding of the structure of teacher competency but also provide practical tools and evidence for scientifically and objectively evaluating the competency levels of medical teachers. Therefore, the construction of a medical teacher competency model can promote further improvement in medical education evaluation, but the current research on competencies for medical teachers still has the following problems.

1. The small scale of research and the limited number of studies cannot meet the growing demands of medical education. The number of studies on competencies for medical teachers has been decreasing year by year, while medical education is growing steadily. Therefore, the development of medical education urgently needs an objective and effective teacher competency model.

2. There is a lack of an authoritative and effective competency model for medical teachers. Although some progress has been made in research on medical teacher competency models in China, there is still no unified competency model for teachers in medical colleges and universities (Li et al., 2021).

3. There is an urgent need for a medical teacher competency model that meets the

requirements of education development in the new era. In addition, with the development and popularization of teaching reforms such as blended teaching and the integration of ideological and political education into the curriculum, new requirements have been put forward for competency models for teachers in medical colleges and universities (Cong & Wu, 2023; Ning et al., 2023).

Therefore, there is an urgent need to build a medical teacher competency model that meets the requirements of the new era. In this study, based on commonly used competency models, we intend to build a medical teacher competency model that is in line with Southern Medical University, a typical comprehensive medical university, for reference.

Chapter 3: Research Design

In conclusion, we propose two research questions that merit in-depth discussion in the current research on medical education competence:

First, what are the dimensions of the teaching competence model for medical teachers?

Second, what is the current level of competence among medical teachers?

Given the absence of a systematic competency model for medical education in China, establishing such a model first requires representative subjects to preliminarily determine its structure. After validating the model, it can be further tested using multi-center samples. Southern Medical University, as one of the first batch of independent medical universities jointly established by the central ministries and the provincial government, plays a highly exemplary role nationwide with its faculty evaluation system for medical educators. Therefore, this study takes the medical teacher competency at Southern Medical University as an empirical case, and all the data are from Southern Medical University.

Firstly, this research plan uses the method of literature analysis to summarize and analyze the current research status of competence, understand the new trends and needs in medical education development, and determine the research objectives and research directions.

Based on familiarity with and a full understanding of the research status and existing problems, a questionnaire survey and semi-structured interviews were conducted with front-line teachers, managers, and students on medical teachers' competence. The preliminary competency model framework was then developed by combining the domains of existing medical teachers' competence identified through literature research.

In view of the fact that this model framework is still a simple set of elements that cannot be directly used for teacher evaluation, the Delphi method is adopted to further refine the model framework, and the weights of indicators at all levels of competency of medical teachers in the model are determined to form a more mature model.

Finally, to verify the reliability and validity of the model, a questionnaire was developed to evaluate the competency level of medical teachers at Southern Medical University, and the model's validity and feasibility were verified. (For detailed data analysis, please refer to Figure 3.1)

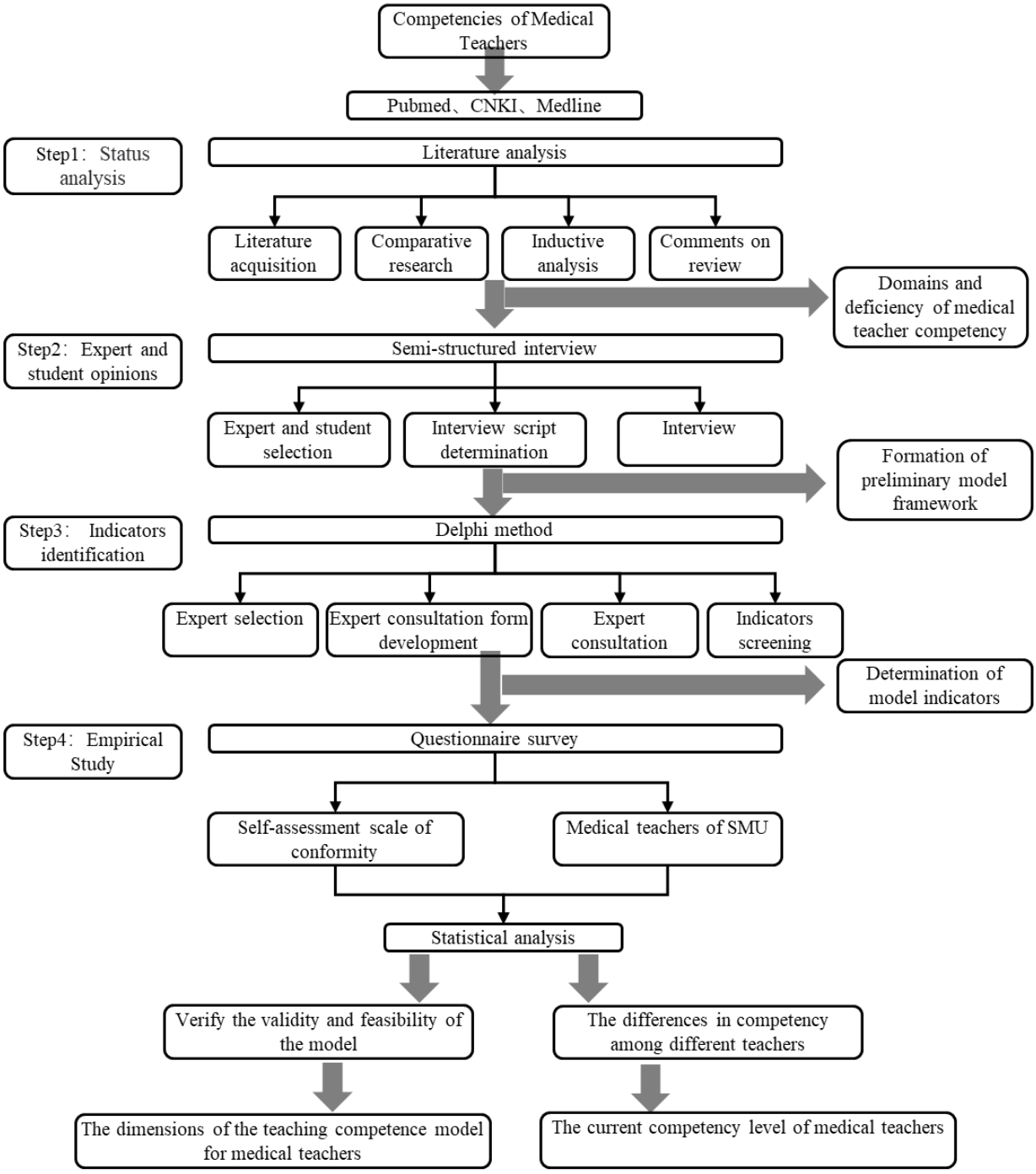


Figure 3.1 Research design

Chapter 4: The Domains of Medical Teachers' Competency Research on the Domains of Competency

Based on familiarity with and a full understanding of the research status and existing problems, a questionnaire survey and a semi-structured interview were conducted with front-line teachers, managers, and students regarding medical teachers' competence. The preliminary competency model framework was then developed by combining the domains of existing medical teachers' competence identified through literature research.

4.1 Method

4.1.1 Semi-structured interview method

Interviewees: Using purposive sampling, teachers and students in medical-related majors at Southern Medical University were selected for interviews. Given that medical education primarily focuses on clinical medicine while also including disciplines such as basic medicine and traditional Chinese medicine, the selection of teachers for semi-structured interviews shall prioritize clinical medicine, while also including teachers from basic medicine and traditional Chinese medicine, as well as teachers from the teaching supervision group. The inclusion criteria for semi-structured interviews with teachers were: (1) engaged in medical education-related work for ≥10 years; (2) holding an associate senior title or above; (3) agreeing to participate in this study. The inclusion criteria for students were: (1) currently enrolled at Southern Medical University; (2) having received medical education for ≥4 years; (3) agreeing to participate in this study.

4.1.2 Teacher interviews

Six teachers were selected for interviews. Among the six interviewees, four were male (66.7%) and two were female (33.3%); the average age was 52.2 ± 11.8 years; the average duration of engagement in medical education work was 20.0 ± 11.4 years; all six held doctoral degrees (100.0%); and all six held senior professional titles (100.0%). All interviewees were faculty members of Southern Medical University, with two also serving as administrative personnel at

the university. Although the six interviewed teachers came from a limited range of disciplines, their selection was based on purposive sampling, emphasizing role diversity: including a basic medicine educator (representing fundamental medical theory), clinical medicine educators (representing surgical and medical clinical practice), a traditional Chinese medicine educator, and a teaching supervision expert (representing quality assurance perspectives). These teachers had an average of 20 years of teaching experience and extensive interdisciplinary teaching and administrative exposure. During the interviews, no new competency themes emerged after the sixth teacher and eighth student, indicating data saturation. Therefore, the research team believes that the selected interviewees effectively captured the core, common dimensions of medical teacher competency, meeting the methodological requirements of qualitative research. (For detailed data analysis, please refer to Table 4.1).

Table 4.1 Expert interviewees

	Teacher No.	Affiliation	Gender	Age	Educational background	Professional title	Years of working experience
Administrative Personnel	Teacher 1	School of Basic Medicine	Male	47	Doctor	Professor	17
	Teacher 2	School of Traditional Chinese Medicine	Female	45	Doctor	Professor/ Chief Physician	13
Frontline Faculty	Teacher 3	Department of Urology	Male	47	Doctor	Professor/ Chief Physician	14
	Teacher 4	Department of Obstetrics and Gynecology	Female	48	Doctor	Chief Physician	16
	Teacher 5	Department of General Surgery	Male	50	Doctor	Chief Physician	17
	Teacher 6	Teaching Supervision Committee	Male	76	Doctor	Professor	43

4.1.3 Student interviews

Eight students were selected for interviews. Of the eight interviewees, seven were male (87.5%) and one was female (12.5%); the average age was 24.5 ± 2.7 years; there were four undergraduate students (50%), two master's students (25%), and two doctoral students (25%). All interviewees were enrolled at Southern Medical University. (For detailed data analysis, please refer to Table 4.2.)

Table 4.2 Student interviewee demographics

Name	Major	Gender	Age	Educational Background
Student 1	Clinical Medicine	Male	22	Year-4 undergraduate
Student 2	Clinical Medicine	Male	22	Year-4 undergraduate
Student 3	Clinical Medicine	Female	23	Year-5 undergraduate
Student 4	Clinical Medicine	Male	23	Year-5 undergraduate
Student 5	Clinical Medicine (Urological Surgery)	Male	24	Master's student
Student 6	Oncology	Male	25	Master's student
Student 7	Surgery	Male	29	Doctoral student
Student 8	Internal Medicine (Gastroenterology)	Male	28	Doctoral student

4.1.4 Sample size

The sample size for the interviews was determined by the principle that no new information emerged from the collected data. This study included six teachers and eight students. After completing semi-structured interviews with these participants, thematic saturation was reached, and no new themes emerged, leading to the decision to stop recruiting additional interviewees. Consequently, the final sample size was set at six teachers and eight students.

4.1.5 Interview tools

Semi-structured interviews are a common method in qualitative research. The thematic framework of semi-structured interviews consists mainly of open-ended questions, and new questions can be added according to the progress of the interview. In this study, the core elements are "medical teachers" and "competency." Based on literature analysis, theoretical research, and relevant work experience, we reviewed similar studies (Alwazzan et al., 2023; Li et al., 2022; Saaiq et al., 2024), employed brainstorming to draft a preliminary interview outline. Then we invited several medical teaching experts to discuss and revise the outline to form the final version of the interview outline. The interview instrument for this study consists of three parts: Part I: Informed consent form; Part II: Basic information; and Part III: Interview outline. The contents of the interview outline include the following aspects.

(1) From your personal point of view, what competencies do you think medical teachers should possess? What are the specific domains of these competencies?

(2) What professional qualities do you think medical teachers need to possess?

(3) Do you think the competencies currently possessed by medical teachers can meet the current needs of medical education?

(4) What do you think are the differences between the competencies required of medical teachers and non-medical teachers?

(5) In addition to the above competencies, is there anything else you would like to add?

The interview tools please see Annex A.

4.1.6 Data collection

This study strictly adhered to the ethical norms and operational procedures of qualitative research during the interview phase. First, pre-interview preparations and informed consent were obtained. Before the interviews began, the research team provided each interviewee with a detailed explanation of the study's purpose, methods, content, and the necessity of recording. They were explicitly informed of the voluntary nature of their participation and the principle of anonymity. After obtaining written or oral informed consent, the research team and interviewees mutually agreed on a quiet, undisturbed location to create a relaxed, candid environment for communication. Semi-structured, open-ended questions were used throughout the interview process. During the exchanges, the researchers fully respected interviewees' communication habits and adjusted the question sequence as needed to facilitate in-depth discussion of relevant topics. The entire interview was audio-recorded and supplemented with on-site notes to capture nonverbal cues and key points. Each interview session lasted 60–90 minutes, ensuring thorough yet concise content. Throughout the process, the researchers used gentle language and maintained a neutral attitude, encouraging interviewees to express their personal experiences and viewpoints honestly and freely while strictly protecting their privacy and feelings. Post-interview data processing was conducted promptly. Within 24 hours of the interviews concluding, the research team began organizing and analyzing the data. Two researchers collaborated to review the audio recordings and notes, transcribe them into written materials, and conduct preliminary summarization. To protect the privacy of the interviewees, all were assigned anonymous codes, sequentially labeled M1, M2, M3, etc., ensuring objectivity and standardization in the information-processing procedure.

4.1.7 Data analysis

This study employed content analysis for data processing:

(1) Selecting analysis units

Sample selection principles: 1) Statements that clearly define the conceptual meaning of medical teachers' competency; 2) Statements that reflect the competency characteristics of medical teachers, such as skills, knowledge, role positioning, values, self-perception, qualities, and motivation; 3) Statements that elaborate on the selection, training, and assessment of nurses

engaged in medical teaching. The selected statements served as the minimum units of analysis.

(2) Constructing the category system

Based on the Iceberg Model of Competency (McClelland, 1973) as the theoretical framework, the selected statements were analyzed. Skills, knowledge, role positioning, values, self-perception, qualities, and motivation were preliminarily defined as first-level categories. The conceptual connotations extracted from the analysis units were coded, summarized, and integrated to form several nodes, which were then classified as second-level items under their corresponding first-level categories.

(3) Content coding

This study employed content analysis to systematically code and process the data. 1) Coder Training: The research utilized content analysis for the systematic coding and processing of the data. 2) Data Coding Process: Based on the theoretical framework of the competency "iceberg model," the coders used NVivo 11 qualitative analysis software to independently code statements related to the competency of medical teachers found in the literature. During coding, any inconsistencies were first discussed and negotiated between the two coders. If a consensus could not be reached through discussion, relevant experts were consulted for arbitration until a unified coding result was achieved. 3) Reliability Analysis: To assess coding consistency, the following methods were used for reliability testing: Inter-Rater Agreement = $2 \times (T1 \cap T2) / (T1 \cup T2)$, where T1 and T2 represent the total number of codes assigned by the two coders respectively, $T1 \cap T2$ is the number of codes on which both coders agreed, and $T1 \cup T2$ is the total union of all coded items. The Coding Reliability Coefficient = n × Average Inter-Rater Agreement / [1 + (n - 1) × Average Inter-Rater Agreement], where n is the number of coders (in this study, n=2). According to relevant methodological literature, a coding reliability coefficient > 0.9 is considered acceptable, indicating high coding consistency and credible analysis results (Li et al., 2022) .

4.2 Results

Indicator Compilation: The interview results from six teachers and eight students were coded and analyzed, yielding six first-level indicators, Professional Ethics and Conduct (Values), Professional Competence (Knowledge), Teaching Literacy (Skills), Guiding Ability (Skills), Management Ability (Skills), and Developmental Ability (Qualities), along with 38 second-level indicators (For detailed data analysis, please refer to Table 4.3). The average inter-coder agreement between the two coders was 0.87, with a coding reliability coefficient (R) of 0.93,

indicating a high level of internal consistency.

Table 4.3 Preliminary indicator system

Primary Indicator	Secondary Indicator	Teacher Freq	Teacher Example Content	Student Freq	Student Example Content
Professional Ethics and Conduct (Values)	Exemplary Conduct	4	Teacher 4: "In the medical profession, especially in teaching hospitals, every action and word of yours is a lesson for the students. If you are late yourself, how can you demand punctuality from students? If you are impatient with patients, students learn indifference."……	5	Student 3: "I believe a qualified medical teacher should possess the ability to lead by example, aligning words with actions. Being a role model can subtly influence us for a lifetime. Some teachers are incredibly serious in class, setting a true example for us."……
	Student Care	5	Teacher 2: "Students shouldn't be treated merely as a workforce. Notice their dark circles from staying up late studying, understand their nervousness when first encountering patients. A word of concern, a patient explanation, might change their fear of the difficulty of medicine."……	3	Student 4: "Teachers should, more often, understand content students find difficult from the perspective of someone who has been through it (from a medical student's viewpoint), show empathy, provide timely feedback, and explain clearly. Such teachers are remarkable."……
	Dedication Spirit	6	Teacher 1: "Research has deadlines, clinical work has surgery schedules, but students' questions are not on a timetable. Replying to students' emails at 11 or 12 pm, refining lesson plans on weekends—this is the norm. Without a spirit of dedication, one cannot be a good medical teacher."……	3	Student 1: "Some teachers, although not in particularly high positions, are very willing to teach students. This ethos should be promoted."……
	Personal Charisma	3	Teacher 4: "Knowledge can be cold, but a teacher can be warm. I sometimes share my setbacks and reflections from medical practice in class. Students then see you as a flesh-and-blood mentor, not just a 'player' of knowledge."……	4	Student 1: "Whether they can engage all classmates and motivate everyone to participate is a significant issue."……
	Sense of Professional Identity	4	Teacher 1: "My most cherished moments are not publishing high-impact thesis, but hearing my former students confidently present their research findings at academic conferences. At that moment, you feel your life as a teacher is continuing."……	2	Student 1: "Some teachers come to class just to fulfill a duty, which may not yield good results; others genuinely want to teach."……
	Sense of Professional Responsibility	4	Teacher 3: "We are training people who wield scalpels. Teaching one wrong anatomical layer could lead to a medical	7	Student 3: "The teacher's attention to their attire, personal appearance, and seriousness

			accident in the future. This sense of responsibility, as if walking on thin ice, must permeate all teaching."……		towards the classroom also reflects part of their teaching attitude."……
	Personal Specialty	2	Teacher 1: "I enjoy photography and often take pictures of key anatomy during surgeries and rare pathological specimens, creating a unique teaching image library. This attracts students more than textbook pictures."……	1	Student 7: "Every teacher can have their own specialties. Such talents may not be core competencies required for medical teaching—they could be in fields completely unrelated to the profession, like sports skills, photography, or artistic literacy. However, it is precisely these 'X-factors' that can inject diverse vitality into medical teaching, making classroom formats richer and more multi-dimensional."
	Clinical Theoretical Competence	3	Teacher 5: "A surgeon must explain from anatomy, physiology, pathophysiology to surgical indications. Without a solid theoretical foundation, surgery is mere 'craftsmanship,' and students will only learn to imitate, not to think."……	8	Student 3: "Teaching ability is reflected in the classroom by how thoroughly they can explain the knowledge they intend to impart."……
Professional Competence (Knowledge)	Clinical Practical Competence	5	Teacher 4: "In obstetrics teaching, 'hands-on' is not a metaphor. Techniques for fetal position examination, judgment of labor progression—a tiny error leads to great mistakes. If your own technique isn't precise, how can you teach students?"……	2	Student 1: "A teacher's communication skills are very important; they should know how to guide students in teamwork, engage everyone, and mobilize enthusiasm."……
	Research Capability	5	Teacher 1: "Without research, teaching is water without a source. I break down my national research projects into smaller questions, allowing undergraduates to participate in literature searches or basic experiments, letting them smell the 'scent of research' early on."……	2	Student 4: "The teacher's own ability is crucial—meaning research capability—which needs tangible results to support it."……
	Ability to Grasp Disciplinary Frontiers	3	Teacher 3: "Treatment guidelines for prostate cancer are updated almost yearly. I require myself, and my students, to follow the latest trends from top conferences like ASCO and EAU. Classroom content must advance with the times."……	3	Student 3: "He (the teacher) regularly consults new diagnosis and treatment guidelines or updates, reads new documents, and persists in learning."……
	Interdisciplinary Integration Competence	4	Teacher 1: "Teachers in basic medical sciences must take the initiative to integrate. When teaching pathophysiology, I introduce the latest gene sequencing technologies and molecular imaging discoveries, showing students how basic	1	Student 2: "In medicine, especially clinical specialties, various disciplines intersect significantly... Even non-clinical specialties... have substantial overlap... Knowledge can reinforce each other, so having multi-

			research illuminates the ‘black box’ of clinical diagnosis and treatment."……		disciplinary knowledge supplementation is beneficial."
	Clinical Experience	4	Teacher 4: "I have a folder on my computer called ‘Teaching Treasure Trove,’ filled with imaging data, surgical videos, and patient follow-up records of typical cases. These vivid stories are more compelling than any textbook."……	6	Student 1: "When a teacher shares the logic from their practice and learning process...(it) yields the best classroom effect."……
	Clinical Teaching Awareness	3	Teacher 3: "In the wards, you need ‘eagle eyes.’ You must monitor the patient’s condition while peripherally observing where the students are and what they’re doing. When you see them at a loss, a glance or a hint is the best teaching."……	4	Student 3: "Teaching guidance includes both classroom instruction and hospital-based guidance. Teachers must certainly show us the way in learning details and general direction."……
	Classroom Management Ability	4	Teacher 1: "How to prevent a lecture for 200 from becoming a ‘sleeping hall’? I deliberately design real-time polls, one-minute discussions to force interaction and ‘grab’ students’ attention back."……	2	Student 1: "Whether they can engage all classmates to participate is a significant issue."……
	Demonstration Ability	4	Teacher 4: "When teaching the four-step Leopold’s maneuvers, I not only demonstrate myself but also have a student act as a ‘model’ for others to practice on. Incorrect techniques are corrected on the spot; correct sensations are reinforced immediately."……	4	Student 2: "He can transform knowledge vividly, making it acceptable to everyone."……
Teaching Literacy (Skills)	Observational Ability	2	Teacher 3: "During rounds, I don’t just listen to the student’s case presentation; I observe their posture and tone. If they avoid eye contact with the patient or sound uncertain, it might indicate unfamiliarity with the knowledge or communication anxiety, requiring different guidance."……	1	Student 3: "Some teachers are very adept at picking up on our emotions... adjusting based on our reactions."
	Teaching Effectiveness Evaluation Ability	2	Teacher 2: "Exam scores are summative assessment. I prefer formative assessment. For example, in PBL, observing the quality of students’ questions, their literature search paths, and teamwork performance better reflects the growth of higher-order thinking skills."……	2	Student 1: "Post-class mastery may require some feedback, not just homework or quizzes. But at least some effect should be seen in exams."……
	Instructional Design Ability	3	Teacher 1: "Designing a class is like directing a film. What case ‘hooks’ students at the start? How to create cognitive conflict in the middle? How to reveal the core mechanism at the climax? How to conclude and leave food for thought? Everything must be meticulously planned."……	6	Student 4: "Lesson preparation ability is crucial. Don’t let being busy turn class into simply reading PPTs. Understand from an experienced perspective what students find

					difficult, and thus design targeted teaching."……
	Knowledge Structuring Ability	4	Teacher 3: "For urological diseases, I don't follow the textbook index. I use core symptoms like 'hematuria,' 'low back pain,' 'dysuria' as threads to string together knowledge of various etiologies, diagnoses, and treatments like pearls, helping students build clinical mind maps."……	5	Student 2: "If he can present his own clear logic throughout the lecture, the level of acceptance is actually very high."……
	Knowledge Condensation Ability	3	Teacher 2: "TCM formulary is vast. What I teach is the 'comparative analysis of formula categories' method. For example, formulas for treating colds—Ma Huang Tang, Gui Zhi Tang, Yin Qiao San—what are the differences in their core pathogenesis, applicable signs, and herb combinations? Grasping this 'essence' enables generalization."……	5	Student 3: "The ability to visualize relatively abstract knowledge content helps students understand better."……
	Differentiated Instruction Ability	2	Teacher 5: "For eight-year program students with research potential, I provide more literature reading and small project design. For five-year program students aiming for clinical practice, I offer more hands-on opportunities and clinical decision-making explanations. A one-size-fits-all approach doesn't nurture personalized talent."……	3	Student 2: "Teachers need to recognize they are teaching an audience whose grasp of knowledge is not yet solid."……
	Listening Ability	4	Teacher 2: "When students ask questions, they often can't clearly express their real confusion. You need to listen patiently, even help clarify the question: 'Are you asking about A, or are you actually concerned about B?' Listening itself is a form of guidance."……	1	Student 3: "Some teachers are very adept at picking up on our emotions."
Guiding Ability (Skills)	Expressive Ability	3	Teacher 1: "Language must be precise. 'Apoptosis' and 'necrosis' cannot be confused. But it also needs to be vivid. I might say, 'This signaling pathway is like an assembly line, and this gene mutation jams the most critical gear.'"……	4	Student 1: "How to motivate classmates... Whether they can engage all classmates to participate."……
	Feedback Ability	4	Teacher 3: "A student's first cystoscopy—their hands were shaking terribly. My feedback wasn't 'don't be nervous,' but specific guidance: 'Relax your wrist, hold the scope like a pen between your thumb and index finger, using the urethra as a fulcrum...' Positive, specific, actionable feedback is useful."……	2	Student 1: "Post-class mastery may require some feedback, not just homework or quizzes."……

	Empathic Ability	5	Teacher 2: "A student failed the postgraduate entrance exam and came to me crying. My first response wasn't reasoning but saying, 'I know you put in a lot of effort; this must be very hard.' Acknowledge the emotion first, then plan the future together. Being a teacher requires a parental heart."……	4	Student 1: "How to guide students not to 过度追求 (overly pursue) benefits... To provide the most appropriate treatment for patients based on the actual situation."……
	Communication Ability	5	Teacher 5: "Doctor communication is layered: with patients and families, be understandable and empathetic; with nurses, be clear and collaborative; with peers, be professional and efficient. In teaching, I simulate these different scenarios to train students' ability to 'switch channels.'"……	2	Student 1: "A teacher's communication skills are very important; they should know how to guide students in teamwork..."……
	Mentoring and Guidance Ability	5	Teacher 1: "From the sophomore year in the lab, I draw a 'research growth map' for each student: learn techniques in sophomore year, conduct a project in junior year, write a thesis in senior year. With a plan, their efforts have direction, avoiding confusion."……	2	Student 1: "Under his guidance, students can utilize some of the teacher's excellent practical methods to attempt their first clinical practice, avoiding detours."……
	Command Ability	5	Teacher 5: "Managing multiple trauma resuscitation or major surgery is like a battle. As the lead surgeon or senior, you must remain calm and composed, quickly assigning tasks (who manages the airway, who establishes IV access, who contacts the blood bank) to make the team operate efficiently. This command ability must be cultivated starting from simulation training."……	0	
Management Ability (Skills)	Team Collaboration Ability	3	Teacher 4: "Obstetrics is a highly team-dependent department. Doctors, midwives, nurses, and neonatologists must work seamlessly. In teaching, I strongly emphasize role awareness and mutual support within the team."……	1	Student 6: "Teachers need to possess good team coordination skills."
	Decision-Making Ability	3	Teacher 5: "The core of clinical teaching is teaching decision-making. Faced with an abdominal pain patient, should imaging be a CT scan or conservative observation first? Surgery: laparoscopic or open? There's no single answer, only trade-offs. I present these dilemmas to students to train their decision-making thinking."……	0	
	Organizational Ability	2	Teacher 2: "Organizing a hospital-wide TCM classics training workshop involves everything from inviting experts,	0	

			scheduling, coordinating venues to logistics. An excellent teacher should also be an excellent project manager."……		
	Coordination Ability	4	Teacher 4: "A clinician's time is fragmented. How to coordinate outpatient clinics, surgeries, meetings with one's own teaching and research time? My secret is 'modular' management and efficient team delegation."……	1	Student 6: "Frontline clinical doctors are usually quite busy, so an excellent clinical teacher should have good coordination skills to balance their teaching and clinical work."
	Self-Assessment Ability	2	Teacher 1: "I review my teaching every year, asking myself three questions: Which class am I most satisfied with? What was my most failed interaction? What teaching bottleneck do I most want to break through next year?"……	1	Student 1: "Teachers also need to conduct regular post-class summaries."
	Reflective Ability	3	Teacher 3: "After teaching each cohort, I write a teaching reflection. What points did this cohort generally struggle with? Was there a problem with my explanation at the time? How can I present it better next time?"……	2	Student 3: "He can adjust his teaching content based on our different reactions."……
Developmental Ability (Skills)	Innovative Ability	5	Teacher 1: "I tried introducing virtual simulation experiments into pathology teaching. Students can 'dissect' organs and observe dynamic disease development on computers. Though development is time-consuming, the learning effect is revolutionary."……	2	Student 3: "He regularly consult new diagnosis and treatment guidelines or read updated documents, persistently learning."……
	Lifelong Learning Ability	3	Teacher 5: "Surgical techniques change rapidly, from open to laparoscopic to robotic surgery. Without learning, you become obsolete immediately. I demand that myself and my students adopt the mindset that 'graduation is the start of learning.'"……	2	Student 3: "Medical knowledge updates quickly; one must maintain a rigorous attitude towards lifelong learning, studying the latest diagnosis and treatment guidelines and industry documents."……
	"Internet+" Ability	4	Teacher 2: "I created a WeChat public account for the course, pushing classic cases, frontier information, and outstanding student assignments. A class is only 50 minutes, but the 'mobile classroom' can happen anytime, anywhere." ……	0	

4.2.1 Professional ethics and conduct

4.2.1.1 Exemplary conduct

It refers to the teacher serving as a role model not only in imparting knowledge but also in moral character, behavior, ideological outlook, and values. Teachers must maintain strict self-discipline because their words and actions are constantly observed and learned by students.

4.2.1.2 Student care

Denotes the teacher's genuine care, concern, respect, and understanding for students. This extends beyond basic welfare to include respecting students' personal dignity and differences; understanding their thoughts, emotions, and needs; paying attention to their physical and mental health and overall development (academic, psychological, social); treating every student fairly and justly; and patiently listening to and assisting students in resolving difficulties.

4.2.1.3 Dedication spirit

It signifies the teacher's willingness to prioritize educational endeavors and student development over personal gain, time, energy, or even partial self-interest, demonstrating a spirit of selfless contribution.

4.2.1.4 Personal charisma

It refers to a compelling and influential spiritual quality naturally emanating from the teacher's inner cultivation, moral character, knowledge, talent, personality, emotional attitude, and behavioral demeanor. It fosters students' respect, affection, and trust.

4.2.1.5 Sense of professional identity

It indicates the teacher's positive evaluation and active acceptance of their teaching profession.

4.2.1.6 Sense of professional responsibility

It denotes the teacher's profound awareness of the social, moral, and educational responsibilities inherent in their profession, coupled with a conscientious commitment to fulfilling these duties and obligations.

4.2.1.7 Personal specialty

It refers to outstanding skills, talents, or interests the teacher possesses outside their primary teaching domain. For medical teachers, personal specialties are not only an expression of personal charm but also a crucial factor in enhancing teaching quality, promoting students'

holistic development, and driving innovation in medical education, potentially offering targeted benefits to individual students.

4.2.2 Professional competence

4.2.2.1 Clinical theoretical competence

Medical teachers possess solid clinical and theoretical knowledge, enabling them to systematically structure medical knowledge frameworks and organize complex information logically.

4.2.2.2 Clinical practical competence

It refers to the teacher's diagnostic and therapeutic proficiency in clinical work. Medical education emphasizes the integration of theory and practice; thus, medical teachers should incorporate clinical theory into practical teaching.

4.2.2.3 Research capability

It reflects personal academic achievement and is a key driver of advances in medical science, improved teaching quality, and the cultivation of innovative medical talent. In medical institutions, teachers' research capabilities foster students' research and innovation skills. Medical teachers should actively participate in or lead research projects and publish academic theses. With the establishment of modern educational science systems, the translation of research findings into teaching is widely recognized. Producing high-quality research outputs and training skilled researchers have become essential components of research activities.

4.2.2.4 Ability to grasp disciplinary frontiers

It refers to the medical teacher's capacity to continuously track, deeply understand, and effectively integrate the latest research advances, technological breakthroughs, theoretical updates, clinical guidelines, and development trends within their discipline and related fields.

4.2.2.5 Clinical experience

It is an indispensable resource for training future medical professionals and enhancing the quality of medical education. Accumulating cases during clinical teaching and practice enables a more precise grasp of disease diagnosis and treatment principles, providing students with rich, vivid teaching materials. Experience gained from clinical work enriches teaching, helping students better understand and master medical knowledge.

4.2.3 Teaching literacy

4.2.3.1 Clinical teaching awareness

It signifies the teacher's profound understanding and conscious embrace of the responsibilities and mission intrinsic to the role of "clinical preceptor." This role transcends mere knowledge transmission; it entails the professional conscientiousness to guide, demonstrate, supervise, and cultivate trainees, including medical students, residents, and visiting physicians, within authentic clinical settings such as wards, outpatient clinics, and operating rooms.

4.2.3.2 Classroom management ability

It refers to the teacher's capacity to effectively organize teaching processes, maintain good instructional order, foster a positive learning atmosphere, and handle unexpected situations within teaching environments (including traditional classrooms, PBL discussion rooms, skills labs, and online classrooms) to ensure efficient and orderly teaching activities.

4.2.3.3 Demonstration ability

It denotes the teacher's ability to clearly, accurately, and in a standardized manner demonstrate procedural steps, essential skills, anatomical structures, pathological features, or instrument use to students. This is a core element of practical medical teaching, particularly in skills training.

4.2.3.4 Observational ability

It refers to the teacher's capacity to keenly and purposefully observe students' behavioral performance, operational details, communication methods, emotional states, and difficulties or progress during learning, especially in clinical teaching and skills training.

4.2.3.5 Teaching effectiveness evaluation ability

It signifies the teacher's capacity to systematically collect information using diverse methods and tools to judge, analyze, and reflect on students' learning outcomes (knowledge acquisition, skill proficiency, attitude/behavioral changes, competency development) and the effectiveness of their own teaching activities.

4.2.3.6 Instructional design ability

It refers to the teacher's ability to design classroom instruction, encompassing course planning, analysis of teaching materials, and formulation of teaching strategies. An excellent instructional design comprehensively considers student needs, learning objectives, content, teaching methods, assessment feedback, and technological support. Given the vast and complex medical

knowledge systems, medical teachers require ingenuity in designing learning-centered teaching plans that promote student learning.

4.2.3.7 Knowledge structuring ability

It refers to the teacher's ability to effectively integrate and organize medical knowledge into systematic, coherent structures. Connecting different knowledge points in an orderly manner facilitates students' clear, intuitive understanding of knowledge frameworks, fostering a holistic view.

4.2.3.8 Knowledge condensation ability

It denotes the medical teacher's skill in distilling vast medical knowledge into core content that is easy for students to comprehend and master, maximizing the delivery of key and difficult points within limited class time.

4.2.3.9 Differentiated instruction ability

Emphasizes adopting tailored teaching approaches based on students' individual differences and actual needs to promote their holistic development and personalized growth. Medical teachers should adapt their teaching strategies for different schools, majors, and individual students. For instance, differences exist between clinical majors and health administration majors in medical institutions, such as preferences for rational or intuitive thinking.

4.2.4 Guiding ability

In this model, "Listening Ability," "Expressive Ability," and "Communication Ability" are parallel indicators that respectively focus on information reception, information output, and bidirectional interactive exchange, each with distinct behavioral manifestations in medical education contexts. "Research Capability" refers to the teacher's ability to conduct research, while "Ability to Grasp Disciplinary Frontiers" refers to the ability to track the latest advances and integrate them into teaching. The two are distinct in competency evaluation.

4.2.4.1 Listening ability

It refers to the teacher's capacity to actively, attentively, patiently, and without bias to receive and understand information, needs, feelings, and perspectives conveyed by students, patients, colleagues, or other relevant individuals through verbal and nonverbal means (expressions, body language, tone).

4.2.4.2 Expressive ability

It signifies the teacher's capacity to use clear, accurate, logical, and audience-appropriate oral and written language, as well as nonverbal methods (body language, expressions, demonstrations), to effectively convey information, knowledge, viewpoints, requirements, and feedback.

4.2.4.3 Feedback ability

It refers to the teacher's capacity to provide timely, specific, and constructive evaluation information to students, colleagues, or team members regarding their performance, behavior, or outcomes, aimed at promoting their learning, improvement, and development. The core lies in "facilitating growth" rather than "judging right or wrong."

4.2.4.4 Empathic ability

It denotes the teacher's capacity to understand the feelings, situations, and perspectives of students, patients, and colleagues by putting themselves in their place, and to demonstrate this understanding and care through communication and actions. It combines cognitive (understanding) and affective (caring) components.

4.2.4.5 Communication ability

In medical education, effective communication between teachers and students is vital for knowledge transmission and skill development. Effective communication is bidirectional. Through adept listening and communication, medical teachers can promptly understand students' learning status, confusions, and needs, adjust teaching strategies, and stimulate students' interest and motivation.

Furthermore, positive teacher-student interaction fosters mutual understanding and trust, providing strong support for student growth. Medical teachers' communication ability also manifests in interactions with patients. Effective patient communication helps patients better understand disease knowledge, treatment plans, and prognoses, enhances their self-management capabilities, and improves treatment outcomes.

4.2.4.6 Mentoring and guidance ability

Medical teachers are not only knowledge transmitters but also mentors and guides on students' growth paths. They should provide career guidance and advice tailored to students' interests, strengths, and career aspirations. Teachers should help students understand the current state and trends of the medical profession, guide them in establishing sound professional values, and

clarify their career goals and development directions. Given the high pressure and intense competition in medical studies, students are prone to psychological issues. Medical teachers should monitor students' mental health and provide necessary psychological support and counseling.

4.2.5 Management ability

4.2.5.1 Command ability

It refers to the ability to issue clear instructions, coordinate resources, assign tasks, and direct actions in specific teaching, clinical, or team situations (e.g., emergencies, surgeries, large-scale teaching activities, team projects) to ensure the efficient and orderly achievement of objectives. It emphasizes leadership in critical moments or specific scenarios.

4.2.5.2 Team collaboration ability

It signifies the teacher's capacity to function effectively as a team member by collaborating with others (colleagues, students, and other professionals such as nurses, technicians, and social workers), sharing information, resources, responsibilities, and decisions, respecting and supporting one another, and working collectively toward team goals (e.g., patient care, teaching programs, research projects).

4.2.5.3 Decision-making ability

It refers to the teacher's capacity to analyze problems, weigh pros and cons, and ultimately make timely, reasonable, and responsible decisions based on available information, professional knowledge, ethical principles, and risk assessment in complex teaching, clinical, or management situations.

4.2.5.4 Organizational ability

It denotes the teacher's capacity to effectively plan, arrange, coordinate, and utilize various resources (time, human resources, materials, information) to ensure the orderly, efficient, and high-quality completion of teaching, clinical work, research projects, or other responsibilities.

4.2.5.5 Coordination ability

It encompasses team coordination, balancing work and teaching responsibilities, and aligning teacher instruction with student self-directed learning. Only with strong coordination skills can teachers navigate complex and dynamic educational environments effectively, thereby contributing to student growth and development.

4.2.6 Developmental ability

4.2.6.1 Self-Assessment ability

It refers to the teacher's proactive and systematic examination of their teaching practices, professional knowledge, and professional conduct, identifying strengths and weaknesses through critical reflection and formulating plans for improvement. This is the internal engine of continuous professional development.

4.2.6.2 Learning ability

In the rapidly evolving medical field, the learning ability of medical teachers, as knowledge disseminators and innovation leaders, is paramount. Medical teachers must continually update their professional knowledge.

4.2.6.3 Reflective ability

Reflection is the process by which teachers critically examine their professional activities, analyzing their actions and the resulting outcomes. Through critical reflection, teachers purposefully review completed teaching practices, engage in rational thinking, and enhance their capacity to summarize and evaluate teaching.

4.2.6.4 Innovative ability

Higher education is a prime period for cultivating students' innovative thinking. To foster this, university teachers must possess the ability to innovate in teaching, daring to break free from traditional constraints and experiment with new teaching methods and tools to meet diverse student needs and interests, making medical classrooms more dynamic and engaging.

4.2.6.5 Lifelong learning ability

Given the constant evolution of medical knowledge, teachers must maintain awareness and capacity for lifelong learning. This entails continuously updating their knowledge and teaching philosophies by attending academic conferences, pursuing advanced courses, and engaging with current literature to keep pace with advancements in the field.

4.2.6.6 "Internet+" ability

It refers to the teacher's proactive integration of internet technologies, digital tools, and data thinking to transform medical education. It goes beyond merely "using technology," emphasizing the innovation of teaching paradigms through technology.

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Chapter 5: Development of A Competency Model for Medical Teachers

In view of the fact that this model framework is still a simple set of elements that cannot be directly used for teacher evaluation, the Delphi method is adopted to further refine the model framework, and the weights of indicators at all levels of competency of medical teachers in the model are determined to form a more mature model.

5.1 Method

5.1.1 The Delphi method

The Delphi method, also known as the expert consultation method, is a systematic, interactive technique for forecasting and decision-making. Developed by the RAND Corporation in the United States in the 1950s, it aims to efficiently and scientifically collect and integrate the collective opinions of experts in a field through multiple rounds of anonymous surveys. Its core features include anonymity (experts are unaware of each other's identities, allowing independent, free expression of opinions), feedback (aggregated statistical results from each round are provided to experts for reference and revision in the next round), and statistical analysis (quantitative analysis and processing of expert opinions). These characteristics help the Delphi method avoid issues such as dominance by authority figures or conformity pressure often encountered in group discussions, gradually reducing divergence and ultimately forming a highly consensual collective judgment among experts. Due to its scientific and rigorous nature, the Delphi method plays an irreplaceable role in constructing various evaluation index systems, screening and determining key indicators, and forecasting development trends. In recent years, this method has been widely applied in medical and related fields, frequently used for developing clinical guidelines, establishing quality evaluation standards, defining teaching competency models, or identifying core curriculum elements—tasks that require the convergence of professional consensus.

5.1.1.1 Expert selection

Inclusion criteria: (1) Professional qualifications: Continuous engagement in medical education,

clinical teaching, or related management work for five years or more, with solid practical experience; (2) Academic background: Possession of a bachelor's degree or higher, ensuring the necessary theoretical literacy and knowledge foundation; (3) Willingness and commitment to participate: Full understanding of the research topic, voluntary participation, and the ability to complete three rounds of the Delphi survey, ensuring the coherence and integrity of the study. This study employed purposive sampling, selecting representative experts in medical education from multiple medical colleges and affiliated hospitals in China based on the above criteria. Ultimately, 20 experts agreed to participate and were included in the study, forming an expert panel characterized by both professional depth and diverse perspectives.

This study selected 20 experts for Delphi consultation. Of the 20 invited, 14 were male (70.0%) and 6 were female (30.0%). Fifteen experts (75%) were faculty members at Southern Medical University, while 5 (25%) were from other medical-related institutions. In terms of years engaged in medical education: 1 expert had less than 5 years, 1 had 5–10 years, 4 had 11–20 years, 3 had 20–25 years, and 11 had more than 25 years. The expert group represented a variety of roles, including teaching, clinical practice, administration, and research. Nineteen experts (95%) held senior professional titles, and 1 (5%) held an intermediate professional title. For detailed data analysis, please refer to Table 5.1.

Table 5.1 Expert panel overview

No.	Expert ID	Gender	Institution	Department/Unit	Years of Experience	Roles	Position Level
1	Expert 7	Female	Southern Medical University	Teaching Support Center	11–20 years	Teaching ¦ Clinical	Intermediate
2	Expert 8	Male	Southern Medical University	Dept. of Integrated Chinese & Western Medicine	5–10 years	Teaching	Senior
3	Expert 9	Male	Southern Medical University	School of Basic Medicine	11–20 years	Teaching ¦ Administrative	Senior
4	Expert 10	Male	Nanfang Hospital, SMU	Dept. of General Surgery	20-25 years	Teaching ¦ Clinical	Senior
5	Expert 11	Male	Nanfang Hospital, SMU	Dept. of Urology	20-25 years	Teaching ¦ Clinical	Senior
6	Expert 12	Male	Nanfang Hospital, SMU	Anesthesia & Operation Center	>25 years	Teaching ¦ Clinical ¦ Research	Senior
7	Expert 13	Male	Zhujiang Hospital, SMU	Clinical Skills Center	>25 years	Teaching	Senior

No.	Expert ID	Gender	Institution	Department/Unit	Years of Experience	Roles	Position Level
8	Expert 14	Male	Third Affiliated Hospital, SMU	Dept. of Spinal Surgery	11–20 years	Clinical ¦ Administrative	Senior
9	Expert 15	Male	Guangdong Pharmaceutical University	Vice President	>25 years	Teaching ¦ Research ¦ Administrative	Senior
10	Expert 16	Female	Nanfang Hospital, SMU	Dept. of Ultrasound Medicine	>25 years	Teaching ¦ Clinical ¦ Research ¦ Administrative	Senior
11	Expert 17	Female	Southern Medical University	School of Traditional Chinese Medicine	11–20 years	Teaching ¦ Clinical ¦ Research ¦ Administrative	Senior
12	Expert 18	Male	Nanfang Hospital, SMU	Dept. of Orthopedics	>25 years	Teaching ¦ Clinical ¦ Research ¦ Administrative	Senior
13	Expert 19	Male	Nanfang Hospital, SMU	School/Dept. of Stomatology	>25 years	Teaching ¦ Clinical ¦ Research ¦ Administrative	Senior
14	Expert 20	Male	Jinan University	Dept. of Traditional Chinese Medicine	5–10 years	Teaching ¦ Clinical ¦ Research	Senior
15	Expert 21	Female	Shenzhen Hospital, SMU	Dept. of Gastroenterology	>25 years	Teaching ¦ Clinical ¦ Research ¦ Administrative	Senior
16	Expert 22	Male	Jinan University	School of Traditional Chinese Medicine	>25 years	Teaching ¦ Clinical ¦ Administrative	Senior
17	Expert 23	Female	Jinan University	School of Nursing	>25 years	Teaching	Senior
18	Expert 24	Female	Nanfang Hospital, SMU	Dept. of Clinical Medicine	>25 years	Teaching ¦ Clinical	Senior
19	Expert 25	Male	Nanfang Hospital, SMU	Dept. of Clinical Medicine/General Surgery	20-25 years	Teaching ¦ Clinical ¦ Administrative	Senior
20	Expert 26	Male	First Affiliated Hospital, Jinan University	Dept. of Surgery	11–20 years	Clinical	Senior

5.1.1.2 Compilation of expert consultation form

The expert consultation questionnaire for this study consists of the following three parts: (1)

Questionnaire Introduction: Clearly explains the purpose, background, instructions, and specific requirements of this Delphi study to ensure that experts have a comprehensive understanding of the research. (2) Expert Basic Information: Collects experts' personal background information, including name, gender, age, highest level of education, professional technical title, and years of experience in medical education or related fields. This information will facilitate subsequent analysis of the expert panel's composition and authority. (3) Main Content of the Questionnaire: This is the core section, listing all competency characteristics or behavioral items to be evaluated. For each competency item, experts are invited to rate its importance using a 5-point Likert scale (1 = "Very Unimportant," 2 = "Unimportant," 3 = "Moderately Important," 4 = "Important," 5 = "Very Important"). An open-ended comments section is also included to provide experts with space to add suggestions, propose modifications, or recommend additions or deletions of items. Additionally, the questionnaire includes an Expert Self-Assessment Form, which comprises: (1) "Expert Judgment Basis for the Items": Typically categorized into dimensions such as theoretical analysis, practical experience, peer knowledge, and intuitive selection, with different levels of influence assigned. (2) "Expert Self-Rated Familiarity with the Item Content": Usually assessed using a multi-level rating scale from "Very Familiar" to "Not Familiar." This serves as the basis for calculating the expert authority coefficient.

5.1.1.3 Expert consultation

This study plans to conduct three rounds of expert consultation. In each round, the consultation questionnaire will be distributed to all selected experts via email, with a retrieval period of approximately two weeks. The first round will be based on the initial items, while the second and third rounds will consolidate the statistical analysis results and expert feedback from the previous round. Revised versions of the questionnaire will be redistributed to further converge opinions and achieve final consensus.

To scientifically evaluate the rationality and reliability of the constructed competency evaluation index system for medical teachers, this study will analyze the quality of the consultation process and its results across the following four dimensions.

(1) Expert Positive Response Coefficient

The engagement coefficient is reflected by the questionnaire recovery rate (calculated as: number of returned questionnaires / number of distributed questionnaires × 100%), indicating the level of attention and cooperation among experts in this study.

(2) Expert Authority Coefficient

The authority coefficient (Cr) is calculated from the Familiarity Coefficient (Cs) and the Judgment Basis Coefficient (Ca) using the formula: Cr = (Cs + Ca) / 2. Cs is rated on five levels: very unfamiliar, somewhat unfamiliar, moderately familiar, familiar, and very familiar, with corresponding values of 0.2, 0.4, 0.6, 0.8, and 1.0. Ca is assessed based on the degree of influence from four domains of judgment basis, as evaluated by the experts: theoretical analysis, practical experience, various types of relevant information, and intuitive feeling. For theoretical analysis, the values for major, medium, and minor influence are 0.3, 0.2, and 0.1, respectively; for practical experience, 0.5, 0.4, and 0.3; for various types of relevant information, 0.1, 0.1, and 0.1; and for intuitive feeling, 0.1, 0.1, and 0.1. Generally, an authority coefficient (Cr) greater than 0.5 indicates a high level of expert authority.

(3) Expert Coordination Degree

The level of coordination among expert opinions is a key indicator of the reliability and consensus of the Delphi method or expert consultation results. This study primarily uses two types of statistical measures for comprehensive evaluation: the coordination coefficient and the coefficient of variation.

The Coordination Coefficient (W) reflects the degree of consistency among all m experts participating in the consultation in their weight assessments of n indicators. It is measured using Kendall's W, which ranges from 0 to 1. A W value closer to 1 indicates higher coordination and stronger consensus among the experts in evaluating the indicators, whereas a lower value suggests greater divergence in opinions. In this study, professional statistical software (e.g., DView) was used for calculation. If the P-value associated with the W statistic is less than 0.05 (i.e., statistically significant), it can be concluded that the experts' ratings of the indicator system are significantly consistent.

The Coefficient of Variation (CV) is a relative measure used to assess the dispersion of expert ratings for a specific item. It is calculated as the ratio of the standard deviation to the mean of the ratings for that item. A smaller CV indicates more concentrated expert ratings and a higher level of coordination regarding the item's importance. In this study, a CV < 0.25 was set as the acceptable coordination standard.

By combining the W value and the CV values, the coordination level of expert opinions can be comprehensively and objectively evaluated: the W value reflects the overall consistency of the expert group, while the CV values measure the dispersion of ratings for specific indicators.

(4) Expert Opinion Concentration Degree

The concentration of expert opinions is primarily used to determine the relative importance of each indicator within the system, as measured by the following two metrics:

Arithmetic Mean: The average score experts assign to the importance of a specific indicator. A higher mean indicates that the indicator is considered more important overall by the experts.

Full Score Frequency: The proportion of experts who gave the highest possible score (e.g., the top score on a Likert scale) for a specific indicator, relative to the total number of experts rating that indicator. A higher full score frequency indicates a greater share of experts who consider the indicator extremely important, underscoring its significance.

These two metrics together reflect the consensus among experts on the importance of the indicators.

5.1.1.4 Indicator screening

To ensure the scientific rigor and conciseness of the indicator system, this study uses the "Threshold Method" for screening. First, the arithmetic mean, full-score frequency, and coefficient of variation for each indicator are calculated. Subsequently, thresholds for each metric are determined using the following formulas:

For the arithmetic mean and full-score frequency, the threshold is calculated as: Threshold = Mean - Standard Deviation. Indicators with scores above this threshold are retained during screening.

For the coefficient of variation, the threshold is calculated as: Threshold = Mean + Standard Deviation. Indicators with scores below this threshold (i.e., those with lower variation and higher consensus) are retained during screening.

During the screening process, a cautious principle is applied: Indicators that fail to meet all three criteria (i.e., mean and full-score frequency below the threshold, and coefficient of variation above the threshold) are eliminated. For indicators that fail to meet only one or two criteria, no immediate elimination is applied. Instead, the research team discusses their content rationality, systematic role within the framework, and theoretical or practical basis to decide whether to modify, retain, or merge them. This approach maintains the objectivity of the screening while allowing necessary flexibility to avoid omitting professionally valuable indicators that may have slightly divergent ratings.

5.1.2 Quality control method

5.1.2.1 Indicator screening and design phase

During the preliminary development of the competency indicator system and its definitions, a systematic review of relevant domestic and international literature was conducted to ensure a solid theoretical foundation and comprehensive coverage. Semi-

structured interviews with practitioners or scholars in related fields were also conducted to align the indicators more closely with practical contexts, enhancing their representativeness and applicability. When designing the expert consultation questionnaire, in addition to soliciting importance ratings, experts were asked about their familiarity with the indicators and the basis for their judgments (e.g., theoretical analysis, practical experience). This facilitated subsequent quantitative analysis of expert authority levels and the evaluation of the reasonableness of their ratings.

5.1.2.2 Questionnaire design and expert consultation stage

The study planned three rounds of expert consultations. Before each round, preliminary communication with experts was conducted to explain the research background, objectives, and completion requirements, thereby improving experts' understanding, cooperation, and the quality of questionnaire responses. Between rounds, statistical analyses of the previous round's results were performed and fed back to the experts for reference in their subsequent ratings, promoting the convergence of opinions.

5.1.3 Statistical analysis stage

After questionnaire retrieval, a structured dedicated database was pre-established. Before data entry, each questionnaire was individually reviewed to identify missing items, omissions, or logical issues. Any such problems were promptly addressed by contacting the relevant experts for completion or confirmation. Data entry was performed independently by two individuals, followed by comparison and verification to ensure accuracy, providing a reliable foundation for subsequent analysis.

5.2 Results

5.2.1 Indicator screening

5.2.1.1 Expert response rate

In this study, 20 experts in relevant fields were invited to participate. Two rounds of expert consultations were conducted using the Delphi Method. The consultation process combined one-on-one in-depth interviews with structured questionnaire follow-ups to ensure that the experts fully understood the research content and provided well-considered feedback. In the first round, 20 questionnaires were distributed, and all 20 were effectively collected, resulting

in a valid response rate of 100%. In the second round, revised questionnaires based on the first-round feedback were distributed again, and all 20 were also effectively collected, maintaining a response rate of 100%. The positive coefficient for both rounds of consultations (i.e., the effective questionnaire response rate) was 100%, indicating a high level of attention and excellent participation from the experts, which provided a reliable data foundation for the study. For detailed data analysis, please refer to Table 5.2.

Table 5.2 Questionnaire return status

Questionnaires Distributed	Completed Questionnaires	Response Rate
20	20	100%
20	20	100%

5.2.1.2 Expert authority coefficient

The authority level of experts is a key indicator for assessing the credibility of consultation results, typically quantified by the Expert Authority Coefficient (Cr). This coefficient is determined by two dimensions: the experts' familiarity with the consultation topics (Cs) and the basis for their judgments (Ca). The calculation formula is: $Cr = (Cs + Ca) / 2$. Generally, a $Cr \geq 0.5$ indicates a high level of expert authority and credible results.

During the two rounds of expert consultations, familiarity with the consultation form's content was as follows: unfamiliar (0 experts), somewhat unfamiliar (0 experts), moderately familiar (1 expert), familiar (7 experts), and very familiar (12 experts), yielding a calculated $Cs = 0.91$. Regarding the basis for judgment and its degree of influence: Work experience: major influence (18 experts), moderate influence (1 expert), minor influence (1 expert). Theoretical analysis: major influence (12 experts), moderate influence (7 experts), minor influence (1 expert). Relevant information: major influence (8 experts), moderate influence (10 experts), minor influence (2 experts). Intuition: major influence (7 experts), moderate influence (8 experts), minor influence (5 experts). This yielded a calculated $Ca = 0.94$.

Based on the above data, the overall expert authority coefficient for this study is: $Cr = (0.91 + 0.94) / 2 = 0.93$. This value is well above the acceptable threshold of 0.5, indicating that the participating experts possess a high level of professional authority. Their evaluations are highly credible and valuable for reference, effectively ensuring the scientific rigor and reliability of the research findings. For detailed data analysis, please refer to Tables 5.3, 5.4 and 5.5.

Table 5.3 Expert familiarity level table

Expert ID	Familiarity (Cs)	Practical Experience Score	Theoretical Analysis Score	Various Types of Relevant Information Score	Intuitive Feeling Score	Basis for Judgment (Ca)

Expert 1	0.8	0.5	0.2	0.1	0.1	0.9
Expert 2	0.6	0.4	0.2	0.1	0.1	0.8
Expert 3	1	0.5	0.2	0.1	0.1	0.9
Expert 4	0.8	0.5	0.2	0.1	0.1	0.9
Expert 5	1	0.5	0.2	0.1	0.1	0.9
Expert 6	1	0.5	0.3	0.1	0.1	1
Expert 7	0.8	0.5	0.3	0.1	0.1	1
Expert 8	0.8	0.5	0.3	0.1	0.1	1
Expert 9	0.8	0.5	0.3	0.1	0.1	1
Expert 10	0.8	0.5	0.2	0.1	0.1	0.9
Expert 11	1	0.5	0.3	0.1	0.1	1
Expert 12	1	0.5	0.3	0.1	0.1	1
Expert 13	1	0.5	0.3	0.1	0.1	1
Expert 14	1	0.3	0.1	0.1	0.1	0.6
Expert 15	1	0.5	0.3	0.1	0.1	1
Expert 16	1	0.5	0.3	0.1	0.1	1
Expert 17	1	0.5	0.3	0.1	0.1	1
Expert 18	1	0.5	0.2	0.1	0.1	0.9
Expert 19	0.8	0.5	0.3	0.1	0.1	1
Expert 20	1	0.5	0.3	0.1	0.1	1

Table 5.4 Expert familiarity level quantification

Familiarity Level	Unfamiliar	Slightly Familiar	Moderately Familiar	Familiar	Very Familiar
Number of Experts	0	0	1	7	12
Weighting Value	0.2	0.4	0.6	0.8	1.0
Familiarity Coefficient Calculation	Cs=(1×0.6+7×0.8+12×1)/20=0.91				

Table 5.5 Basis of judgment quantification

Basis of Judgment	Strong Influence		Medium Influence		Weak Influence		Weighted Score
	n	Value	n	Value	n	Value	
Work Experience	18	0.5	1	0.4	1	0.3	0.485
Theoretical Analysis	12	0.3	7	0.2	1	0.1	0.255
Literature/Data	8	0.1	10	0.1	2	0.1	0.1
Intuition	7	0.1	8	0.1	5	0.1	0.1
Total C_a							0.94

5.2.1.3 Expert concordance

Based on feedback from the first round of expert consultations, we made significant revisions to the initial indicator system. Analysis of expert coordination in the first round showed that the coefficient of variation for the first-level indicators ranged from [0.0259, 0.1509], with a harmony coefficient of 0.326, $\chi^2 = 32.624$, and $P < 0.001$, meeting both criteria. For the second-level indicators, the coefficient of variation ranged from [0.0653, 0.1333], with a harmony coefficient of 0.162, $\chi^2 = 119.709$, and $P < 0.001$; however, the harmony coefficient did not meet the required standard.

Among the suggestions, 2 experts jointly recommended adding a comprehensive first-level indicator—"Medical Teaching Competence." After deliberation by the research team, this

suggestion was adopted, and six corresponding second-level indicators were developed around this core: "Clinical Thinking Teaching Ability," "Clinical Practice Teaching Ability," "Research Thinking Teaching Ability," "Doctor-Patient Communication Teaching Ability," "Clinical Psychology Teaching Ability," and "Medical Ethics Teaching Ability." Additionally, based on expert opinions, some original second-level indicators were deleted or merged to ensure a more concise and structurally reasonable indicator system. After completing the revisions, the second-round expert consultation questionnaire was developed and redistributed to all 20 experts.

Statistical analysis after the second round of questionnaire collection indicated a significant improvement in the coordination and concentration of expert opinions. The results showed that the coefficient of variation (CV) for the first-level indicators decreased to the range [0.0910, 0.1720], well below the conventional threshold of 0.25, with a harmony coefficient of 0.322, $\chi^2 = 38.583$, and $P < 0.001$, reflecting a high level of consensus among experts on the importance of the first-level indicators. Similarly, the coefficient of variation for the second-level indicators was controlled within the range [0.0910, 0.1720], with a harmony coefficient of 0.3110, $\chi^2 = 278.951$, and $P < 0.001$. The low degree of dispersion and high consensus indicated a marked improvement in the coordination of opinions, which fell within an ideal range. Given that the coefficient of variation after the second round was in an extremely low range and the harmony coefficient showed significant improvement with statistical significance, expert consensus had stabilized. Therefore, the research team deemed a third round of consultation unnecessary, and the indicator system was finalized accordingly. For detailed data analysis, please refer to Tables 5.6 and 5.7.

Table 5.6 Coordination level of expert opinions in the first-round consultation

Evaluation Content	CV	W	X^2	P
Primary Indicators	0.0259-0.1509	0.326	32.624	<0.001
Secondary Indicators	0.0653-0.1333	0.162	119.709	<0.001

Table 5.7 Coordination level of expert opinions in the second round consultation

Evaluation Content	CV	W	X^2	P
Primary Indicators	0.0293-0.1439	0.322	38.583	<0.001
Secondary Indicators	0.0910-0.1720	0.310	278.951	<0.001

5.2.1.4 Concentration of expert opinions

The concentration of expert opinions reflects the level of consensus and the general tendency

among experts regarding the importance of a specific indicator, serving as a key basis for determining the relative significance of indicators within the overall framework. This study employs two complementary statistical metrics, the arithmetic mean and the full-score frequency, to comprehensively assess the central tendency of expert ratings.

First Round: Among the six first-level indicators, expert opinions on “Professional Ethics and Conduct” were highly consistent, with a mean of 5.00, a standard deviation of 0, and a full-score frequency of 100%, making it the indicator with the highest recognition. “Professional Competence” had a mean of 4.90, a standard deviation of 0.3078, a coefficient of variation of 0.0628, and a full-score frequency of 90%, indicating concentrated opinions and high recognition. “Teaching Literacy” also had a mean of 4.90, a standard deviation of 0.3078, a coefficient of variation of 0.0628, and a full-score frequency of 90%, indicating concentrated opinions and high recognition. “Guiding Ability” had a mean of 4.80, a standard deviation of 0.4104, a coefficient of variation of 0.0855, and a full-score frequency of 80%. “Management Ability” had a mean of 4.35, a standard deviation of 0.7452, a coefficient of variation of 0.1713, and a full-score frequency of 50%. “Developmental Ability” had a mean of 4.60, a standard deviation of 0.6806, a coefficient of variation of 0.1479, and a full-score frequency of 70%.

Among the 38 second-level indicators, “Clinical Teaching Awareness (Indicator 14)” had the highest mean (4.95) and a full-score frequency of 95%, reflecting the strongest expert consensus. Indicators related to Professional Ethics and Conduct (such as “Exemplary Conduct (Indicator 1)”, “Sense of Professional Responsibility (Indicator 6)”) and professional competence (such as “Clinical Theoretical Competence (Indicator 8)”, “Clinical Practical Competence (Indicator 9)”) mostly had means between 4.85–4.90 and full-score frequencies between 85%–90%, indicating high expert recognition. Indicators with lower means included “Personal Specialty (Indicator 7)” (mean: 4.10, full-score frequency: only 35%, standard deviation: 0.91, coefficient of variation: 0.22), showing the greatest divergence in expert opinions. Indicators such as “Interdisciplinary Integration Competence (Indicator 12)” (mean: 4.40) and “Research Capability (Indicator 10)” (mean: 4.55) also had relatively low full-score frequencies (50%–55%), indicating moderate expert recognition.

Second Round: Based on expert suggestions, the first-level indicator “Medical Teaching Literacy” was added. Teaching competencies were detailed within the second-level indicators, resulting in a more comprehensive structure. However, recognition of some original indicators (e.g., “Personal Specialty”, “Interdisciplinary Integration Competence”, “Research Capability”) remained low, prompting plans to delete them pending further expert consultation.

The overall trend in expert evaluation of these seven first-level indicators was similar to the

first round. “Professional Ethics and Conduct” maintained a perfect score (mean: 5.00, full-score frequency: 100%). “Professional Competence” had a mean of 4.90, a standard deviation of 0.3078, a coefficient of variation of 0.0628, and a full score frequency of 90%, indicating highly concentrated opinions and extremely high recognition. “Teaching Literacy” showed identical statistics (mean: 4.90, standard deviation: 0.3078, coefficient of variation: 0.0628, full score frequency: 90%), also receiving highly concentrated expert recognition. The newly added “Medical Teaching Literacy” had a mean of 4.85, a standard deviation of 0.3663, a coefficient of variation of 0.0755, and a full score frequency of 85%, indicating high evaluation and relatively concentrated opinions. “Communication and Guiding Ability” (Note: implied combination/renaming from "Guiding Ability") had a mean of 4.80, a standard deviation of 0.4104, a coefficient of variation of 0.0855, and a full score frequency of 80%. “Management Ability” had a mean of 4.35, a standard deviation of 0.7452, a coefficient of variation of 0.1713, and a full score frequency of 50%. “Developmental Ability” had a mean of 4.60, a standard deviation of 0.6806, a coefficient of variation of 0.1479, and a full score frequency of 70%.

Among the 46 second-level indicators assessed in the second round, several indicators, including “Exemplary Conduct (Indicator 1)”, “Student Care (Indicator 2)”, “Clinical Theoretical Competence (Indicator 8)”, and “Clinical Teaching Awareness (Indicator 14)”, had high means (≥4.80) and low coefficients of variation (≤0.0855), indicating a high degree of expert consensus. Apart from the indicators marked for deletion (e.g., “Personal Specialty (Indicator 7)”), most remaining indicators received favorable evaluations from experts, with consensus levels within an acceptable range. The concentration of opinions improved significantly and fell within a relatively ideal range. Therefore, we decided not to proceed with a third round of the Delphi survey. For detailed data analysis, please refer to Tables 5.8, 5.9, 5.10, and 5.11.

Table 5.8 Summary results of first-round level-1 indicator questionnaire

Indicators	Mean	Standard Deviation	Coefficient of Variation	Full Score Frequency
Professional Ethics and Conduct	5	0	0	1
Professional Competence	4.9	0.3078	0.0628	0.9
Teaching Literacy	4.9	0.3078	0.0628	0.9
Guiding Ability	4.8	0.4104	0.0855	0.8
Management Ability	4.35	0.7452	0.1713	0.5
Developmental Ability	4.6	0.6806	0.1479	0.7

Table 5.9 Summary results of first-round level-2 indicator questionnaire

Indicators		Mean	Standard Deviation	Coefficient of Variation	Full Score Frequency
Indicator 1	Exemplary Conduct	4.90	0.31	0.06	0.90
Indicator 2	Student Care	4.85	0.37	0.08	0.85
Indicator 3	Dedication Spirit	4.75	0.55	0.12	0.80
Indicator 4	Personal Charisma	4.65	0.59	0.13	0.70
Indicator 5	Sense of Professional Identity	4.80	0.52	0.11	0.85
Indicator 6	Sense of Professional Responsibility	4.90	0.31	0.06	0.90
Indicator 7	Personal Specialty	4.10	0.91	0.22	0.35
Indicator 8	Clinical Theoretical Competence	4.90	0.31	0.06	0.90
Indicator 9	Clinical Practical Competence	4.90	0.31	0.06	0.90
Indicator 10	Research Capability	4.55	0.51	0.11	0.55
Indicator 11	Ability to Grasp Disciplinary Frontiers	4.65	0.49	0.11	0.65
Indicator 12	Interdisciplinary Integration Competence	4.40	0.68	0.15	0.50
Indicator 13	Clinical Experience	4.65	0.59	0.13	0.70
Indicator 14	Clinical Teaching Awareness	4.95	0.22	0.05	0.95
Indicator 15	Classroom Management Ability	4.80	0.41	0.09	0.80
Indicator 16	Demonstration Ability	4.75	0.44	0.09	0.75
Indicator 17	Observational Ability	4.55	0.60	0.13	0.60
Indicator 18	Teaching Effectiveness Evaluation Ability	4.75	0.55	0.12	0.80
Indicator 19	Instructional Design Ability	4.65	0.59	0.13	0.70
Indicator 20	Knowledge Structuring Ability	4.85	0.37	0.08	0.85
Indicator 21	Knowledge Condensation Ability	4.70	0.57	0.12	0.75

Indicators		Mean	Standard Deviation	Coefficient of Variation	Full Score Frequency
Indicator 22	Differentiated Instruction Ability	4.85	0.37	0.08	0.85
Indicator 23	Listening Ability	4.85	0.37	0.08	0.85
Indicator 24	Expressive Ability	4.90	0.31	0.06	0.90
Indicator 25	Feedback Ability	4.90	0.31	0.06	0.90
Indicator 26	Empathic Ability	4.60	0.50	0.11	0.60
Indicator 27	Communication Ability	4.75	0.55	0.12	0.80
Indicator 28	Mentoring and Guidance Ability	4.80	0.41	0.09	0.80
Indicator 29	Command Ability	4.55	0.60	0.13	0.60
Indicator 30	Team Collaboration Ability	4.70	0.47	0.10	0.70
Indicator 31	Decision-Making Ability	4.60	0.60	0.13	0.65
Indicator 32	Organizational Ability	4.75	0.44	0.09	0.75
Indicator 33	Coordination Ability	4.75	0.55	0.12	0.80
Indicator 34	Lifelong Learning Ability	4.90	0.31	0.06	0.90
Indicator 35	Self-Assessment Ability	4.90	0.31	0.06	0.90
Indicator 36	Reflective Ability	4.85	0.49	0.10	0.90
Indicator 37	Innovative Ability	4.85	0.37	0.08	0.85
Indicator 38	"Internet+" Ability	4.75	0.55	0.12	0.80

Table 5.10 Summary results of second-round level-1 indicator questionnaire

Indicators	Mean	Standard Deviation	Coefficient of Variation	Full Score Frequency
Professional Ethics and Conduct	5	0	0	1
Professional Competence	4.9	0.3078	0.0628	0.9
General Teaching Literacy	4.9	0.3078	0.0628	0.9
Medical Teaching Literacy	4.85	0.3663	0.0755	0.85
Communication and Guiding Ability	4.8	0.4104	0.0855	0.8
Management Ability	4.35	0.7452	0.1713	0.5
Developmental Ability	4.6	0.6806	0.1479	0.7

Table 5.11 Summary results of second-round level-2 indicator questionnaire

Indicators		Mean	Standard Deviation	Coefficient of Variation	Full Score Frequency
Indicator 1	Exemplary Conduct	4.85	0.3663	0.0755	0.85
Indicator 2	Student Care	4.8	0.4104	0.0855	0.8
Indicator 3	Dedication Spirit	4.6	0.5026	0.1093	0.6
Indicator 4	Personal Charisma	4.4	0.5982	0.136	0.45
Indicator 5	Sense of Professional Identity	4.65	0.4894	0.1052	0.65
Indicator 6	Sense of Professional Responsibility	4.8	0.4104	0.0855	0.8
Indicator 7	Personal Specialty	3.55	0.9987	0.2813	0.15
Indicator 8	Clinical Theoretical Competence	4.8	0.4104	0.0855	0.8
Indicator 9	Clinical Practical Competence	4.6	0.5026	0.1093	0.6
Indicator 10	Research Capability	4.2	1.0052	0.2393	0.45
Indicator 11	Ability to Grasp Disciplinary Frontiers	4.5	0.6882	0.1529	0.6
Indicator 12	Interdisciplinary Integration Competence	4.3	0.6569	0.1528	0.4
Indicator 13	Clinical Experience	4.55	0.6863	0.1508	0.65
Indicator 14	Clinical Teaching Awareness	4.8	0.4104	0.0855	0.8
Indicator 15	Classroom Management Ability	4.55	0.6048	0.1329	0.6
Indicator 16	Demonstration Ability	4.55	0.6048	0.1329	0.6
Indicator 17	Observational Ability	4.3	0.6569	0.1528	0.4
Indicator 18	Teaching Effectiveness Evaluation Ability	4.65	0.4894	0.1052	0.65
Indicator 19	Instructional Design Ability	4.6	0.5026	0.1093	0.6

Indicators		Mean	Standard Deviation	Coefficient of Variation	Full Score Frequency
Indicator 20	Contemporary Teaching Adaptability	4.5	0.7609	0.1691	0.65
Indicator 21	Knowledge Structuring Ability	4.6	0.5982	0.1301	0.65
Indicator 22	Knowledge Condensation Ability	4.7	0.5712	0.1215	0.75
Indicator 23	Differentiated Instruction Ability	4.6	0.5982	0.1301	0.65
Indicator 24	Clinical Reasoning Instruction	4.7	0.4702	0.1	0.7
Indicator 25	Clinical Practice Teaching	4.75	0.4443	0.0935	0.75
Indicator 26	Research Thinking Cultivation	4.4	0.5982	0.136	0.45
Indicator 27	Patient Communication Training	4.5	0.7609	0.1691	0.65
Indicator 28	Clinical Psychological Education	4.5	0.607	0.1349	0.55
Indicator 29	Medical Ethics Instruction	4.3	0.6569	0.1528	0.4
Indicator 30	Medical Knowledge Translation Ability	4.3	0.6569	0.1528	0.4
Indicator 31	Listening Ability	4.65	0.5871	0.1263	0.7
Indicator 32	Expressive Ability	4.55	0.6863	0.1508	0.65
Indicator 33	Feedback Ability	4.45	0.6863	0.1542	0.55
Indicator 34	Empathic Ability	4.1	0.9679	0.2361	0.35
Indicator 35	Communication Ability	4.65	0.5871	0.1263	0.7
Indicator 36	Mentoring and Guidance Ability	4.45	0.5104	0.1147	0.45
Indicator 37	Team Command Ability	4.45	0.6048	0.1359	0.5

Indicators		Mean	Standard Deviation	Coefficient of Variation	Full Score Frequency
Indicator 38	Team Collaboration Ability	4.65	0.4894	0.1052	0.65
Indicator 39	Decision-Making Ability	4.55	0.6863	0.1508	0.65
Indicator 40	Organizational Ability	4.55	0.5104	0.1122	0.55
Indicator 41	Coordination Ability	4.65	0.4894	0.1052	0.65
Indicator 42	Self-Assessment Ability	4.6	0.5982	0.1301	0.65
Indicator 43	Reflective Ability	4.7	0.4702	0.1	0.7
Indicator 44	Innovative Ability	4.75	0.4443	0.0935	0.75
Indicator 45	Lifelong Learning Ability	4.7	0.5712	0.1215	0.75
Indicator 46	"Internet+" Ability	4.6	0.5026	0.1093	0.6

5.2.2 Model refinement and finalization

This study used the threshold method for indicator screening, with thresholds calculated as follows:

For full-mark frequency and arithmetic mean: Threshold = Mean – SD. Indicators scoring above this threshold were retained. For the coefficient of variation (CV): Threshold = Mean + SD. Indicators scoring below this threshold were retained.

To ensure that key indicators are not eliminated, we will eliminate those that do not meet the requirements of the three standards. For indicators that do not meet the requirements of only one or two standards, we will modify them or discuss and select them based on principles such as rationality and systematicity.

5.2.2.1 Soliciting expert opinions (first round)

After the first-round expert consultation, the research team conducted a quantitative evaluation of all indicators using the predefined "threshold method." The results showed that both Indicator 7 (Personal Specialty) and Indicator 12 (Interdisciplinary Integration Competence) had a full-mark frequency and an arithmetic mean below the corresponding thresholds calculated across all indicators, indicating that experts had relatively low agreement on their importance. At the same time, their coefficient of variation (CV) exceeded the threshold, reflecting high dispersion

and insufficient consensus among expert opinions. None of the three quantitative criteria met the retention requirements. In the open-ended feedback, multiple experts noted that these two indicators were either ambiguously defined or overlapped with other competency dimensions in the system. Based on both the failure to meet the quantitative thresholds and the experts' qualitative suggestions, the research team decided to delete these two indicators during the first-round revision.

Indicators 10 (Research Capability), 17 (Observational Ability), 26 (Empathic Ability), and 39 (Decision-Making Ability) failed to meet the 1-2 threshold criteria.

Thus, these indicators were retained for further deliberation in the second round.

Concurrently, experts proposed revisions:

1. Add one primary indicator: Medical Teaching Literacy, with 7 secondary indicators: clinical reasoning instruction, clinical practice teaching, research thinking cultivation, patient communication training, clinical psychological education, medical ethics instruction, and medical knowledge translation ability.

2. Add one secondary indicator under general teaching literacy: Contemporary teaching adaptability.

3. Rename “guiding ability” to “communication and guiding ability”.

4. Refine “command ability” to “team command ability”.

The revised indicator system was subsequently submitted for the second-round expert consultation. Detailed data analysis is shown in Table 5.12.

Table 5.12 Review results of first-round level-1 indicators

	Mean	Standard Deviation	Threshold
Arithmetic Mean	4.7583	0.2417	4.5166
Coefficient of Variation	0.0884	0.0625	0.1509
Full Score Frequency	0.8	0.1789	0.6211

5.2.2.2 Soliciting expert opinions (second Round)

During the second-round consultation, although Indicators 7 (Personal Specialty) and 12 (Interdisciplinary Integration Competence) had already been removed, the research team still explained the first-round deletion decision and rationale in the feedback report to the experts to test the stability of the indicator system and the convergence of expert opinions, and to solicit final input. In their recommendations, the experts again explicitly supported the deletion. Consequently, the research team finalized the deletion of these two indicators in the second round. Indicators 10 (Research Capability), 17 (Observational Ability), 26 (Empathic Ability), and 29 (Team Command Ability) failed to meet the 1–2 threshold criteria. Thus, these indicators were retained for further deliberation. Concurrently, experts reiterated proposed revisions:

1. Add one primary indicator: Medical Teaching Literacy, with 7 secondary indicators: clinical reasoning instruction, clinical practice teaching, research thinking cultivation, patient communication training, clinical psychological education, medical ethics instruction, and medical knowledge translation ability.

2. Add one secondary indicator under general teaching literacy: contemporary teaching adaptability.

3. Rename “guiding ability” to “communication and guiding ability”.

4. Refine “command ability” to “team command ability”.

The revised indicator system was finalized following these modifications. For detailed data analysis, please refer to Tables 5.13 and 5.14.

Table 5.13 Review results of first-round level-2 indicators

	Mean	Standard Deviation	Threshold
Arithmetic Mean	4.7434	0.1677	4.5757
Coefficient of Variation	0.0993	0.034	0.1333
Full Score Frequency	0.7711	0.1339	0.6372

Table 5.14 Summary results of second-round level-2 indicator questionnaire

Indicators		Disposition Recommendations	Mean	Standard Deviation	Coefficient of Variation	Full Score Frequency
Indicator 7	Personal Specialty	(Agree to Delete 19/20)	3.55	0.9987	0.2813	0.15
Indicator 10	Research Capability	(Agree to Retain Without Modification 11/20)	4.2	1.0052	0.2393	0.45
Indicator 12	Interdisciplinary Integration Competence	(Agree to Delete 14/20)	4.3	0.6569	0.1528	0.4
Indicator 17	Observational Ability	(Agree to Delete 14/20)	4.3	0.6569	0.1528	0.4
Indicator 23	Differentiated Instruction Ability	(Agree to Retain Without Modification 12/20)	4.6	0.5982	0.1301	0.65
Indicator 34	Empathic Ability	(Agree to Delete 16/20)	4.1	0.9679	0.2361	0.35
Indicator 37	Team Command Ability	(Agree to Modify to "Team Command Ability")	4.45	0.6048	0.1359	0.5
Indicator 39	Decision-Making Ability	(Agree to Delete 15/20)	4.55	0.6863	0.1508	0.65

Indicator 41	Coordination Ability	(Agree to Retain Without Modification 11/20)	4.65	0.4894	0.1052	0.65
Indicator 46	"Internet+" Ability	(Agree to Retain Without Modification 18/20)	4.6	0.5026	0.1093	0.6

Upon concluding the second-round consultation and applying threshold criteria, Indicator 10 (Research Capability) failed to meet thresholds for full-mark frequency, arithmetic mean, and coefficient of variation. However, the expert panel predominantly endorsed its provisional retention (11 approvals/20 experts). Consequently, the research team retained this indicator, though its specific weight allocation within the medical teacher competency framework warrants further deliberation.

In addition, although there is some conceptual overlap among research ability (Indicator 10), the ability to grasp scientific frontiers (Indicator 11), listening capability (Indicator 31), expression ability (Indicator 32), and communication ability (Indicator 35), the results of the semi-structured interviews indicate that they have different emphases and are not entirely identical competencies. Moreover, during the Delphi expert consultation process, expert ratings for these indicators also differed, and no suggestions for merging them were proposed. Therefore, all of them are retained as separate second-level indicators in the model.

After two rounds of expert consultation, the final competency evaluation indicator system for medical teachers was determined to include the revised 7 dimensions and 41 competency elements. (For detailed data analysis, please refer to Table 5.15 and Figure 5.1.)

Table 5.15 Competency model for medical teachers

First-Level Indicator	Second-Level Indicator
Professional Ethics and Conduct	Exemplary Conduct
	Student Care
	Dedication Spirit
	Personal Charisma
Professional Competence	Sense of Professional Identity
	Sense of Professional Responsibility
	Clinical Theoretical Competence
	Clinical Practical Competence
	Research Capability
	Ability to Grasp Disciplinary Frontiers
	Clinical Experience
General Teaching Literacy	Clinical Teaching Awareness
	Classroom Management Ability
	Demonstration Ability
	Teaching Effectiveness Evaluation Ability
	Instructional Design Ability
	Contemporary Teaching Adaptability

Medical Teaching Literacy	Knowledge Structuring Ability
	Knowledge Condensation Ability
	Differentiated Instruction Ability
	Clinical Reasoning Instruction
	Clinical Practice Teaching
	Research Thinking Cultivation
	Patient Communication Training
	Clinical Psychological Education
	Medical Ethics Instruction
	Medical Knowledge Translation Ability
Communication and Guiding Ability	Listening Ability
	Expressive Ability
	Feedback Ability
	Communication Ability
	Mentoring and Guidance Ability
Management Ability	Team Command Ability
	Team Collaboration Ability
	Organizational Ability
	Coordination Ability
Developmental Ability	Self-Assessment Ability
	Reflective Ability
	Innovative Ability
	Lifelong Learning Ability
	"Internet+" Ability

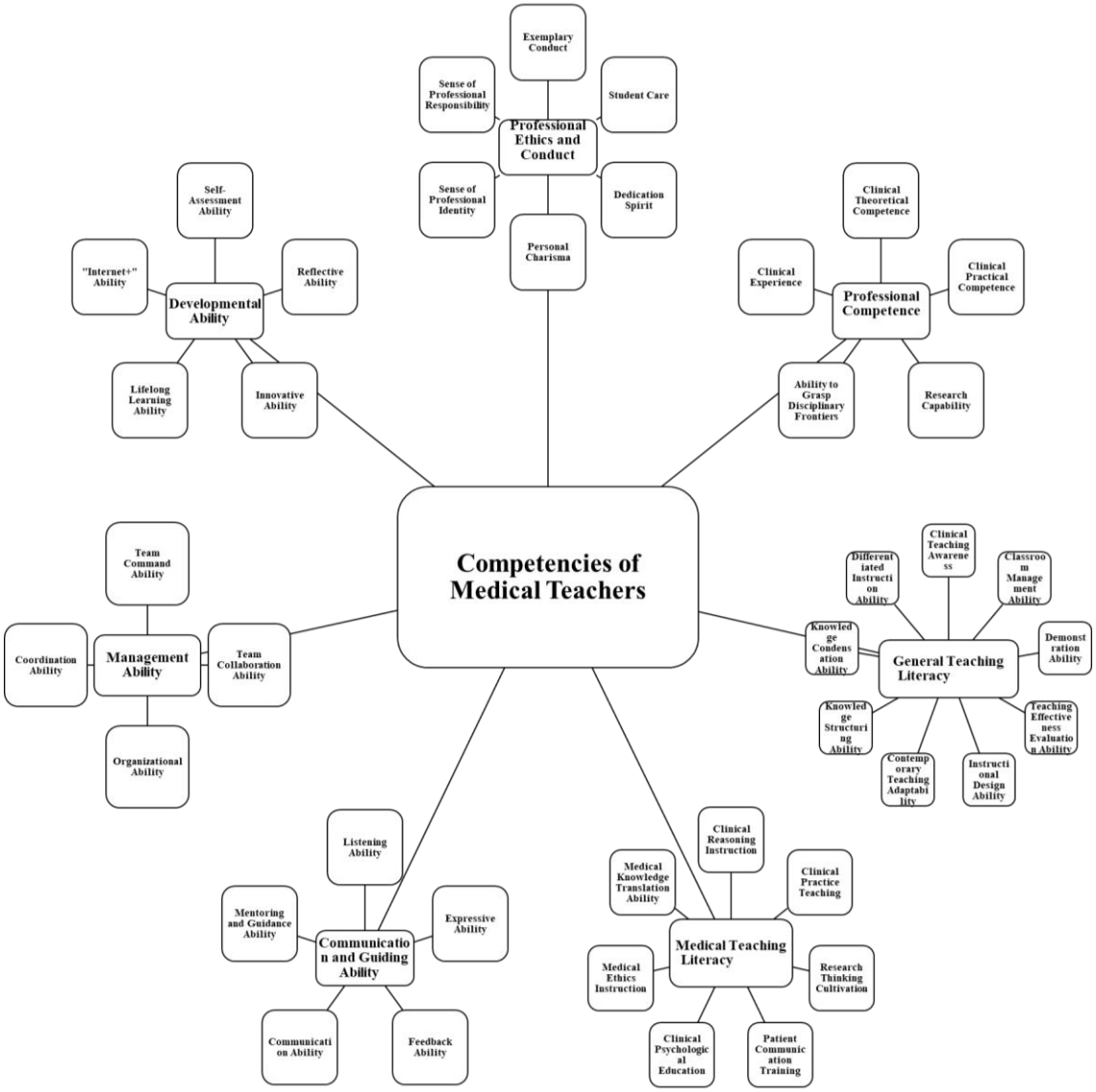


Figure 5.1 Competency model for medical teachers

Chapter 6: Empirical Evaluation of Medical Teachers' Competency Levels

To validate the reliability and validity of this model, a self-assessment questionnaire was used. The indicators revised through the Delphi method served as the self-assessment criteria. The questionnaire was distributed to faculty members across various disciplines at Southern Medical University for self-evaluation of their teaching competency. On the one hand, the reliability, validity, and goodness-of-fit of the analysis model were examined to verify the model's validity and feasibility, thereby clarifying the dimensions of the teaching competence model for medical teachers. On the other hand, by analyzing differences in competence among teachers, the competence situation of teachers at Southern Medical University and the current competence level of medical teachers were further understood.

6.1 Research method

6.1.1 Survey instrument

6.1.1.1 Questionnaire design

A self-assessment scale questionnaire was used to study teachers' competence. The questionnaire consists of two parts. The first part collects demographic information, including gender, years of teaching experience, subject taught, and other job information. The second part is the formal questionnaire, which includes 7 dimensions and 41 competency elements derived from a prior Delphi study. These 41 items are based on the descriptive explanations of each competency element identified through that expert consensus process.

This survey was conducted using the Wenjuanxing online platform for questionnaire distribution and collection, with the target population being in-service medical teachers at Southern Medical University. A total of 1,140 questionnaires were distributed, and 439 valid responses were collected, yielding a valid response rate of 38.5%. Drawing on relevant analytical methods and findings from the literature, and aligned with the research objectives, the questionnaire was designed to assess the status of teachers' competency at the institution. Furthermore, based on the constituent elements of teacher competency, targeted suggestions for

teacher development and improvement were proposed.

The questionnaire is divided into three parts: (1) The first part is the introduction, which explains the purpose of this study, completion guidelines, and related precautions. (2) The second part covers basic information, including demographic details such as name, gender, age, and the grade level taught. (3) The third part is the main content of the questionnaire, which includes items related to the competency of medical teachers, the evaluation of the importance of each item, and a section for opinions and suggestions regarding this study. The importance of each item is measured using a 5-point Likert scale: 5 points for "Very Important," 4 points for "Relatively Important," 3 points for "Moderately Important," 2 points for "Not Important," and 1 point for "Very Not Important." The questionnaire content is structured around seven core dimensions of teacher competency, specifically including: teacher ethics and conduct, professional level, general teaching competence, medical teaching competence, communication and guidance ability, management ability, and development ability. Additionally, this section includes self-assessment forms for judgment basis and familiarity to enhance the reliability of the survey results. Through this structured survey design, comprehensive data were collected to provide a basis for subsequent analysis and recommendations.

During the Delphi expert consultation process, although the "research capability" indicator under the professional competence dimension did not meet the threshold and was proposed for deletion, the expert panel generally agreed to retain it temporarily (11 experts agreed). Consequently, the research team recommended keeping this indicator. In the questionnaire design, in addition to general basic information, an item on "whether they have led research projects" was added to assess the relationship between the sample's research capability and the competency of medical teachers.

The empirical study tools are in Annex B.

6.1.1.2 Sample selection and questionnaire distribution

To ensure the questionnaire's scientific validity and effectiveness, this study first conducted a pilot survey. A small-scale trial was administered to 21 representative faculty members from key disciplines to verify the formal questionnaire's reliability and validity. Experts from Basic Medicine, Traditional Chinese Medicine/Integrated Medicine, and Clinical Medicine were invited to evaluate the Medical Teacher Competency Questionnaire's content validity through item-by-item assessment. The analysis focused on two dimensions: ① Relevance Judgment: Whether item content accurately reflected corresponding competency elements. ② Semantic Evaluation: Grammatical precision and ambiguity detection. Additionally, experts assessed

layout design, clarity, and readability, proposing revisions. Based on feedback, ambiguous items were simplified using participant-friendly language, and problematic items were modified. This process finalized the Medical Teacher Competency Questionnaire.

This study used a stratified random sampling method to select the sample. The sample was drawn from all medical teachers at the selected institutions. During sampling, stratification was based on professional fields, and the distribution of gender and teaching roles (e.g., theoretical teaching, clinical instruction) was also considered. Random selection was performed within each stratum. Before the survey was implemented, all selected teachers were thoroughly briefed on the background, academic significance, and data confidentiality principles of this questionnaire survey to obtain informed consent. They were also invited to complete the questionnaire honestly and conscientiously.

The determination of the sample size followed classical methodological requirements for scale development. For exploratory factor analysis, to ensure the stability and reliability of the results, the sample size should be at least 10 times the number of scale items. The General Practitioner Post Competency Scale used in this study contains 41 items. Of these, 2 items apply only to clinical teachers and are not relevant to non-clinical teachers (e.g., those in basic medical sciences). Therefore, the effective number of items in the analysis is 39. Based on this calculation, the baseline sample size requirement is: 39 (items) × 10 = 390 responses. Additionally, accounting for an estimated 10% rate of ineffective responses or invalid questionnaires, the sample size was further adjusted upward. After calculation, the final minimum required sample size is 429 responses. The actual number of collected samples meets this methodological requirement and can support subsequent statistical analyses, such as factor analysis.

6.1.2 Survey data analysis

6.1.2.1 Variable calculation

A total of 7 competency dimensions were assessed: A. Professional ethics and conduct, B. Professional competence, C. Teaching literacy, D. Medical teaching literacy, E. Communication and guiding ability, F. Management ability, G. Developmental ability, and D. Medical teaching literacy (clinical specialty). The score for each competency dimension was calculated as the mean of the 5-point Likert scale ratings ("degree of conformity") for all items within that dimension. Teacher Competency (representing the overall competency level of medical teachers) was calculated as the mean of the competency scores from the 7 dimensions:

A, B, C, D, E, F, and G. D. Medical teaching literacy (clinical specialty) was excluded from the overall score calculation due to invalid or missing responses from a portion of the participants.

6.1.2.2 Reliability and validity testing

(1) Reliability testing

Reliability aims to measure the stability and consistency of the scale's measurement results. This study employed internal consistency reliability as the primary assessment method, calculated using SPSS statistical analysis software. It was evaluated using the following two indicators: (1) Cronbach's alpha coefficient: This is the most commonly used indicator to assess the internal consistency of a scale, reflecting the degree of consistency among all items. (2) Guttman split-half coefficient: This coefficient randomly divides the scale items into two halves and evaluates reliability by calculating the correlation between the scores of the two parts, serving as another verification of internal consistency.

Both coefficients range from 0 to 1. Generally, a coefficient greater than 0.7 indicates good internal consistency of the scale, while a value greater than 0.8 suggests excellent reliability.

(2) Validity testing

Validity assesses whether the scale accurately measures the theoretical construct (i.e., medical teacher competency). This study primarily established construct validity by conducting confirmatory factor analysis to evaluate the fit of the questionnaire's predefined seven-dimensional model.

First, pre-analysis tests were conducted using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity to assess whether the data were suitable for factor analysis. Typically, a KMO value greater than 0.7 and a significant Bartlett's test are required to proceed with further analysis.

For exploratory factor analysis, the maximum variance rotation method (varimax) is used to identify the correspondence between factors and measurement items. An absolute factor loading greater than 0.4 indicates that the item is associated with the factor.

For confirmatory factor analysis, discriminant validity is tested using Pearson correlations and the square root of the average variance extracted (AVE). If the square root of the AVE for a given factor exceeds the absolute value of the correlation coefficient between that factor and any other factor, and this holds for all factors, it indicates good discriminant validity. Convergent validity is examined using factor loadings, which show the relationships between factors (latent variables) and analysis items (manifest/measurement items). If an item is

statistically significant and has a standardized factor loading greater than 0.7, it indicates a strong correlation. If an item is not statistically significant or has a low standardized factor loading (e.g., below 0.4), the relationship between the item and the factor is considered weak, and removal of the item may be considered. Through the systematic reliability and validity testing described above, strong methodological support is provided for subsequent analyses based on the questionnaire data (such as describing the current state of competency and comparing differences), ensuring that the research conclusions are grounded in reliable and valid measurement foundations.

(3) Differential analysis

ANOVA and independent t-tests were used to examine differences across demographic characteristics in 9 competency domains: Overall Teacher Competency (calculated as the mean of the 7 dimensions A–G); A. Professional ethics and conduct; B. Professional competence; C. General Teaching Literacy; D. Medical Teaching Literacy; E. Communication and guiding ability; F. Management ability; G. Developmental ability; D. Medical Teaching Literacy (Clinical Specialists)

(4) Structural equation modeling (SEM) analysis

The competency model was validated using Structural Equation Modeling (SEM).

6.2 Results

The pilot questionnaire was distributed via Wenjuanxing to full-time faculty at Southern Medical University. A total of 1,140 questionnaires were distributed, and 439 were returned (38.5% response rate). After excluding 36 invalid responses, 403 valid questionnaires were retained for analysis. Drawing on literature analysis methods, the survey was designed to assess current competency levels and propose faculty development strategies.

6.2.1 Descriptive statistical analysis

First, conduct descriptive statistical analysis of the collected questionnaire data to understand the population distribution of the survey and assess whether the data is reasonable, thereby providing a basis for further analysis.

6.2.1.1 Sample characteristics

This analysis included 403 valid samples. The demographic and professional background data

for the variables indicate the following:

Distribution of Years of Teaching Experience: Teachers with less than 5 years of experience numbered 75, accounting for 18.61% of the total. Those with 5-10 years numbered 99 (24.57%); 10-15 years, 83 (20.60%); 15-20 years, 59 (14.64%); and 20-25 years, 87 (21.59%). The cumulative percentage shows that teachers with less than 15 years of experience make up 63.77% of the sample.

Gender Distribution: Of the respondents, 160 were male teachers (39.70%) and 243 were female teachers (60.30%), with female teachers outnumbering male teachers.

Age Distribution: The age of participants was primarily concentrated in the 31-40 and 41-50 age brackets, each with 167 individuals (41.44% each), together accounting for 82.88%. Teachers aged 51-60 numbered 59 (14.64%). Teachers aged 21-30 numbered 8 (1.99%). Only 2 teachers (0.50%) were over 60 years old.

Primary Teaching Discipline: Respondents represented multiple medical-related disciplines. The most common discipline was Clinical Medicine, with 121 individuals (30.02%), followed by Nursing with 44 (10.92%) and Traditional Chinese Medicine / Integrated Chinese and Western Medicine with 41 (10.17%). The numbers and percentages for other disciplines were as follows: Stomatology, 37 (9.18%); Pharmacy, 35 (8.68%); Other Medical-Related Disciplines, 33 (8.19%); Basic Medical Sciences, 27 (6.70%); Medical Technology, 24 (5.96%); Rehabilitation Medicine, 11 (2.73%); Preventive Medicine, 7 (1.74%); Chinese Materia Medica, 7 (1.74%); Biostatistics, 6 (1.49%); Medical Education Management, 5 (1.24%); Psychiatry / Applied Psychology, 4 (0.99%); and Forensic Medicine, 1 (0.25%).

Distribution of Position Type: Over half of respondents (51.61%, 208 individuals) were clinical faculty. Teaching faculty numbered 110 (27.30%), research faculty 35 (8.68%), administrative faculty 29 (7.20%), and teaching-support faculty (e.g., lab technicians, counselors) 15 (3.72%). Six individuals (1.49%) selected "Other" positions.

Distribution of Professional Title: Intermediate-level titles were most common, with 179 individuals (44.42%), followed by associate senior titles (120, 29.78%), full senior titles (75, 18.61%), and junior titles (29, 7.20%). The cumulative percentage indicates that teachers with intermediate-level titles and above make up over 90% of the sample.

Distribution of Highest Degree: The largest share of teachers held doctoral degrees, with 188 individuals (46.65%), followed by 127 with master’s degrees (31.51%) and 88 with bachelor’s degrees (21.84%).

Disciplinary Category of Highest Degree: This distribution was highly correlated with the "Primary Teaching Discipline." The top three categories remained the same: Clinical Medicine,

121 individuals (30.02%); Nursing, 43 (10.67%); and Traditional Chinese Medicine / Integrated Chinese and Western Medicine, 44 (10.92%). Proportions for other disciplines were largely consistent.

Annual Performance Appraisal over the Past Three Years: 239 teachers (59.31%) received at least one "Outstanding" rating in their annual appraisals over the past three years. The remaining 164 (40.69%) received "Qualified" ratings.

Experience Leading Research Projects: 34.74% (140 individuals) had led national-level research projects. 92 individuals (22.83%) had led provincial-level projects, and 44 (10.92%) had led municipal-level projects. 127 individuals (31.51%) had not led a research project at any level.

Therefore, among the 403 surveyed medical teachers, the primary profile consists of early- to mid-career, female teachers aged 31-50 in clinical positions, holding intermediate or associate senior titles, with doctoral degrees, and primarily engaged in clinical medicine teaching. Over half received "Outstanding" ratings in recent performance appraisals. Regarding research, approximately 64.52% have led projects at various levels. The sample distribution is relatively reasonable. For detailed data analysis, please refer to Annex C, Tables C.1-C.11.

6.2.1.2 Descriptive statistics of variables

Descriptive analysis summarizes the overall characteristics of the data using measures such as the mean and median. This analysis included 403 valid samples (320 for the "D. Medical teaching literacy (clinical specialty)" dimension). The mean score for Teacher Competency (the overall teacher competency level, calculated as the mean of the 7 dimensions A–G) was 4.431 points (on a theoretical scale of 1-5). The lowest score was 2.924, and the highest was a perfect 5.000. The standard deviation, indicating data dispersion, was 0.456, and the median score was 4.398. These results suggest that participating teachers rated their overall competency (either self-assessment or peer assessment) relatively highly, and the data distribution was relatively concentrated.

A. The professional ethics and conduct dimension had a mean score of 4.538, the highest among the seven dimensions. The score ranged from 1.000 to 5.000. The standard deviation was 0.589, the largest among all dimensions, indicating that individual differences in ratings for this item were the most pronounced. The median was 4.667.

B. The professional competence dimension had a mean score of 4.389. The score range was 1.000 to 5.000. The standard deviation was 0.575, indicating some dispersion in the ratings. The median was 4.400.

C. The teaching literacy dimension had a mean score of 4.408. The lowest score was 2.444, and the highest was 5.000. The standard deviation was 0.526, indicating a relatively low degree of dispersion across the seven dimensions. The median was 4.444.

D. The medical teaching literacy dimension had a mean score of 4.372. The score range was 1.000 to 5.000. The standard deviation was 0.577, indicating some variability in the ratings. The median was 4.400.

E. The communication and guiding ability dimension had a mean score of 4.462, second only to "Professional Ethics and Conduct." The lowest score was 1.800, and the highest was 5.000. The standard deviation was 0.532, and the median was 4.400.

F. The management ability dimension had a mean score of 4.459. The score range was 1.000 to 5.000. The standard deviation was 0.566. The median was 4.500, slightly higher than the mean.

G. The developmental ability dimension had a mean score of 4.386. The score range was 1.000 to 5.000. The standard deviation was 0.564. The median was 4.400.

D. The medical teaching literacy (clinical specialty) dimension was analyzed specifically for the 320 clinical specialty samples. The mean score was 4.361, slightly lower than the score for the "Medical Teaching Literacy" dimension across all samples. The score range was also from 1.000 to 5.000. The standard deviation was 0.695, the largest among all listed indicators, indicating very pronounced differences in self- or peer-assessment of medical teaching literacy among clinical specialty teachers. The median was 4.500, higher than the mean, suggesting the score distribution might be left-skewed (i.e., the mean was lowered by some relatively low scores).

The statistics indicate that there are no outliers in the current dataset, allowing for further analysis of each indicator. For detailed data analysis, please refer to Annex C Table C.12.

6.2.2 Reliability analysis

This section presents the results of the reliability analysis of the questionnaire data to assess the questionnaire's validity and stability, providing a foundation for subsequent analysis.

A. Professional ethics and conduct

The overall Cronbach’s alpha for the A. Professional ethics and conduct dimension is 0.891. This indicates that the scale has very high internal consistency reliability, and its measurement results are stable and dependable. Generally, an alpha coefficient greater than 0.8 is considered excellent.

To further examine each item’s contribution to the overall reliability, the Corrected item-

total correlation and the Cronbach's Alpha if Item Deleted were analyzed.

A1. Exemplary Conduct: The corrected item-total correlation for this item is 0.599. If this item were deleted, the scale's Cronbach's alpha would be 0.888, slightly lower than the overall reliability (0.891), indicating a positive contribution to overall reliability.

A2. Student Care: The corrected item-total correlation for this item is 0.687. If this item were deleted, the scale's alpha would be 0.876, which is lower than the overall reliability, indicating that this item is an important component of the scale's reliability.

A3. Dedication Spirit: The corrected item-total correlation for this item is 0.653. If this item were deleted, the scale's alpha would be 0.882, which is lower than the overall reliability, confirming the item's effectiveness.

A4. Personal Charisma: This item has a relatively high corrected item-total correlation of 0.765. If this item were deleted, the scale's alpha would drop to 0.863, indicating a noticeable decrease and suggesting that this item is closely associated with the overall scale.

A5. Professional Identity: The corrected item-total correlation for this item is 0.788, relatively high among the six items. If this item were deleted, the scale's alpha would be 0.860, the lowest value observed after removing any single item, indicating that this item contributes substantially.

A6. Professional Responsibility: The corrected item-total correlation for this item is also 0.789, similar to A5. If this item were deleted, the scale's alpha would also be 0.860, further confirming that this item is crucial to the overall reliability.

The corrected item-total correlations for all six items range from 0.599 to 0.789, all exceeding the commonly recommended threshold of 0.5. This indicates that each item correlates well with the scale's total score.

When any single item is deleted, the scale's Cronbach's alpha does not increase; instead, it either decreases or remains unchanged (e.g., deleting A1 lowers alpha from 0.891 to 0.888). This clearly demonstrates that all items should be retained and that no items are ineffective and need to be removed.

The standardized Cronbach's alpha is 0.893, which is very close to and slightly higher than the original (0.891). This further corroborates the scale's excellent reliability.

Therefore, the six items of the measurement scale for Professional Ethics and Conduct (Dimension A) collectively constitute a highly reliable measurement tool. The overall Cronbach's alpha coefficient is 0.891, and each item contributes meaningfully to the overall reliability. Among these, A5 Sense of Professional Identity and A6 Sense of Professional Responsibility show the strongest correlations with the overall scale, and all items are

indispensable components. The measurement results from this scale are highly consistent and reliable, making it suitable for further scientific research or evaluation purposes. For detailed data analysis, please refer to Annex C, Table C.13.

B. Professional competence

The overall Cronbach's alpha for the B. Professional competence dimension is 0.796. This indicates that the scale has good internal consistency reliability, and its measurement results are stable and dependable. Generally, an alpha coefficient greater than 0.7 is considered acceptable, while greater than 0.8 is considered good. This scale has reached a good level.

To thoroughly examine each item's contribution to overall reliability, the corrected item-total correlation and Cronbach's Alpha if Item Deleted were analyzed.

B1. Clinical Theoretical Competence: The corrected item-total correlation for this item is 0.642. If this item were deleted, the scale's Cronbach's alpha would be 0.743, which is lower than the overall reliability (0.796), indicating a positive contribution to overall reliability.

B2. Clinical Practical Competence: The corrected item-total correlation for this item is 0.653. If this item were deleted, the scale's alpha would be 0.740, which is still lower than the overall reliability, indicating that this item is an important component of the scale's reliability.

B3. Research Capability: The corrected item-total correlation for this item is 0.559. If this item were deleted, the scale's alpha would be 0.765, slightly lower than the overall reliability. This indicates the item is effective, but its association with other items is somewhat weaker.

B4. Ability to Grasp Disciplinary Frontiers: Among the five items, this item has the highest corrected item-total correlation at 0.678. If this item were deleted, the scale's alpha would drop to 0.730, indicating a more noticeable decrease. This suggests that this item is closely associated with the overall scale and makes a significant contribution to reliability.

B5. Clinical Experience: The corrected item-total correlation for this item is 0.460. If this item were deleted, the scale's alpha would become 0.813. This is the only item whose deletion would lead to an increase in the overall alpha coefficient (from 0.796 to 0.813).

The corrected item-total correlations for most items (B1, B2, B3, B4) range from 0.559 to 0.678, meeting or approaching the commonly recommended threshold of 0.5, indicating that these items correlate acceptably with the scale's total score.

The corrected item-total correlation for item B5, Clinical Experience (0.460), is below 0.5, indicating a weak correlation with the scale's total score. Furthermore, deleting item B5 increases the scale's alpha coefficient from 0.796 to 0.813. This is typically a signal that this item may not measure content consistent with the rest of the scale, or it might be ambiguous, and its presence slightly reduces overall reliability.

Supplementary metrics in the analysis report indicate that the standardized Cronbach's alpha coefficient is 0.816, which is closer to the alpha after deleting item B5 (0.813) and higher than the original coefficient.

For the Professional Competence scale (Dimension B), the overall reliability of the five items is good (α=0.796). However, in-depth analysis reveals an issue with item B5, Clinical Experience: it has a low correlation with the total score, and its deletion improves overall reliability. Therefore, to optimize scale reliability, consideration should be given to deleting item B5. After deletion, the reliability of the scale composed of the remaining four items (B1, B2, B3, B4) would increase to 0.813 (or a standardized α of 0.816), reaching an even better level, with each item demonstrating a better fit with the overall scale. The revised scale would show further improved consistency and reliability in its measurement results. For detailed data analysis, please refer to Annex C, Table C.14.

C. General teaching literacy

The overall Cronbach's alpha for the C. Teaching literacy dimension is 0.924. This indicates that the scale has extremely high internal consistency reliability, and its measurement results are very stable and dependable. Generally, an alpha coefficient greater than 0.9 represents excellent reliability.

To examine each item's contribution to overall reliability, the corrected item-total correlation and Cronbach's Alpha if Item Deleted were analyzed.

C1. Clinical Teaching Awareness: The corrected item-total correlation for this item is 0.669. If this item were deleted, the scale's Cronbach's alpha would be 0.920, slightly lower than the overall reliability (0.924), indicating a positive contribution.

C2. Classroom Management Ability: The corrected item-total correlation for this item is 0.713. If this item were deleted, the scale's alpha would be 0.917, lower than the overall reliability.

C3. Demonstration Ability: The corrected item-total correlation for this item is 0.692. If this item were deleted, the scale's alpha would be 0.918, which is still lower than the overall reliability.

C4. Teaching Effectiveness Evaluation Ability: The corrected item-total correlation for this item is 0.758. If this item were deleted, the scale's alpha would drop to 0.914, indicating a noticeable decrease and suggesting that this item is closely associated with the overall scale and contributes significantly.

C5. Instructional Design Ability: The corrected item-total correlation for this item is 0.708. If this item were deleted, the scale's alpha would be 0.917, lower than the overall reliability.

C6. Contemporary Teaching Adaptability: The corrected item-total correlation for this item is 0.766, relatively high among the nine items. If this item were deleted, the scale's alpha would be 0.913, underscoring its important role in maintaining high reliability.

C7. Knowledge Structuring Ability: The corrected item-total correlation for this item is 0.738. If this item were deleted, the scale's alpha would be 0.915, lower than the overall reliability.

C8. Knowledge Condensation Ability: The corrected item-total correlation for this item is 0.768, similar to C6 and at a high level. If this item were deleted, the scale's alpha would be 0.913, also indicating a significant contribution to overall reliability.

C9. Differentiated Instruction Ability: The corrected item-total correlation for this item is 0.735. If this item were deleted, the scale's alpha would be 0.915, lower than the overall reliability.

The corrected item-total correlations for all nine items range from 0.669 to 0.768, well above the commonly recommended threshold of 0.5. This indicates that each item correlates very strongly with the scale's total score.

When any single item is deleted, the scale's Cronbach's alpha coefficient does not increase; instead, it decreases in all cases (from the original 0.924 to values between 0.913 and 0.920). This clearly demonstrates that all nine items are effective components of this highly reliable scale, and there are no ineffective items that need to be removed.

The standardized Cronbach's alpha is 0.925, almost identical to and slightly higher than the original (0.924), further confirming the scale's extremely high and very stable reliability.

Therefore, the nine items of the Teaching Literacy measurement scale (Dimension C) collectively constitute an excellent measurement tool with outstanding reliability. The overall Cronbach's alpha coefficient is 0.924, and each item contributes to the overall reliability—deleting any item would reduce it. Among these, C6 Contemporary Teaching Adaptability and C8 Knowledge Condensation Ability show the strongest correlations with the overall scale. The consistency and reliability of the measurement results from this scale are extremely high, making it an excellent measurement tool fully suitable for rigorous scientific research or teaching competency assessment. For detailed data analysis, please refer to Annex C, Table C.15.

D. Medical Teaching Literacy

The overall Cronbach's alpha for the D. Medical teaching literacy dimension is 0.862. This indicates that the scale has good internal consistency reliability, and its measurement results are stable and dependable. Generally, an alpha coefficient greater than 0.8 is considered good

reliability.

To thoroughly examine each item's contribution to overall reliability, the corrected item-total correlation and Cronbach's alpha if item deleted were analyzed.

D1. Clinical Reasoning Instruction: The corrected item-total correlation for this item is 0.739, the highest among the five items. If this item were deleted, the scale's Cronbach's alpha would be 0.820, lower than the overall reliability (0.862), indicating that it makes a significant contribution to overall reliability.

D2. Clinical Practice Teaching: The corrected item-total correlation for this item is 0.693. If this item were deleted, the scale's alpha would be 0.830, which is still lower than the overall reliability, indicating that this item is an effective component of the scale's reliability.

D3. Research Thinking Cultivation: The corrected item-total correlation for this item is 0.630, the lowest among the five items. If this item were deleted, the scale's alpha would be 0.851, representing the smallest decrease. However, this value is still lower than the overall reliability, indicating a positive association with the overall scale.

D4. Medical Ethics Instruction: The corrected item-total correlation for this item is 0.701. If this item were deleted, the scale's alpha would be 0.829, lower than the overall reliability.

D5. Ability for Educational Translation in Medicine: The corrected item-total correlation for this item is 0.667. If this item were deleted, the scale's alpha would be 0.838, which is lower than the overall reliability.

The corrected item-total correlations for all five items range from 0.630 to 0.739, all exceeding the commonly recommended threshold of 0.5. This indicates that each item correlates well with the scale's total score.

When any single item is deleted, the scale's Cronbach's alpha coefficient does not increase; instead, it decreases in all cases (from the original 0.862 to values between 0.820 and 0.851). This indicates that all items contribute positively to the scale's reliability, and no items need to be removed.

Among them, deleting the D1. Clinical Reasoning Instruction item produces the largest drop in the alpha coefficient (to 0.820), indicating that this item is most closely associated with the overall scale and contributes the most to reliability.

Supplementary metrics in the analysis report indicate that the standardized Cronbach's alpha coefficient is 0.866, slightly higher than the original (0.862), further confirming the scale's good and stable reliability.

Therefore, the five items of the Medical Teaching Literacy measurement scale (Dimension D) collectively form a reliable measurement tool. The overall Cronbach's alpha coefficient is

0.862, and each item contributes meaningfully to overall reliability. All items should be retained. Among these, D1 Clinical Reasoning Instruction shows the strongest correlation with the overall scale. The scale demonstrates high consistency and reliability, making it suitable for related research or competency assessment. For detailed data analysis, please refer to Annex C, Table C.16.

E. Communication and guiding ability

The overall Cronbach's alpha for the E. Communication and guiding ability dimension is 0.810. This indicates that the scale has acceptable internal consistency reliability, and its measurement results are generally dependable. Typically, an alpha coefficient greater than 0.7 is considered acceptable, and greater than 0.8 is considered good. This scale has reached a good level.

To thoroughly examine each item's contribution to overall reliability, the corrected item-total correlation and Cronbach's alpha if item deleted were analyzed.

E1. Listening Ability: The corrected item-total correlation for this item is 0.587. If this item were deleted, the scale's Cronbach's alpha would be 0.781, lower than the overall reliability (0.810), indicating a positive contribution.

E2. Expressive Ability: The corrected item-total correlation for this item is 0.710, relatively high among the five items. If this item were deleted, the scale's alpha would drop to 0.743, significantly lower than the overall reliability, indicating that this item is very important for maintaining reliability.

E3. Feedback Ability: The corrected item-total correlation for this item is 0.438, the lowest among the five items and below the commonly recommended threshold of 0.5. If this item were deleted, the scale's alpha would increase to 0.853. This is the only item whose deletion results in a significant increase in the overall alpha coefficient (from 0.810 to 0.853).

E4. Communication Ability: The corrected item-total correlation for this item is 0.733, the highest among the five items. If this item were deleted, the scale's alpha would be 0.739, still lower than the overall reliability, indicating that this item is closely associated with the overall scale and contributes substantially to reliability.

E5. Mentoring and Guidance Ability: The corrected item-total correlation for this item is 0.655. If this item were deleted, the scale's alpha would be 0.756, which is lower than the overall reliability.

The corrected item-total correlations for most items (E1, E2, E4, E5) range from 0.587 to 0.733, all meeting or approaching 0.5, indicating that these items have acceptable to good correlations with the scale's total score.

The corrected item-total correlation for item E3, Feedback Ability (0.438), is significantly below 0.5, indicating a weak correlation with the scale's total score. It may measure content that is not fully consistent with the other items.

Deleting item E3 does not lower the scale's alpha coefficient; instead, it increases from 0.810 to 0.853. This is a clear signal that the presence of this item reduces the scale's overall internal consistency.

Supplementary metrics in the analysis report indicate that the standardized Cronbach's alpha is 0.834, which aligns with the alpha after deleting item E3 (0.853). Both values exceed the original alpha, further suggesting that deleting E3 could optimize the scale.

For the Communication and Guiding Ability scale (Dimension E), the overall reliability of the five items is acceptable (α=0.810). However, in-depth analysis reveals a problem with item E3 (Feedback Ability): it shows a low correlation with the total score, and deleting it significantly improves overall reliability to 0.853 (a good level). Therefore, to optimize scale reliability, it is strongly recommended to delete item E3. After deletion, the reliability of the scale composed of the remaining four items (E1, E2, E4, E5) will be clearly improved, and the measurement results will become more consistent and reliable. If E3 is retained, the total score for this dimension must be interpreted with caution, as its internal consistency is affected by this weakly correlated item. For detailed data analysis, please refer to Annex C, Table C.17.

F. Management ability

The overall Cronbach's alpha for the F. Management ability dimension is 0.901. This indicates that the scale has excellent internal consistency reliability, and its measurement results are very stable and dependable. Generally, an alpha coefficient greater than 0.9 indicates excellent reliability.

To examine each item's contribution to overall reliability, the corrected item-total correlation and Cronbach's alpha if item deleted were analyzed.

F1. Team Command Ability: The corrected item-total correlation for this item is 0.793. If this item were deleted, the scale's Cronbach's alpha would be 0.867, which is lower than the overall reliability (0.901), indicating a positive contribution.

F2. Team Collaboration Ability: The corrected item-total correlation for this item is 0.732, the lowest among the four items, but still high. If this item were deleted, the scale's alpha would be 0.889. Although still in the excellent range, this value is lower than the overall reliability, indicating that this item is an effective component of the scale's reliability.

F3. Organizational Ability: The corrected item-total correlation for this item is 0.784. If this item were deleted, the scale's alpha would be 0.871, lower than the overall reliability.

F4. Coordination Ability: The corrected item-total correlation for this item is 0.811, the highest among the four items. If this item were deleted, the scale's alpha would drop to 0.860, the largest decrease. This suggests that this item is most closely associated with the overall scale and contributes the most to maintaining high reliability.

The corrected item-total correlations for all four items range from 0.732 to 0.811, well above the commonly recommended threshold of 0.5. This indicates that each item correlates very strongly with the scale's total score.

When any single item is deleted, the scale's Cronbach's alpha coefficient does not increase; instead, it decreases in all cases (from the original 0.901 to values between 0.860 and 0.889). This clearly demonstrates that all four items are effective components of this highly reliable scale, and no items need to be removed.

Among them, deleting the F4. Coordination Ability item results in the most noticeable decrease in the alpha coefficient (to 0.860), indicating that this item contributes most to the overall reliability.

The standardized Cronbach's alpha coefficient is 0.901, identical to the original, further confirming the scale's extremely high and very stable reliability.

Conclusion: The four items of the Management Ability scale (Dimension F) collectively form an excellent measurement tool with outstanding reliability. The overall Cronbach's alpha is 0.901, and each item contributes meaningfully to overall reliability. All items should be retained. Among these, F4. Coordination Ability shows the strongest correlation with the overall scale. The measurement results from this scale are highly consistent and reliable, making it an excellent tool fully suitable for rigorous assessment or research related to management ability. For detailed data analysis, please refer to Annex C, Table C.18.

G. Developmental ability

The overall Cronbach's alpha for the G. Developmental ability dimension is 0.870. This indicates that the scale has good internal consistency reliability, and its measurement results are stable and dependable. Generally, an alpha coefficient greater than 0.8 is considered good reliability.

To thoroughly examine each item's contribution to overall reliability, the corrected item-total correlation and Cronbach's alpha if item deleted were analyzed.

G1. Self-Assessment: The corrected item-total correlation for this item is 0.621. If this item were deleted, the scale's Cronbach's alpha would be 0.862, slightly lower than the overall reliability (0.870), indicating a positive contribution.

G2. Reflective Ability: The corrected item-total correlation for this item is 0.781, the

highest among the five items. If this item were deleted, the scale's alpha would drop to 0.824, indicating a noticeable decrease. This suggests that this item is closely associated with the overall scale and contributes substantially to reliability.

G3. Innovative Ability: The corrected item-total correlation for this item is 0.761. If this item were deleted, the scale's alpha would be 0.827, which is still lower than the overall reliability.

G4. Lifelong Learning Ability: The corrected item-total correlation for this item is 0.723. If this item were deleted, the scale's alpha would be 0.837, lower than the overall reliability.

G5. "Internet+" Ability: The corrected item-total correlation for this item is 0.612. If this item were deleted, the scale's alpha would be 0.865, slightly lower than the overall reliability.

The corrected item-total correlations for all five items range from 0.612 to 0.781, all exceeding the commonly recommended threshold of 0.5. This indicates that each item correlates well with the scale's total score.

When any single item is deleted, the scale's Cronbach's alpha coefficient does not increase; instead, it decreases in all cases (from the original 0.870 to values between 0.824 and 0.865). This indicates that all items contribute positively to the scale's reliability, and no items need to be removed.

Among them, deleting the G2. Reflective Ability item results in the most noticeable decrease in the alpha coefficient (to 0.824), indicating that this item contributes most to overall reliability.

Supplementary metrics in the analysis report indicate that the standardized Cronbach's alpha coefficient is 0.873, slightly higher than the original (0.870), further confirming the scale's good and stable reliability.

Therefore, the five items of the Developmental Ability scale (Dimension G) collectively form a measurement tool with good reliability. The overall Cronbach's alpha is 0.870, and each item contributes meaningfully to overall reliability. All items should be retained. Among these, G2. Reflective Ability shows the strongest correlation with the overall scale. The measurement results from this scale are relatively consistent and reliable, making it suitable for related research or competency assessment. For detailed data analysis, please refer to Annex C, Table C.19.

6.2.3 Validity analysis

Conduct a validity analysis of the questionnaire data to test the accuracy and authenticity of the questionnaire's measurement and determine whether the research data is suitable for further

information extraction.

6.2.3.1 KMO and Bartlett's Test of Sphericity

Before factor extraction, KMO and Bartlett's Test of Sphericity were conducted to assess the data's suitability for factor analysis. KMO Value: The sample's KMO value was 0.953. Generally, a KMO value greater than 0.6 indicates that the data are highly suitable for factor analysis. This value is ideal. Bartlett's Test of Sphericity: The test yielded a chi-square value of 11,273.954 with 741 degrees of freedom and a corresponding p-value of 0.000 (less than 0.001). This indicates significant correlations among the variables, rejecting the hypothesis of variable independence. For detailed data analysis, please refer to Annex C, Table C.20.

Therefore, the results of both the KMO and Bartlett's tests indicate that the current data are highly suitable for factor analysis.

Here's the English translation of your detailed results section.

6.2.3.2 Exploratory Factor Analysis

A total of 39 measurement items were included. Principal component analysis with varimax rotation was conducted, yielding 7 factors with eigenvalues greater than 1. The factor loadings and communalities for each item across the 7 factors are as follows:

Factor 1 primarily reflects management and development abilities. Items with high loadings on Factor 1 are mainly from the original F dimension (management ability) and G dimension (development ability), specifically including: F4 Coordination ability, loading = 0.793, communality = 0.768; F3 Organizational ability, loading = 0.745, communality = 0.712; F2 Team collaboration ability, loading = 0.732, communality = 0.696; F1 Team command ability, loading = 0.726, communality = 0.691; G3 Innovation ability, loading = 0.729, communality = 0.728; G2 Reflective ability, loading = 0.722, communality = 0.714; G4 Lifelong learning ability, loading = 0.709, communality = 0.650; G1 Self-assessment, loading = 0.635, communality = 0.557; G5 Internet+ ability, loading = 0.585, communality = 0.548. Additionally, C9 Ability to teach according to aptitude (0.469), C7 Knowledge system construction ability (0.422), and E1 Listening ability (0.424) also showed moderate loadings, but their primary affiliation remains with Factor 1.

Factor 2 primarily reflects general teaching competency and communication and guidance ability. Items with high loadings on Factor 2 are mainly from the C dimension (general teaching competency) and the E dimension (communication and guidance ability), specifically including: C2 Classroom management ability, loading = 0.690, communality = 0.708; C5 Instructional

design ability, loading = 0.674, communality = 0.683; E4 Communication ability, loading = 0.658, communality = 0.726; E2 Expression ability, loading = 0.571, communality = 0.669; C4 Teaching effectiveness evaluation ability, loading = 0.564, communality = 0.661; E5 Planning and guidance ability, loading = 0.505, communality = 0.642; C3 Presentation ability, loading = 0.469, communality = 0.655; C6 Ability to keep teaching updated, loading = 0.422, communality = 0.688; C9 Ability to teach according to aptitude, loading = 0.425, communality = 0.642; C8 Knowledge condensation ability, loading = 0.441, communality = 0.653; D1 Medical thinking teaching ability, loading = 0.436, communality = 0.683.

Factor 3 clearly reflects professional ethics and conduct. It is dominated by the 6 items from the original A dimension (professional ethics and conduct), with high, pure loadings: A5 Professional identity, loading = 0.843, communality = 0.776; A6 Professional responsibility, loading = 0.834, communality = 0.794; A4 Personal charisma, loading = 0.783, communality = 0.744; A2 Caring for students, loading = 0.753, communality = 0.622; A1 Being a role model, loading = 0.709, communality = 0.567; A3 Dedication, loading = 0.702, communality = 0.643. Loadings of items from other dimensions on this factor are all below 0.3, indicating a very clear structure.

Factor 4 primarily reflects professional practice and teaching transformation ability. Items with high loadings on Factor 4 are mainly from practice-related items in the B dimension (professional competence) and from some teaching transformation abilities in the D dimension: B5 Medical work experience, loading = 0.747, communality = 0.645; B2 Practical ability, loading = 0.625, communality = 0.706; D2 Medical practice teaching ability, loading = 0.603, communality = 0.718; D5 Medical education transformation ability, loading = 0.519, communality = 0.669; C1 Mentoring awareness, loading = 0.412, communality = 0.565; C3 Presentation ability, loading = 0.484, communality = 0.655; B1 Theoretical ability, loading = 0.393, communality = 0.679.

Factor 5 primarily reflects medical teaching and higher-order teaching ability. Items with high loadings on Factor 5 are mainly from research thinking and ethics teaching in the D dimension (medical teaching competency) and from higher-order teaching abilities in the C dimension: D3 Research thinking teaching ability, loading = 0.639, communality = 0.692; D4 Medical ethics teaching ability, loading = 0.596, communality = 0.694; D1 Medical thinking teaching ability, loading = 0.452, communality = 0.683; D2 Medical practice teaching ability, loading = 0.445, communality = 0.718; C6 Ability to keep teaching updated, loading = 0.453, communality = 0.688; C7 Knowledge system construction ability, loading = 0.443, communality = 0.672; C8 Knowledge condensation ability, loading = 0.385, communality =

0.653; C9 Ability to teach according to aptitude, loading = 0.383, communality = 0.642; E5 Planning and guidance ability, loading = 0.322, communality = 0.642.

Factor 6 primarily reflects theoretical, research, and frontier-grasping abilities. Items with high loadings on Factor 6 are mainly from theoretical, research, and frontier abilities in the B dimension (professional competence): B3 Research ability, loading = 0.774, communality = 0.777; B4 Ability to grasp disciplinary frontiers, loading = 0.608, communality = 0.667; B1 Theoretical ability, loading = 0.525, communality = 0.679; G5 Internet+ ability, loading = 0.356, communality = 0.548; C6 Ability to keep teaching updated, loading = 0.334, communality = 0.688.

Factor 7: Independently reflects feedback ability. Factor 7 is dominated by a single item: E3 Feedback ability, with a loading of 0.775 and a communality of 0.708. Loadings of other items on this factor are low (the highest is D5 at 0.395, but this item already has a higher loading on Factor 4). This indicates that feedback ability is substantially different from other communication and guidance abilities (such as listening, expression, and communication) in terms of measurement.

Summary of Communalities: The communalities for all 39 items range from 0.548 to 0.794. The items with the highest communalities are A6 Professional responsibility (0.794) and A5 Professional identity (0.776), indicating that the variance in these two items is best explained by the 7 factors. The items with relatively lower communalities are G5 Internet+ ability (0.548) and A1 Being a role model (0.567), but both still exceed the acceptable level of 0.5.

Summary: Excellent structure: Factor 3 (professional ethics and conduct) aligns perfectly with the original A dimension, with all items showing high loadings and no cross-factor contamination, indicating excellent convergent validity.

Good but overlapping aggregation: Factor 1 completely merges the original F dimension (management ability) and G dimension (development ability), suggesting that in teacher self-assessments, management and development abilities may be perceived as highly correlated composite competencies. Factors 2, 4, 5, and 6 show cross-mixing among the original C, D, E, and B dimensions, indicating that "general teaching competency," "medical teaching competency," "communication and guidance ability," and "professional competence" are not fully independent in measurement and have theoretical overlap. For example, Factor 2 mixes classroom management, instructional design, communication and expression, etc.; Factor 4 mixes medical practice experience, practice teaching, and mentoring awareness; Factor 5 mixes medical thinking teaching, research thinking teaching, and higher-order teaching abilities; Factor 6 clearly groups research, frontier, and theoretical abilities together.

Items needing improvement: Factor 7 consists solely of the E3 Feedback ability, and this item also performed poorly in previous reliability analyses, suggesting it may not be suitable for measuring the same construct alongside other E dimension items. Revision or deletion is recommended.

Overall, the rotated factor structure is reasonable, but some theoretical dimensions (especially teaching-related abilities) could not be fully distinguished in the empirical data. Follow-up studies are recommended to optimize the scale or revise the theoretical model based on this structure. (For detailed results, please refer to Appendix C, Table C.21.)

6.2.3.2 Confirmatory Factor Analysis

Discriminant Validity

Pearson correlation coefficients among the seven dimensions and the square roots of AVE for each dimension are presented in detail. The criterion for discriminant validity is that the square root of AVE for each dimension should be greater than the absolute value of the correlation coefficient between that dimension and any other dimension. If a correlation coefficient exceeds the square root of AVE for a dimension, it indicates insufficient discriminant validity between the two dimensions.

(1) Square Roots of AVE for Each Dimension

A Professional ethics and conduct: 0.768, B Professional competence: 0.693, C General teaching competency: 0.761, D Medical teaching competency: 0.751, E Communication and guidance ability: 0.726, F Management ability: 0.835, G Development ability: 0.768.

(2) Pearson Correlation Coefficients Between Dimensions

A (Professional ethics and conduct) with other dimensions: B = 0.487, C = 0.482, D = 0.386, E = 0.404, F = 0.390, G = 0.378; B (Professional competence) with other dimensions: C = 0.734, D = 0.668, E = 0.559, F = 0.569, G = 0.599; C (General teaching competency) with other dimensions: D = 0.794, E = 0.746, F = 0.710, G = 0.742; D (Medical teaching competency) with other dimensions: E = 0.684, F = 0.645, G = 0.650 (D's 0.751); E (Communication and guidance ability) with other dimensions: F = 0.675, G = 0.653; F (Management ability) with G (Development ability): F–G = 0.796.

Summary: Dimensions with good discriminant validity: A (Professional ethics and conduct) shows correlation coefficients with all other dimensions well below its AVE, performing best. Dimension pairs with discriminant validity problems: B (Professional competence) and C (General teaching competency): correlation 0.734 > B's AVE (0.693). C (General teaching competency) and D (Medical teaching competency): correlation 0.794 > C's AVE (0.761) and >

D's AVE (0.751), a prominent issue. C (General teaching competency) and E (Communication and guidance ability): correlation 0.746 > E's AVE (0.726). F (Management ability) and G (Development ability): correlation 0.796 > G's AVE (0.768). Additionally, the correlation between C and G is 0.742, which, although below the AVE of both C and G, is very close and also suggests potential overlap.

Discriminant validity among some dimensions of this scale is not ideal. In particular, the correlation between general teaching competency (C) and medical teaching competency (D) is too high (0.794), indicating that these two constructs may be difficult to distinguish in measurement and may need to be merged or redefined. Management ability (F) and development ability (G) also show a high correlation (0.796), exceeding G's AVE, suggesting they may belong to the same higher-order factor. The correlations between professional competence (B) and general teaching competency (C), as well as between general teaching competency (C) and communication and guidance ability (E), also approach or exceed the threshold. Follow-up studies are recommended to further optimize the scale structure or to re-examine the rationality of the dimension division through theoretical analysis. (For detailed results, please refer to Appendix C, Table C.22)

Convergent Validity

Factor loadings show the relationships between factors (latent variables) and analysis items (manifest/measurement items). The p-values for all paths are 0.000 (<0.001), indicating that the contribution of all measurement items to the latent variables is highly significant.

For A (Professional ethics and conduct): A1 Being a role model, standardized factor loading = 0.628, indicating this item reasonably reflects professional ethics and conduct; A2 Caring for students = 0.709; A3 Dedication = 0.689, close to 0.7; A4 Personal charisma = 0.822; A5 Professional identity = 0.855; A6 Professional responsibility = 0.872, the highest in dimension A, indicating the strongest association with professional ethics and conduct.

For B (Professional competence): B1 Theoretical ability = 0.729; B2 Practical ability = 0.702; B3 Research ability = 0.692; B4 Ability to grasp disciplinary frontiers = 0.778; B5 Medical work experience = 0.539, relatively low but still above the acceptable standard of 0.5, indicating a weaker contribution to professional competence.

For dimension C (General teaching competency): C1 Mentoring awareness = 0.710; C2 Classroom management ability = 0.736; C3 Presentation ability = 0.721; C4 Teaching effectiveness evaluation ability = 0.784; C5 Instructional design ability = 0.730; C6 Ability to keep teaching updated = 0.798; C7 Knowledge system construction ability = 0.775; C8 Knowledge condensation ability = 0.807, the highest in dimension C, indicating the strongest

association with general teaching competency; C9 Ability to teach according to aptitude = 0.781. All items in dimension C have loadings >0.7, indicating very high overall measurement quality.

For D (Medical teaching competency): D1 Medical thinking teaching ability = 0.838; D2 Medical practice teaching ability = 0.723; D3 Research thinking teaching ability = 0.692; D4 Medical ethics teaching ability = 0.757; D5 Medical education transformation ability = 0.739. D3's loading is relatively low but still acceptable.

For E (Communication and guidance ability): E1 Listening ability = 0.693; E2 Expression ability = 0.808; E3 Feedback ability = 0.476, below 0.5, indicating a weak association with communication and guidance ability and unsatisfactory measurement performance; E4 Communication ability = 0.815; E5 Planning and guidance ability = 0.784. E3 Feedback ability is the only item with a loading below 0.5, suggesting it may not be suitable as a measurement indicator for this dimension.

For F (Management ability): F1 Team command ability = 0.831; F2 Team collaboration ability = 0.799; F3 Organizational ability = 0.845; F4 Coordination ability = 0.865, the highest in dimension F, indicating the strongest association with management ability. All F dimension items have loadings >0.79, indicating excellent measurement quality.

For G (Development ability): G1 Self-assessment = 0.675; G2 Reflective ability = 0.844; G3 Innovation ability = 0.830; G4 Lifelong learning ability = 0.797; G5 Internet+ ability = 0.675. G2 and G3 have high loadings; G1 and G5 are lower but still acceptable.

Summary: Among the 39 items, the standardized factor loadings for 38 items are above 0.5, with most exceeding 0.7, indicating good overall measurement quality of the scale. The exception is E3 Feedback ability (0.476), which has repeatedly performed poorly across multiple analyses, and revision or deletion is recommended for subsequent scales. Additionally, the loadings for B5 Medical work experience (0.539), G1 Self-assessment (0.675), and G5 Internet+ ability (0.675) are relatively low but remain within acceptable ranges (for detailed results, please refer to Appendix C, Table C.23).

6.2.4 Structural equation modeling (SEM)

Analyze the model's fit and explanatory power to clarify the dimensions of the teaching competence model for medical teachers.

6.2.4.1 Overall model fit Assessment

The model was evaluated for overall goodness-of-fit using a series of indices. Although the chi-square value (χ^2) was 1734.232 with 686 degrees of freedom (df) and the corresponding p-value

was 0.000 (less than the strict threshold of 0.05), more emphasis was placed on other relative fit indices because large sample sizes tend to produce significant chi-square results.

The ratio of chi-square to degrees of freedom (χ^2/df) was 2.528, below the criterion of 3, indicating acceptable model fit. The Root Mean Square Error of Approximation (RMSEA) was 0.062, with a 90% confidence interval of 0.058 to 0.065, both below the good standard of 0.08, suggesting acceptable model error. The Comparative Fit Index (CFI) was 0.904, and the Incremental Fit Index (IFI) was 0.905, both exceeding the standard of 0.9. The Non-Normed Fit Index (NNFI/TLI) was 0.897, and the Normed Fit Index (NFI) was 0.852, both slightly below 0.9 but close. The Goodness-of-Fit Index (GFI) was 0.814, and the Adjusted Goodness-of-Fit Index (AGFI) was 0.789, failing to meet the ideal standard of 0.9. The Root Mean Square Residual (RMR) was 0.023, and the Standardized Root Mean Square Residual (SRMR) was 0.046, both below the standards of 0.05 and 0.1, indicating good performance. Overall, the model's global fit is acceptable. Key indices such as CFI, IFI, and RMSEA meet good standards, but the lower GFI and AGFI suggest some discrepancy between the model structure and the actual data, leaving room for improvement.

6.2.4.2 Measurement model: relationships between latent variables and observed variables

The measurement model specifies how the seven dimensions (latent variables) are measured by their respective items (observed variables). All path *p*-values were 0.000, indicating that all items contribute extremely significantly to their respective dimensions.

A. Professional ethics and conduct: Has a significant positive influence across all 6 items. The standardized regression coefficients (factor loadings) range from 0.627 (A1 Exemplary Conduct) to 0.870 (A6 Sense of Professional Responsibility), with A5 Sense of Professional Identity (0.855) and A6 (0.870) showing the highest loadings.

B. Professional competence: Has a significant positive influence on all 5 items. The standardized regression coefficients range from 0.545 (B5 Clinical Experience) to 0.769 (B4 Ability to Grasp Disciplinary Frontiers). B1 Clinical Theoretical Competence (0.733) and B2 Clinical Practical Competence (0.711) also show relatively high loadings, whereas B5 has the lowest.

C. Teaching literacy: Has a significant positive effect on all 9 items. The standardized regression coefficients range from 0.711 (C1 Clinical Teaching Awareness) to 0.791 (C8 Knowledge Condensation Ability), with generally high and balanced loadings across items.

D. Medical teaching literacy: Has a significant positive effect on all 5 items. The

standardized regression coefficients range from 0.696 (D3 Research Thinking Cultivation) to 0.834 (D1 Clinical Reasoning Instruction), with D1 showing the highest loading.

E. Communication and guiding ability: Has a significant positive influence on all 5 items. The standardized regression coefficients vary considerably, ranging from 0.468 (E3 Feedback Ability) to 0.807 (E4 Communication Ability). The loading for E3 Feedback Ability is significantly lower than for the other items (E1 Listening Ability: 0.738; E2 Expressive Ability: 0.800; E5 Mentoring and Guidance Ability: 0.806).

F. Management ability: Has a significant positive influence on all 4 items. The standardized regression coefficients range from 0.800 (F2 Team Collaboration Ability) to 0.869 (F4 Coordination Ability), indicating very high loadings.

G. Developmental ability: Has a significant positive influence on all 5 items. The standardized regression coefficients range from 0.673 (G5 "Internet+" Ability) to 0.844 (G2 Reflective Ability), with G2 Reflective Ability and G3 Innovative Ability (0.827) showing the highest loadings.

The measurement model is generally good, with the vast majority of items effectively reflecting their respective latent variables. However, the relatively low loading for E3 Feedback Ability again suggests that its measurement effect within this dimension may be suboptimal.

6.2.4.3 Structural model: causal relationships among latent variables

The structural model reveals the relationships between "Medical Teacher Competency" and the seven dimensions, as well as relationships among some dimensions. Impact of "Medical Teacher Competency" on the Seven Dimensions: The greatest impact is on C. Teaching literacy (standardized coefficient 0.993, *p* < 0.001). Significant impact on D. Medical teaching literacy (standardized coefficient 0.905, *p* < 0.001). Significant impact on B. Professional competence (standardized coefficient 0.843, $p < 0.001$). Significant impact on E. Communication and guiding ability (standardized coefficient 0.854, $p < 0.001$). Significant impact on G. Developmental ability (standardized coefficient 0.615, $p < 0.001$). Direct impact on F. Management ability is relatively small but significant (standardized coefficient 0.162, $p = 0.018$).

The impact path for A. Professional ethics and conduct shows an anomalous, significant negative relationship (standardized coefficient -2.327, $p < 0.001$), with an absolute value greater than 1. Combined with the warning note "excessive correlation among data leading to regression coefficient >1," this result is not credible and may be due to multicollinearity or model misspecification.

Inter-dimensional Influence Relationships: E. Communication and guiding ability has a significant positive influence on G. Developmental ability (standardized coefficient 0.246, $p = 0.004$). G. Developmental ability has a very strong, significant positive influence on F. Management ability (standardized coefficient 0.759, $p < 0.001$).

6.2.4.4 Model explanatory power (R^2 Values)

The R^2 values indicate how much variance in the dependent variables is explained by the independent variables in the model. Explanatory Power for Dimensions: "Medical Teacher Competency" explains an extremely high proportion of variance in C. Teaching literacy ($R^2 = 0.987$). Its explanatory power is also strong for D. Medical teaching literacy ($R^2 = 0.819$), F. Management ability ($R^2 = 0.806$), B. Professional competence ($R^2 = 0.711$), E. Communication and guiding ability ($R^2 = 0.729$), and G. Developmental ability ($R^2 = 0.697$). The R^2 for A. Professional ethics and conduct is negative (-0.258), which is meaningless and corresponds to the aforementioned anomalous path. Explanatory Power for Items: The explanatory power (R^2) of each dimension for its subordinate items varies considerably. For example, within the Professional Ethics and Conduct dimension, the explained variance for A6 Sense of Professional Responsibility reaches 0.757, while for A1 Exemplary Conduct it is 0.393. Within the Communication and Guiding Ability dimension, the explained variance for E3 Feedback Ability is the lowest, only 0.219. Within the Developmental Ability dimension, the explained variance for G5 "Internet+" Ability is relatively low at 0.452.

Model is Basically Valid but Requires Revision: The Structural Equation Model shows an overall fit that is generally acceptable. The measurement model (except for E3) performs well. The structural model shows the strong predictive power of competency across most teaching and professional ability dimensions, as well as the important influence of developmental ability on management ability.

The most prominent issue with the model is the unusually large negative coefficient and negative R^2 on the influence path from "Medical Teacher Competency" to "A. Professional ethics and conduct." This strongly suggests model misspecification: "Professional Ethics and Conduct" may not be suitable as an outcome variable (dependent variable) of "Medical Teacher Competency." Theoretically, professional ethics and conduct are more likely to be the foundation or core component of teacher competency, or even its antecedent, rather than a result "influenced" by it. Based on this, the model should be adjusted by adding the influence of "A. Professional ethics and conduct" on "Medical Teacher Competency."

Based on the scale, the medical teacher competency model established via Structural

Equation Modeling (SEM) includes two types of relationships in its regression table: structural influence relationships and measurement relationships. For both structural influence and measurement relationships, standardized path coefficients are typically used to indicate the strength and direction of the relationship. If a path coefficient is significant, it indicates a significant influence or measurement relationship; otherwise, it suggests no influence or measurement relationship between the items. If a large number of path coefficients are not significant, it indicates a poor model, suggesting the need to re-specify the model relationships, i.e., adjust the model.

In structural equation modeling, there are numerous fit indices, and in practical research, it is generally not necessary to satisfy all of them. Instead, a comprehensive judgment is based on several commonly used core indicators. This study primarily examines the following indices: the chi-square-to-degrees-of-freedom ratio, the Goodness-of-Fit Index (GFI), the Root Mean Square Error of Approximation (RMSEA), the Standardized Root Mean Square Residual (RMR), the Comparative Fit Index (CFI), the Normed Fit Index (NFI), and the Non-Normed Fit Index (NNFI). The results indicate that all fit indices for the model constructed in this study meet acceptable standards, demonstrating a good fit between the model and the data and satisfactory overall validity. For detailed data analysis, please refer to Annex C, Tables C.24-C.28, and Figure 6.1.

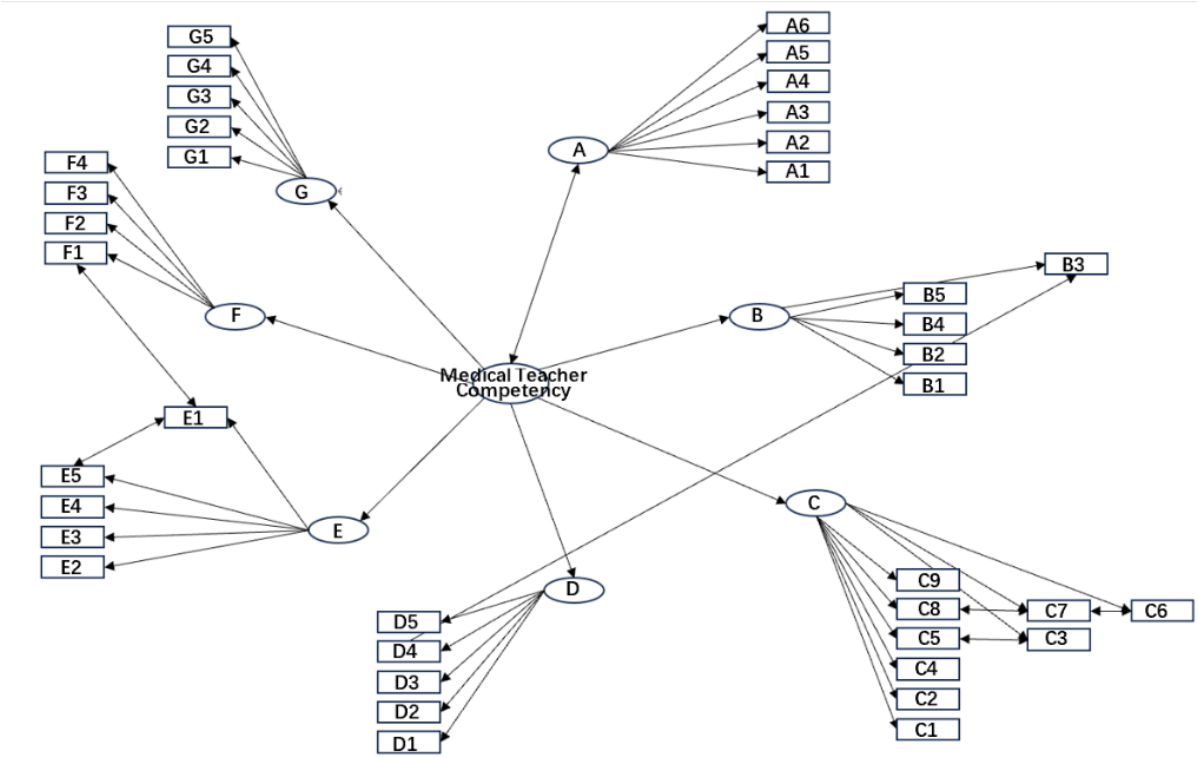


Figure 6.1 Model results diagram

6.2.5 Differential analysis

The second aim of this study is to assess the current level of competency among teachers. By analyzing differences in the competencies of various teachers, we can further understand the competency situations of teachers from different groups and the current competency level of medical teachers.

6.2.5.1 Differences in medical teacher competency by teaching experience (years)

One-way ANOVA was used to examine differences in teaching experience (years) across nine dimensions: Overall Teacher Competency, A. Professional Ethics, B. Professional competence, C. General Teaching Literacy, D. Medical Teaching Literacy, E. Communication & Guidance, F. Management ability, G. Developmental ability, and D. Medical Teaching Literacy (Clinical Specialists). The results indicate: Samples with different teaching experience showed no significant differences ($p>0.05$) in A. Professional Ethics, E. Communication & Guidance, F. Management ability, and D. Medical Teaching Literacy (Clinical Specialists), meaning these four dimensions remained consistent across experience levels. Samples with different teaching experience showed significant differences ($p<0.05$) in Overall Teacher Competency, B. Professional competence, C. General Teaching Literacy, D. Medical Teaching Literacy, and G. Developmental ability, indicating experience-based variations in these five dimensions. Specific analysis reveals:

I. Overall teacher competency score

There were significant differences in the overall Teacher Competency score across groups with different years of teaching experience ($F=4.172$, $p=0.003$). The scores showed an overall upward trend with increasing years of experience: the group with less than 5 years had the lowest score (4.27 ± 0.52); the 5–10 years group increased to 4.46 ± 0.40; the 10–15 years group showed a slight decline (4.39 ± 0.48); the 15–20 years group scored 4.47 ± 0.39; and the 20–25 years group achieved the highest score of 4.55 ± 0.45.

II. Score differences across dimensions

A. Professional ethics and conduct: Differences in scores on this dimension across experience groups did not reach statistical significance ($F=2.174$, $p=0.071$). However, mean scores still showed a trend toward improvement with more experience, rising from 4.39 ± 0.74 in the <5 years group to 4.66 ± 0.58 in the 20–25 years group.

B. Professional competence: There were highly significant differences in Professional Competence across experience groups ($F=6.074$, $p < 0.001$). The <5 years group scored notably lower (4.13 ± 0.68). The score increased significantly to 4.47 ± 0.46 in the 5–10 years group

and remained relatively stable in subsequent groups (10–15 years: 4.38 ± 0.59; 15–20 years: 4.39 ± 0.55; 20–25 years: 4.53 ± 0.53).

C. Teaching literacy: There were extremely significant differences among groups with different years of experience ($F=5.171$, $p < 0.001$). Scores also showed an upward trend with experience: the <5 years group scored 4.23 ± 0.64, while the 20–25 years group scored the highest at 4.56 ± 0.47. The 15–20 years group (4.50 ± 0.43) also demonstrated a relatively high level.

D. Medical teaching literacy: Score differences across experience groups were significant ($F=3.931$, $p=0.004$). The <5 years group had the lowest score (4.15 ± 0.71). The other groups' scores ranged from 4.38 to 4.48, with the 20–25 years group scoring highest (4.48 ± 0.56).

E. Communication and guiding ability: Differences in scores on this dimension across experience groups were not statistically significant ($F=1.667$, $p=0.157$). Scores ranged from 4.38 ± 0.61 (10–15 years group) to 4.53 ± 0.52 (20–25 years group), indicating relatively similar values.

F. Management ability: There were no significant differences in Management Ability scores across experience groups ($F=0.816$, $p=0.516$). Mean scores ranged from 4.40 ± 0.58 in the <5 years group to 4.54 ± 0.54 in the 20–25 years group.

G. Developmental ability: Significant differences were observed across experience groups ($F=3.070$, $p=0.016$). Scores showed an overall upward trend, from 4.23 ± 0.63 in the <5 years group to 4.52 ± 0.50 in the 20–25 years group.

D. Medical teaching literacy (clinical specialty): Analysis specific to clinical specialty teachers showed that score differences in this specialized literacy across experience groups were not significant ($F=1.647$, $p=0.162$). Scores gradually increased from 4.17 ± 0.80 in the <5 years group to 4.46 ± 0.64 in the 20–25 years group.

Summary: Years of teaching experience is an important factor influencing the competency of medical teachers, but its impact is most evident in dimensions closely tied to the accumulation of knowledge and skills, such as Professional Competence, Teaching Literacy, Medical Teaching Literacy, and Developmental Ability. Scores in these areas generally improve with greater experience. In contrast, differences across experience groups are less pronounced in dimensions more associated with personal traits and soft skills, such as Professional Ethics and Conduct, Communication and Guiding Ability, and Management Ability. This suggests that the former may depend more on accumulated experience, while the latter may be relatively stable individual traits or may be formed early in one’s career. For detailed data analysis, please refer to Annex C, Table C.29, and Annex D, Figures D.1-D.3.

6.2.5.2 Differences in medical teacher competency by gender

Independent samples t-tests were used to examine gender differences across nine dimensions: Overall Teacher Competency, A. Professional Ethics, B. Professional competence, C. General Teaching Literacy, D. Medical Teaching Literacy, E. Communication & Guidance, F. Management ability, G. Developmental ability, and D. Medical Teaching Literacy (Clinical Specialists). Results indicate: Samples of different genders showed no significant differences ($p>0.05$) in Overall Competency, C. General Teaching Literacy, E. Communication & Guidance, F. Management ability, and D. Medical Teaching Literacy (Clinical Specialists), meaning these five dimensions remained consistent across genders. Samples of different genders showed significant differences ($p<0.05$) in A. Professional Ethics, B. Professional competence, D. Medical Teaching Literacy, and G. Developmental ability, indicating gender-based variations in these four dimensions. Specific analysis reveals:

I. Overall teacher competency score

Regarding the overall Teacher Competency score, the mean for male teachers was 4.47 ± 0.45, and for female teachers, 4.40 ± 0.46. Although the mean score for males was slightly higher, an independent-samples t-test indicated that the difference between the two groups was not statistically significant ($t = 1.575$, $p = 0.116$).

II. Score differences across dimensions

A. Professional ethics and conduct: The gender difference on this dimension was statistically significant ($t = -1.987$, $p = 0.048$). Female teachers (4.59 ± 0.44) had a significantly higher mean score than male teachers (4.46 ± 0.75). The standard deviation for male teachers was larger on this item, indicating greater variability in ratings within that group.

B. Professional competence: The gender difference was significant ($t = 2.104$, $p = 0.036$). Male teachers (4.46 ± 0.62) had a significantly higher mean score than female teachers (4.34 ± 0.54).

C. Teaching literacy: The mean score for male teachers was 4.47 ± 0.51, and for female teachers it was 4.37 ± 0.53. The difference between the groups was on the borderline of statistical significance but did not reach the conventional 0.05 level ($t = 1.819$, $p = 0.070$).

D. Medical teaching literacy: The gender difference was highly significant ($t = 2.784$, $p = 0.006$). Male teachers (4.47 ± 0.51) had a significantly higher mean score than female teachers (4.31 ± 0.61).

E. Communication and guiding ability: The mean scores were 4.51 ± 0.55 for male teachers and 4.43 ± 0.55 for female teachers. The difference between the groups was not statistically

significant (t = 1.447, p = 0.149).

F. Management ability: The mean score for male teachers was 4.50 ± 0.60, and for female teachers, 4.43 ± 0.54. The difference between the groups was not statistically significant (t = 1.134, p = 0.257).

G. Developmental ability: The gender difference was significant (t = 2.035, p = 0.043). Male teachers (4.46 ± 0.57) had a significantly higher mean score than female teachers (4.34 ± 0.56).

D. Medical teaching literacy (clinical specialty): This specialized analysis revealed mean scores of 4.37 ± 0.74 for male clinical specialty teachers and 4.36 ± 0.67 for female clinical specialty teachers. The difference between the groups was minimal and not statistically significant (t = 0.154, p = 0.878).

Summary: Gender showed statistically significant differences across several dimensions of medical teacher competency. Specifically: Female teachers performed significantly better than male teachers on the Professional Ethics and Conduct dimension. Male teachers scored significantly higher on three dimensions: Professional Competence, Medical Teaching Literacy, and Developmental Ability. Gender differences were not apparent in the overall Teacher Competency score or in the Teaching Literacy, Communication and Guiding Ability, and Management Ability dimensions. No significant gender difference was found for the Medical Teaching Literacy (Clinical Specialty) dimension specific to clinical specialty teachers. These results suggest that gender may be associated with self-assessment or actual performance across different competencies, but overall competency level is not influenced by gender. For detailed data analysis, please refer to Annex C Table C.30 and Annex D Figures D.4-D.6.

6.2.5.3 Differences in medical teacher competency by age

One-way ANOVA was used to examine age differences across nine dimensions: Overall Teacher Competency, A. Professional Ethics, B. Professional competence, C. General Teaching Literacy, D. Medical Teaching Literacy, E. Communication & Guidance, F. Management ability, G. Developmental ability, and D. Medical Teaching Literacy (Clinical Specialists). Results indicate: Samples of different ages showed no significant differences ($p>0.05$) in Overall Competency, A. Professional Ethics, B. Professional competence, E. Communication & Guidance, F. Management ability, and G. Developmental ability, meaning these six dimensions remained consistent across age groups. Samples of different ages showed significant differences ($p<0.05$) in C. General Teaching Literacy, D. Medical Teaching Literacy, and D. Medical Teaching Literacy (Clinical Specialists), indicating age-based variations in these three

dimensions. Specific analysis reveals:

I. Overall teacher competency score

The difference in the overall Teacher Competency score across age groups approached but did not reach statistical significance ($F = 2.289$, $p = 0.059$). Based on the mean scores, a trend of improvement with increasing age was observed: the youngest group (21–30 years old) had the lowest score (4.27 ± 0.50); the 31–40 years group scored 4.38 ± 0.47; the 41–50 years group scored 4.43 ± 0.45; the 51–60 years group increased to 4.57 ± 0.43; and the over 60 years group (sample size of only 2) had the highest score of 4.66 ± 0.48.

II. Score differences across dimensions

A. Professional ethics and conduct: Differences in scores across age groups on this dimension did not reach statistical significance ($F = 1.696$, $p = 0.150$). The mean scores showed that the 51–60 years group had the highest score (4.71 ± 0.41), the 21–30 years group scored 4.50 ± 0.43, and the other groups scored between 4.49 and 4.53.

B. Professional competence: Differences in scores across age groups did not reach statistical significance ($F = 2.112$, $p = 0.079$). However, the mean scores showed an upward trend, with the 21–30 years group scoring lowest (4.08 ± 0.49) and the 51–60 years group scoring highest (4.51 ± 0.55).

C. Teaching literacy: Significant differences were observed across age groups ($F = 3.102$, $p = 0.016$). Scores improved with age: the 21–30 years group scored 4.08 ± 0.79 (a large standard deviation), the 31–40 years group scored 4.35 ± 0.54, the 41–50 years group scored 4.42 ± 0.51, and the 51–60 years group reached 4.58 ± 0.44.

D. Medical teaching literacy: Score differences across age groups were significant ($F = 2.923$, $p = 0.021$). Scores also showed an upward trend, increasing from 4.00 ± 0.58 in the 21–30-year group to 4.53 ± 0.55 in the 51–60-year group.

E. Communication and guiding ability: Score differences across age groups were not statistically significant ($F = 1.295$, $p = 0.271$). Across groups, scores ranged from 4.40 ± 0.50 (21–30 years group) to 4.60 ± 0.48 (51–60 years group).

F. Management ability: There were no significant differences in Management Ability scores across age groups ($F = 0.615$, $p = 0.652$). The mean scores across groups were similar, ranging from 4.44 ± 0.60 (31–40 years group) to 4.56 ± 0.52 (51–60 years group).

G. Developmental ability: Score differences among age groups did not reach statistical significance ($F = 1.150$, $p = 0.333$). The mean scores showed that the over-60 group had the highest score (4.80 ± 0.28, though the sample size was very small), the 51–60 group scored 4.51 ± 0.48, and the other groups scored between 4.30 and 4.37.

D. Medical teaching literacy (clinical specialty): Analysis specific to clinical specialty teachers showed significant differences in scores on this specialized literacy across age groups ($F = 2.681$, $p = 0.032$). The 21–30 years group scored notably lower (3.50 ± 1.00, with a large standard deviation). Scores for subsequent age groups increased significantly and stabilized: the 31–40 years group scored 4.33 ± 0.69, the 41–50 years group scored 4.34 ± 0.72, and the 51–60 years group scored highest at 4.57 ± 0.52.

Summary: The influence of age on medical teacher competency is primarily concentrated in the domains of knowledge and skills directly related to teaching. Significant differences among age groups were observed for Teaching Literacy, Medical Teaching Literacy, and Medical Teaching Literacy (Clinical Specialty), with scores generally improving with age (and experience), highlighting the importance of accumulated experience. In contrast, differences among age groups did not reach statistical significance for dimensions such as Professional Ethics and Conduct, Professional Competence, Communication and Guiding Ability, Management Ability, and Developmental Ability. Notably, the youngest teacher group (21–30 years, with a relatively small sample size) had the lowest scores across multiple measures, particularly scoring significantly lower on clinical specialty teaching literacy. This may reflect that early-career teachers are still in a learning phase of transforming professional experience into teaching capability. Due to the small sample size (2 individuals) in the over 60 years group, their high scores should be interpreted with caution and not overgeneralized. For detailed data analysis, please refer to Annex C Table C.31 and Annex D Figures D.7-D.9.

6.2.5.4 Differences in medical teacher competency by primary teaching discipline

One-way ANOVA was used to examine differences in primary teaching disciplines across nine dimensions: Overall Teacher Competency, A. Professional Ethics, B. Professional competence, C. General Teaching Literacy, D. Medical Teaching Literacy, E. Communication & Guidance, F. Management ability, G. Developmental ability, and D. Medical Teaching Literacy (Clinical Specialists). Results indicate: Samples from different primary teaching disciplines showed no significant differences ($p>0.05$) in Overall Competency, A. Professional Ethics, E. Communication & Guidance, F. Management ability, and G. Developmental ability, meaning these five dimensions remained consistent across disciplines. Samples from different primary teaching disciplines showed significant differences ($p<0.05$) in B. Professional competence, C. General Teaching Literacy, D. Medical Teaching Literacy, and D. Medical Teaching Literacy (Clinical Specialists), indicating discipline-based variations in these four dimensions. Specific analysis reveals:

I. Overall teacher competency score

The differences in the overall Teacher Competency score across discipline groups did not reach statistical significance ($F = 1.538$, $p = 0.095$). In terms of mean scores, the Stomatology group had the highest score (4.52 ± 0.46), followed by the Clinical Medicine group (4.49 ± 0.47), the Other Medical-Related Disciplines group (4.49 ± 0.41), and the Preventive Medicine group (4.47 ± 0.36), all at relatively high levels. The Basic Medical Sciences group (4.17 ± 0.53), the Medical Education Management group (4.13 ± 0.22), and the Forensic Medicine group (only one person, 4.15) scored relatively lower.

II. Score differences across dimensions

A. Professional ethics and conduct: Differences in scores across discipline groups did not reach statistical significance ($F = 1.694$, $p = 0.054$). The Other Medical-Related Disciplines group had the highest mean score (4.64 ± 0.76). The Nursing (4.61 ± 0.48), Medical Technology (4.63 ± 0.38), and Traditional Chinese Medicine/Integrated Chinese and Western Medicine (4.59 ± 0.40) groups also scored highly. The Medical Education Management group scored significantly lower (3.50 ± 1.41) and showed large within-group variation.

B. Professional competence: Differences in scores across discipline groups approached significance ($F = 1.718$, $p = 0.050$). The Preventive Medicine (4.60 ± 0.40), Stomatology (4.52 ± 0.54), and Clinical Medicine (4.47 ± 0.61) groups scored higher. The Basic Medical Sciences (4.06 ± 0.64) and Rehabilitation Medicine (4.11 ± 0.81) groups scored lower.

C. Teaching literacy: There were highly significant differences among discipline groups ($F = 2.331$, $p = 0.004$). The Stomatology (4.51 ± 0.53), Clinical Medicine (4.48 ± 0.51), and Other Medical-Related Disciplines (4.57 ± 0.49) groups performed notably well. By comparison, the Basic Medical Sciences (4.06 ± 0.62), Psychiatry/Applied Psychology (4.06 ± 0.19), and Rehabilitation Medicine (4.16 ± 0.68) groups scored lower.

D. Medical teaching literacy: Score differences among discipline groups were significant ($F = 2.036$, $p = 0.015$). The Clinical Medicine (4.50 ± 0.51) and Stomatology (4.51 ± 0.56) groups had the highest scores. The Basic Medical Sciences group had the lowest score (4.05 ± 0.70). The Nursing (4.17 ± 0.56) and Forensic Medicine (only one person, 4.00) groups were also relatively low.

E. Communication and guiding ability: Differences in scores across discipline groups were not significant ($F = 1.441$, $p = 0.131$). The Other Medical-Related Disciplines (4.62 ± 0.45) and Stomatology (4.58 ± 0.48) groups scored higher. The Forensic Medicine group (only one person, 3.80) and the Chinese Materia Medica group (4.17 ± 0.42) scored lower.

F. Management ability: Differences in scores among discipline groups were not significant

($F = 0.902$, $p = 0.557$). Mean scores across groups ranged from 4.13 ± 0.21 (Biostatistics group) to 4.54 ± 0.53 (Stomatology group), with the Forensic Medicine group (only one person) at 3.50.

G. Developmental ability: Differences in scores across discipline groups were not significant ($F = 1.071$, $p = 0.383$). The Pharmacy (4.51 ± 0.52) and Preventive Medicine (4.49 ± 0.54) groups scored higher. The Chinese Materia Medica group (3.94 ± 0.63) scored significantly lower than the other groups.

D. Medical teaching literacy (clinical specialty): This specialized analysis revealed highly significant differences in scores across clinically related discipline groups ($F = 8.428$, $p < 0.001$). The Clinical Medicine (4.56 ± 0.51), Stomatology (4.53 ± 0.55), and Traditional Chinese Medicine/Integrated Chinese and Western Medicine (4.55 ± 0.48) groups scored very highly. In contrast, the Basic Medical Sciences (3.61 ± 0.87) and Other Medical-Related Disciplines (3.89 ± 1.07) groups scored significantly lower. Many disciplines not directly related to clinical practice (e.g., Medical Technology, Pharmacy) had missing values for this item.

Summary: Teachers with different disciplinary backgrounds showed significant differences in their competency in core teaching abilities. Teachers in core clinical disciplines, such as Clinical Medicine and Stomatology, generally performed better in Teaching Literacy, Medical Teaching Literacy, and specialized Clinical Medical Teaching Literacy. Teachers in non-clinical disciplines, such as Basic Medical Sciences, had lower average scores in these teaching-related abilities, especially in clinical teaching literacy. No significant differences were found among teachers from different disciplinary backgrounds in more general dimensions or those focusing on personal traits, such as Professional Ethics and Conduct, Communication and Guiding Ability, Management Ability, and Developmental Ability. Special attention is needed: Teachers in Medical Education Management positions had an unusually low self-assessment score for Professional Ethics and Conduct. This may be related to their different job responsibilities and evaluation perspectives, but further study is needed given the small sample size. The stability and representativeness of results for some disciplines with very small sample sizes (e.g., Forensic Medicine with only one person, Psychiatry/Applied Psychology with 4, Preventive Medicine with 7) should be viewed with caution. These results suggest that disciplinary background and job content may significantly influence the development of teachers' specific teaching abilities, particularly in translating professional knowledge into teaching practice. For detailed data analysis, please refer to Annex C Table C.32 and Annex D Figures D.10-D.12.

6.2.5.5 Differences in medical teacher competency by position type

Using the tables, one-way ANOVA was used to examine differences in position types across nine dimensions: Overall Teacher Competency, A. Professional Ethics, B. Professional competence, C. General Teaching Literacy, D. Medical Teaching Literacy, E. Communication & Guidance, F. Management ability, G. Developmental ability, and D. Medical Teaching Literacy (Clinical Specialists). Results indicate: Samples of different position types showed no significant differences ($p>0.05$) in Overall Competency, A. Professional Ethics, B. Professional competence, C. General Teaching Literacy, E. Communication & Guidance, F. Management ability, and G. Developmental ability, meaning these seven dimensions remained consistent across position types. Samples of different position types showed significant differences ($p<0.05$) in D. Medical Teaching Literacy and D. Medical Teaching Literacy (Clinical Specialists), indicating position-based variations in these two dimensions. Specific analysis reveals:

I. Overall teacher competency score

The differences in the overall Teacher Competency score across position types were not statistically significant ($F = 1.634$, $p = 0.150$). Based on mean scores, teaching faculty had the highest overall score (4.49 ± 0.41), followed by clinical faculty (4.44 ± 0.49), administrative faculty (4.41 ± 0.34), research faculty (4.31 ± 0.46), and teaching-support faculty (4.26 ± 0.48). The "Other" position category had the lowest score (4.22 ± 0.06).

II. Score differences across dimensions

A. Professional ethics and conduct: Differences in scores across position types on this dimension were not significant ($F = 0.647$, $p = 0.664$). The mean scores across groups were similar. Teaching faculty (4.60 ± 0.54) and teaching-support faculty (4.53 ± 0.39) scored slightly higher, whereas the "Other" category scored lowest (4.31 ± 0.27).

B. Professional competence: Differences in scores across position types were not significant ($F = 0.797$, $p = 0.552$). Clinical faculty had the highest mean score (4.41 ± 0.62), followed by teaching faculty (4.42 ± 0.53), research faculty (4.32 ± 0.54), and teaching-support faculty (4.17 ± 0.59).

C. Teaching literacy: Score differences across position types were not significant ($F = 1.509$, $p = 0.186$). Teaching faculty scored highest (4.48 ± 0.46), followed by clinical faculty (4.41 ± 0.56). Teaching-support and "Other" faculty scored lower, at 4.19 ± 0.65 and 4.13 ± 0.41, respectively.

D. Medical teaching literacy: Significant differences were observed across position types

($F = 2.554$, $p = 0.027$). Teaching faculty scored highest (4.45 ± 0.53), closely followed by clinical faculty (4.41 ± 0.56). Research faculty (4.15 ± 0.80) and teaching-support faculty (4.09 ± 0.65) scored significantly lower.

E. Communication and guiding ability: Differences in scores across position types were not significant ($F = 1.463$, $p = 0.201$). Teaching faculty had the highest mean score (4.53 ± 0.48), followed by administrative faculty (4.48 ± 0.46) and clinical faculty (4.47 ± 0.56). Teaching-support faculty and the "Other" category scored lower, at 4.24 ± 0.44 and 4.20 ± 0.44, respectively.

F. Management ability: Differences in scores across position types were not significant ($F = 0.906$, $p = 0.477$). Scores were relatively tightly clustered across groups. Administrative faculty had the highest mean (4.52 ± 0.45), followed by clinical faculty (4.48 ± 0.59) and teaching faculty (4.47 ± 0.53). The "Other" category had the lowest mean (4.21 ± 0.43).

G. Developmental ability: Score differences across position types approached statistical significance ($F = 2.063$, $p = 0.069$). Teaching faculty scored notably higher (4.50 ± 0.49), followed by administrative faculty (4.41 ± 0.41) and clinical faculty (4.36 ± 0.61). Research faculty (4.22 ± 0.61), teaching-support faculty (4.27 ± 0.59), and the "Other" category (4.13 ± 0.27) scored lower.

D. Medical teaching literacy (clinical specialty): This specialized analysis revealed extremely significant differences among position types ($F = 8.156$, $p < 0.001$). Clinical faculty scored far ahead (4.46 ± 0.55). Administrative faculty also scored high (4.53 ± 0.44), though the sample size was small. In stark contrast, research faculty (3.68 ± 1.10) and teaching-support faculty (3.33 ± 1.51) scored very low, with extremely large within-group variation (standard deviation). Teaching faculty scored 4.31 ± 0.72.

Summary: The influence of position type on medical teacher competency is most evident in professional teaching abilities closely tied to specific work contexts. Teaching faculty performed well across multiple dimensions, including Medical Teaching Literacy, Developmental Ability, Teaching Literacy and Communication, and Guiding Ability. They scored significantly higher than research and teaching-support faculty in Medical Teaching Literacy, reflecting the advantage of their core teaching responsibilities. Clinical faculty held an absolute advantage in specialized Clinical Medical Teaching Literacy, which is highly relevant to their job content. Research and teaching-support faculty rated themselves significantly lower in Medical Teaching Literacy (especially in the clinical specialty direction). This suggests that their work focus may deviate from frontline clinical teaching, or that they lack relevant practical opportunities. No significant differences were found among teachers of

different position types in dimensions such as Professional Ethics and Conduct, Professional Competence, and Management Ability, suggesting these may be universal foundational competencies across positions. These results indicate that teacher development and evaluation should consider position-specific characteristics, with particular attention and support to cultivate medical teaching (especially clinical teaching) abilities for faculty in positions like research and teaching support. For detailed data analysis, please refer to Annex C Table C.33 and Annex D Figures D.13-D.15.

6.2.5.6 Differences in medical teacher competency by academic rank

One-way ANOVA was used to examine differences in academic ranks across nine dimensions: Overall Teacher Competency, A. Professional Ethics, B. Professional competence, C. General Teaching Literacy, D. Medical Teaching Literacy, E. Communication & Guidance, F. Management ability, G. Developmental ability, and D. Medical Teaching Literacy (Clinical Specialists). Results indicate: Samples of different academic ranks showed no significant differences ($p>0.05$) in F. Management ability and D. Medical Teaching Literacy (Clinical Specialists), meaning these two dimensions remained consistent across ranks. Samples of different academic ranks showed significant differences ($p<0.05$) in Overall Competency, A. Professional Ethics, B. Professional competence, C. General Teaching Literacy, D. Medical Teaching Literacy, E. Communication & Guidance, and G. Developmental ability, indicating rank-based variations in these seven dimensions. Specific analysis reveals:

I. Overall teacher competency score

There were highly significant differences in the overall Teacher Competency score across professional title groups ($F = 8.665$, $p < 0.001$). The scores showed a clear stepwise increase with title promotion: teachers with junior titles had the lowest overall score (4.14 ± 0.25); teachers with intermediate and associate senior titles had similar scores (4.41 ± 0.46 and 4.41 ± 0.47, respectively); and teachers with full senior titles had the highest overall score (4.61 ± 0.40).

II. Score differences across dimensions

A. Professional ethics and conduct: There were extremely significant differences among title groups on this dimension ($F = 8.727$, $p < 0.001$). Teachers with junior titles scored significantly lower (4.08 ± 0.66). Scores for teachers with intermediate (4.57 ± 0.47) and associate senior titles (4.50 ± 0.70) improved significantly and were comparable. Teachers with full senior titles scored the highest (4.71 ± 0.53).

B. Professional competence: There were extremely significant differences among title

groups ($F = 10.313$, $p < 0.001$). Scores increased steadily with title level: junior (4.06 ± 0.69), intermediate (4.34 ± 0.57), associate senior (4.38 ± 0.57), and full senior (4.67 ± 0.43).

C. Teaching literacy: There were extremely significant differences among title groups ($F = 8.507$, $p < 0.001$). Teachers with junior titles scored lowest (4.07 ± 0.52). Scores improved significantly for intermediate (4.38 ± 0.53) and associate senior titles (4.40 ± 0.52), with full senior title teachers scoring highest (4.61 ± 0.44).

D. Medical teaching literacy: There were extremely significant differences among title groups ($F = 7.085$, $p < 0.001$). Scores also showed a clear promotional gradient: junior (4.08 ± 0.48) < intermediate (4.33 ± 0.60) ≈ associate senior (4.37 ± 0.57) < full senior (4.60 ± 0.48).

E. Communication and guiding ability: Significant differences were observed among title groups ($F = 2.971$, $p = 0.032$). Teachers with junior titles scored 4.28 ± 0.38, intermediate 4.48 ± 0.50, associate senior 4.41 ± 0.60, and full senior 4.58 ± 0.53. Differences among the intermediate, associate senior, and full senior groups were relatively smaller than in other dimensions.

F. Management ability: Differences in scores across title groups did not reach statistical significance ($F = 2.034$, $p = 0.109$). Nonetheless, the mean scores still showed an upward trend: junior (4.28 ± 0.36), intermediate (4.44 ± 0.61), associate senior (4.46 ± 0.54), and full senior (4.57 ± 0.56).

G. Developmental ability: There were very significant differences among title groups ($F = 4.606$, $p = 0.003$). Teachers with junior titles scored lowest (4.11 ± 0.44). Teachers with intermediate titles (4.37 ± 0.59) and associate senior titles (4.38 ± 0.55) had similar scores, while those with full senior titles scored highest (4.55 ± 0.52).

D. Medical teaching literacy (clinical specialty): Analysis specific to clinical specialty teachers showed that score differences in this specialized literacy across title groups were not significant ($F = 1.769$, $p = 0.153$). However, the mean scores still showed an increasing trend from junior (4.09 ± 0.78) to full senior (4.50 ± 0.60).

Summary: Professional title is a crucial factor in determining the competency level of medical teachers. Across the five core dimensions of Professional Ethics and Conduct, Professional Competence, Teaching Literacy, Medical Teaching Literacy, and Developmental Ability, there were extremely or very significant differences among title groups. Scores generally followed the pattern: "Junior < Intermediate ≈ Associate Senior < Full Senior." This pattern indicates that these abilities are closely linked to teachers' professional growth and career advancement. Teachers with full senior titles led across all dimensions, reflecting their overall strength as academic backbones. In contrast, differences in Management Ability and

Clinical Specialty Medical Teaching Literacy across titles were not significant, suggesting these competencies may not be primary evaluation criteria for title promotion or may be more influenced by individual traits, specific positions, and other factors. For detailed data analysis, please refer to Annex C Table C.34 and Annex D Figures D.16-D.18.

6.2.5.7 Differences in medical teacher competency by highest degree

Using one-way ANOVA on the tables, differences in highest degrees across nine dimensions were examined: Overall Teacher Competency, A. Professional Ethics, B. Professional competence, C. General Teaching Literacy, D. Medical Teaching Literacy, E. Communication & Guidance, F. Management ability, G. Developmental ability, and D. Medical Teaching Literacy (Clinical Specialists). Results indicate: Samples with different highest degrees showed no significant differences ($p>0.05$) in Overall Competency, A. Professional Ethics, D. Medical Teaching Literacy, E. Communication & Guidance, F. Management ability, and D. Medical Teaching Literacy (Clinical Specialists), meaning these six dimensions remained consistent across degree levels. Samples with different highest degrees showed significant differences ($p<0.05$) in B. Professional competence, C. General Teaching Literacy, and G. Developmental ability, indicating degree-based variations in these three dimensions. Specific analysis reveals:

I. Overall teacher competency score

The differences in the overall Teacher Competency score across groups with different highest academic degrees approached but did not reach conventional levels of statistical significance ($F = 2.941$, $p = 0.054$). In terms of mean scores, the overall score showed an increasing trend with higher degrees: teachers with bachelor's degrees scored 4.34 ± 0.49, those with master's degrees scored 4.43 ± 0.46, and those with doctoral degrees scored highest at 4.48 ± 0.43.

II. Score differences across dimensions

A. Professional ethics and conduct: Differences in scores across degree groups were not significant ($F = 0.752$, $p = 0.472$). The mean scores for the three groups were very similar: bachelor's group (4.57 ± 0.52), master's group (4.49 ± 0.60), and doctoral group (4.56 ± 0.62).

B. Professional competence: There were very significant differences among degree groups ($F = 6.136$, $p = 0.002$). Scores increased markedly with higher degrees: teachers with bachelor's degrees had the lowest mean score (4.21 ± 0.61); those with master's degrees had a mean of 4.41 ± 0.53; and those with doctoral degrees had the highest mean (4.46 ± 0.57).

C. Teaching literacy: There were very significant differences among degree groups ($F = 5.768$, $p = 0.003$). As with professional competence, scores increased with higher degrees:

bachelor's group (4.25 ± 0.59), master's group (4.42 ± 0.51), and doctoral group (4.48 ± 0.49).

D. Medical teaching literacy: Score differences across degree groups were on the borderline of statistical significance (F = 2.686, p = 0.069). The mean scores showed that the bachelor's group scored relatively low (4.25 ± 0.57), whereas the master's (4.40 ± 0.53) and doctoral groups (4.41 ± 0.60) scored higher and were comparable.

E. Communication and guiding ability: Differences in scores among degree groups were not significant (F = 0.924, p = 0.398). Across the three groups, scores were very similar, with the bachelor's and master's groups both at 4.43 (standard deviations of 0.51 and 0.57, respectively), and the doctoral group slightly higher at 4.50 ± 0.51.

F. Management ability: Differences in scores among degree groups were not significant (F = 0.661, p = 0.517). The mean scores across groups ranged from 4.40 ± 0.66 (bachelor's group) to 4.48 ± 0.54 (doctoral group), indicating very small differences.

G. Developmental ability: Significant differences were observed across degree groups (F = 4.007, p = 0.019). Scores showed a clear degree gradient: teachers with bachelor's degrees scored lowest (4.25 ± 0.66); those with master's degrees scored 4.39 ± 0.54; and those with doctoral degrees scored highest (4.45 ± 0.52).

D. Medical teaching literacy (clinical specialty): Specialized analysis of clinical specialty teachers showed no significant differences in scores across degree groups (F = 1.899, p = 0.151). Notably, clinical specialty teachers with master's degrees scored highest on this item (4.47 ± 0.56), whereas the doctoral group scored lower (4.31 ± 0.81), with considerable within-group variation.

Summary: The influence of the highest academic degree on medical teacher competency is most evident in areas closely tied to the depth of professional knowledge and research training. Teachers with doctoral degrees scored significantly or notably higher than those with bachelor's or master's degrees in Professional Competence, Teaching Literacy, and Developmental Ability, reflecting the advantages of higher-level academic training. No significant differences were found among teachers with different academic backgrounds in dimensions more focused on personal qualities, values, and general skills, such as Professional Ethics and Conduct, Communication and Guiding Ability, and Management Ability. In Medical Teaching Literacy, teachers with master's and doctoral degrees performed better than those with bachelor's degrees, but the difference between master's and doctoral holders was minimal. In the clinical specialty teaching component, teachers with master's degrees showed an advantage, which may be related to the balance of their knowledge structure, clinical training, and teaching practice. Overall, a higher academic degree (especially a doctorate) is associated with stronger

professional cognitive abilities, teaching construction abilities, and developmental potential, but has little impact on general qualities like professional ethics and communication management. For detailed data analysis, please refer to Annex C Table C.35 and Annex D Figures D.19-D.21.

6.2.5.8 Differences in medical teacher competency by discipline of highest degree

Using one-way ANOVA on the tables, differences in disciplines of highest degrees were examined across nine dimensions: Overall Teacher Competency, A. Professional Ethics, B. Professional competence, C. General Teaching Literacy, D. Medical Teaching Literacy, E. Communication & Guidance, F. Management ability, G. Developmental ability, and D. Medical Teaching Literacy (Clinical Specialists). Results indicate: Samples from different disciplines of highest degrees showed no significant differences ($p>0.05$) in Overall Competency, A. Professional Ethics, B. Professional competence, C. General Teaching Literacy, D. Medical Teaching Literacy, E. Communication & Guidance, F. Management ability, and G. Developmental ability, meaning these eight dimensions remained consistent across disciplinary backgrounds. Samples from different disciplines of highest degrees showed significant differences ($p<0.05$) in D. Medical Teaching Literacy (Clinical Specialists), indicating disciplinary variations in this dimension. Specific analysis reveals:

I. Overall teacher competency score

Teachers with different disciplines for their highest degree did not show significant between-group differences in the overall competency score ($F = 1.048$, $p = 0.405$). Among the disciplines, teachers with a Stomatology background had the highest overall score (4.52 ± 0.47), followed by those with a Clinical Medicine background (4.50 ± 0.46). Teachers with backgrounds in Medical Education Management (4.17 ± 0.19), Chinese Materia Medica (4.18 ± 0.36), and Forensic Medicine (only 2 individuals, 4.18 ± 0.04) had relatively lower overall scores.

II. Score differences across dimensions

A. Professional ethics and conduct: Differences in scores across disciplinary background groups were not statistically significant ($F = 1.695$, $p = 0.054$). Teachers with a Nursing background had the highest mean score on this dimension (4.64 ± 0.46). Teachers with backgrounds in Clinical Medicine (4.58 ± 0.55), Traditional Chinese Medicine/Integrated Chinese and Western Medicine (4.58 ± 0.45), and Medical Technology (4.60 ± 0.74) also scored highly. Teachers with a Medical Education Management background scored noticeably lower (3.67 ± 1.10), with substantial within-group variation.

B. Professional competence: Differences in scores across disciplinary background groups were not significant ($F = 1.235$, $p = 0.247$). Teachers with a Stomatology background had the highest mean score (4.57 ± 0.53), followed by those with a Clinical Medicine background (4.48 ± 0.59). Teachers with backgrounds in Chinese Materia Medica (4.13 ± 0.44), Nursing (4.20 ± 0.55), and Basic Medical Sciences (4.26 ± 0.68) had lower mean scores.

C. Teaching literacy: Score differences among disciplinary background groups were not significant ($F = 1.472$, $p = 0.118$). Teachers with backgrounds in Medical Technology (4.56 ± 0.52), Clinical Medicine (4.48 ± 0.51), and Stomatology (4.50 ± 0.55) scored higher. Teachers with backgrounds in Forensic Medicine (only 2 individuals, 4.00 ± 0.16), Preventive Medicine (4.14 ± 0.76), and Chinese Materia Medica (4.13 ± 0.40) scored lower.

D. Medical teaching literacy: Score differences among disciplinary background groups were not significant ($F = 1.347$, $p = 0.177$). Teachers with a Clinical Medicine background had the highest mean score (4.51 ± 0.50), and those with a Stomatology background scored 4.49 ± 0.58. Teachers with backgrounds in Nursing (4.16 ± 0.58), Basic Medical Sciences (4.27 ± 0.68), and Biostatistics (4.10 ± 0.42) scored relatively lower.

E. Communication and guiding ability: Score differences among disciplinary background groups were not significant ($F = 0.765$, $p = 0.707$). Scores were relatively concentrated across discipline groups. Teachers with backgrounds in Medical Technology (4.56 ± 0.53), Stomatology (4.54 ± 0.52), and Pharmacy (4.51 ± 0.53) scored slightly higher.

F. Management ability: Score differences among disciplinary background groups were not significant ($F = 1.079$, $p = 0.375$). Teachers with backgrounds in Medical Technology (4.57 ± 0.56), Stomatology (4.54 ± 0.54), and Clinical Medicine (4.51 ± 0.62) scored higher. Teachers with backgrounds in Chinese Materia Medica (4.06 ± 0.50) and Biostatistics (4.13 ± 0.14) scored lower.

G. Developmental ability: Score differences among disciplinary background groups were not significant ($F = 0.735$, $p = 0.739$). Teachers with a Pharmacy background had the highest mean score (4.53 ± 0.54), followed by Clinical Medicine (4.44 ± 0.64) and Medical Technology (4.44 ± 0.56). Teachers with backgrounds in Chinese Materia Medica (4.15 ± 0.67) and Forensic Medicine (only 2 individuals, 4.10 ± 0.42) scored lower.

D. Medical teaching literacy (clinical specialty): This specialized analysis revealed extremely significant differences among teachers with different (clinically related) disciplinary backgrounds ($F = 3.952$, $p < 0.001$). Teachers with a Clinical Medicine background scored highest (4.58 ± 0.49). Those with backgrounds in Stomatology (4.48 ± 0.60), Traditional Chinese Medicine/Integrated Chinese and Western Medicine (4.50 ± 0.60), and Pharmacy (4.67

± 0.29, though possibly not a directly clinical discipline) also scored high. In contrast, teachers from non-directly clinical disciplines such as Basic Medical Sciences (4.00 ± 0.94), Medical Technology (3.75 ± 1.09), and Other Medical-Related Disciplines (3.86 ± 1.12) scored significantly lower on this item. Results for some disciplines with extremely small sample sizes (e.g., Forensic Medicine, 2 individuals scoring 5.00) should be disregarded.

Summary: The disciplinary background of a teacher's highest degree has a limited impact on the evaluation of overall competency and most general dimensions, with no widespread significant differences found. However, its influence is quite prominent in specialized competencies that are highly dependent on specific professional domain knowledge and practical experience: Teachers graduating from core clinical disciplines such as Clinical Medicine and Stomatology have a significant advantage in Clinical Medical Teaching Literacy. Teachers graduating from non-directly clinical or technical-support disciplines, such as Basic Medical Sciences and Medical Technology, face greater challenges in applying their knowledge to teaching in clinical contexts, as reflected in their significantly lower average self-assessment scores. A noteworthy phenomenon is the exceptionally low score of teachers with a Medical Education Management background on the Professional Ethics and Conduct dimension (despite a small sample size and a non-significant p-value). This may reflect the unique role perception or evaluation perspective associated with this interdisciplinary position, warranting further investigation. These results emphasize the need for particular attention to the cultivation and support of competency in transitioning to clinical teaching scenarios for teachers from non-mainstream clinical disciplinary backgrounds during medical teacher training and development. For detailed data analysis, please refer to Annex C Table C.36 and Annex D Figures D.22-D.24.

6.2.5.9 Differences in medical teacher competency by annual performance assessment (Past 3 Years)

From the tables, independent samples t-tests were used to examine differences in annual performance assessments across nine dimensions: Overall Teacher Competency, A. Professional Ethics, B. Professional competence, C. General Teaching Literacy, D. Medical Teaching Literacy, E. Communication & Guidance, F. Management ability, G. Developmental ability, and D. Medical Teaching Literacy (Clinical Specialists). Results indicate:

I. Overall teacher competency score

Regarding the overall Teacher Competency score, teachers who received "Outstanding" performance appraisals had an average score of 4.46 ± 0.44, while those with "Qualified" appraisals averaged 4.38 ± 0.47. Although the mean score for the Outstanding group was

slightly higher, the results of an independent samples t-test indicated that the difference between the two groups was not statistically significant ($t = 1.794$, $p = 0.074$).

II. Score differences across dimensions

A. Professional ethics and conduct: There was a significant difference between the two groups on this dimension ($t = 2.001$, $p = 0.046$). Teachers with Outstanding appraisals had a significantly higher mean score (4.59 ± 0.52) than those with Qualified appraisals (4.46 ± 0.67).

B. Professional competence: There was a significant difference between the two groups ($t = 2.113$, $p = 0.035$). Teachers with Outstanding appraisals had a significantly higher mean score (4.44 ± 0.54) than those with Qualified appraisals (4.32 ± 0.61).

C. Teaching literacy: The difference in scores between the two teacher groups was not significant ($t = 0.798$, $p = 0.426$). The Outstanding group averaged 4.43 ± 0.52, and the Qualified group averaged 4.38 ± 0.54.

D. Medical teaching literacy: The difference in scores between the two teacher groups was not significant ($t = 0.991$, $p = 0.322$). The Outstanding group averaged 4.40 ± 0.59, and the Qualified group averaged 4.34 ± 0.56.

E. Communication and guiding ability: The difference in scores between the two teacher groups was not significant ($t = 1.238$, $p = 0.216$). The Outstanding group averaged 4.49 ± 0.54, and the Qualified group averaged 4.42 ± 0.52.

F. Management ability: The difference in scores between the two teacher groups was not significant ($t = 1.622$, $p = 0.105$). The Outstanding group averaged 4.50 ± 0.57, and the Qualified group averaged 4.40 ± 0.56.

G. Developmental ability: The difference in scores between the two teacher groups was not significant ($t = 1.246$, $p = 0.214$). The Outstanding group averaged 4.42 ± 0.57, and the Qualified group averaged 4.34 ± 0.55.

D. Medical teaching literacy (clinical specialty): Specialized analysis of clinical specialty teachers showed no significant difference in scores between the two groups ($t = 0.678$, $p = 0.498$). The Outstanding group averaged 4.38 ± 0.72, and the Qualified group averaged 4.33 ± 0.65.

Summary: Annual performance appraisal ratings over the past three years showed a significant correlation with certain competency dimensions among medical teachers. In the dimensions of Professional Ethics and Conduct and Professional Competence, teachers who received "Outstanding" appraisals had significantly higher average scores than those who consistently received "Qualified" ratings. This suggests that strong professional ethics, a sense of professional identity, and solid professional knowledge and skills may be important factors

contributing to or reflected in an outstanding appraisal outcome. However, no statistically significant differences were observed between the Outstanding and Qualified groups in the overall Teacher Competency score or in other dimensions such as Teaching Literacy, Medical Teaching Literacy, Communication and Guiding Ability, Management Ability, and Developmental Ability. This implies that the current annual performance appraisal system may not comprehensively or significantly distinguish teachers' levels in these teaching, management, and personal development abilities, or that these competencies aren't the key factors determining the appraisal results. (For detailed data analysis, please refer to Annex C Table C.37 and Annex D Figures D.25-D.27.)

6.2.5.10 Differences in medical teacher competency by leadership of research projects

Using one-way analysis of variance (ANOVA), differences in research project leadership across nine dimensions were examined: Overall Teacher Competency, A. Professional Ethics, B. Professional competence, C. General Teaching Literacy, D. Medical Teaching Literacy, E. Communication & Guidance, F. Management ability, G. Developmental ability, and D. Medical Teaching Literacy (Clinical Specialists). Results indicate: Samples with or without research project leadership showed no significant differences ($p>0.05$) in Overall Competency, A. Professional Ethics, C. General Teaching Literacy, D. Medical Teaching Literacy, E. Communication & Guidance, F. Management ability, G. Developmental ability, or D. Medical Teaching Literacy (Clinical Specialists), meaning these eight dimensions remained consistent regardless of research leadership status. Samples with different research leadership status showed significant differences ($p<0.05$) in B. Professional competence, indicating variation in this dimension. Specific analysis reveals:

I. Overall teacher competency score

The differences in the overall Teacher Competency score across groups with varying experience leading research projects approached but did not reach conventional levels of statistical significance ($F = 2.227$, $p = 0.085$). In terms of mean scores, teachers who had led provincial-level projects had the highest overall score (4.49 ± 0.45), followed by those who had led national-level projects (4.47 ± 0.41). Teachers without project leadership experience scored 4.37 ± 0.51, while those who had led municipal-level projects had the lowest overall score (4.34 ± 0.39).

II. Score differences across dimensions

A. Professional ethics and conduct: Differences in scores across groups approached statistical significance ($F = 2.533$, $p = 0.057$). Teachers who had led national-level projects had

the highest mean score (4.60 ± 0.50). Teachers without project leadership experience also scored relatively high (4.58 ± 0.51), whereas those who had led municipal-level projects scored lower (4.35 ± 0.80).

B. Professional competence: There were extremely significant differences among groups based on research project leadership experience ($F = 6.984$, $p < 0.001$). Teachers who had led provincial-level projects performed best on this dimension, with a mean score of 4.53 ± 0.49. Teachers who had led national-level projects also scored highly (4.47 ± 0.50). In contrast, teachers without project leadership experience (4.27 ± 0.60) and those who had led municipal-level projects (4.17 ± 0.74) scored significantly lower.

C. Teaching literacy: Differences in scores among groups approached significance ($F = 2.240$, $p = 0.083$). Teachers who had led provincial-level projects had the highest mean score (4.49 ± 0.48), followed by those who had led national-level projects (4.45 ± 0.48). Teachers who had led municipal-level projects scored 4.36 ± 0.48, and those without project leadership experience scored 4.32 ± 0.61.

D. Medical teaching literacy: Score differences among groups approached significance ($F = 2.556$, $p = 0.055$). Teachers who had led provincial-level projects had the highest mean score (4.48 ± 0.53). Teachers who had led national- and municipal-level projects scored 4.39 ± 0.61 and 4.39 ± 0.45, respectively. Teachers without project leadership experience scored lower (4.27 ± 0.61).

E. Communication and guiding ability: Differences in scores among groups were not significant ($F = 0.424$, $p = 0.736$). Across groups, scores were very close, ranging from 4.39 ± 0.61 (municipal-level group) to 4.49 ± 0.50 (national-level group).

F. Management ability: Differences in scores among groups were not significant ($F = 0.750$, $p = 0.523$). Teachers who had led provincial-level projects had a slightly higher mean score (4.52 ± 0.52). The other groups' scores ranged from 4.40 ± 0.65 (no project leadership group) to 4.47 ± 0.53 (national-level group).

G. Developmental ability: Differences in scores among groups approached statistical significance ($F = 2.470$, $p = 0.062$). Teachers who had led provincial-level projects had the highest mean score (4.47 ± 0.51), followed by those who had led national-level projects (4.43 ± 0.51). Teachers who had led municipal-level projects scored 4.29 ± 0.49, and those without project leadership experience scored 4.30 ± 0.66.

D. Medical teaching literacy (clinical specialty): Specialized analysis of clinical specialty teachers showed no significant differences in scores across groups ($F = 1.109$, $p = 0.346$). Teachers who had led provincial-level projects had the highest mean score (4.47 ± 0.61),

followed by those without project leadership experience (4.37 ± 0.65). Teachers who had led national- and municipal-level projects scored 4.29 ± 0.78 and 4.28 ± 0.77, respectively.

Summary: Leading research projects at the project level shows an extremely significant association with the professional competence of medical teachers. Teachers who have led provincial-level or higher research projects perform significantly better in professional competence than those without such experience or those who have only led municipal-level projects. This highlights the strong link between research training and the development of professional capability.

Furthermore, research experience (especially with provincial-level projects) shows potential advantages in Teaching Literacy, Medical Teaching Literacy, and Developmental Ability (with p-values approaching 0.05). However, no significant differences were found among groups with different research experience in dimensions such as Professional Ethics and Conduct, Communication and Guiding Ability, and Management Ability. This indicates that research capability primarily enhances a teacher's depth of knowledge, research thinking, and related teaching and developmental abilities, but does not directly influence general qualities such as professional ethics and interpersonal communication. (For detailed data analysis, please refer to Annex C, Table C.38, and Annex D, Figures D.28-D.30.)

Teachers with different years of teaching experience, gender, age, primary teaching discipline, position type, professional title, and highest degree earned have different levels of competence across dimensions. This indicates that these factors positively influence each dimension and the overall competence of medical teachers to varying degrees. However, experience leading research projects shows differences only in the professional level dimension and has no significant impact on other dimensions or overall competence. Scientific research projects mainly reflect the research level. This indicates that research capabilities have a significant impact on professional levels, while other competency dimensions and overall competence are more influenced by other factors.

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Chapter 7: Discussion and Conclusion

Medical teacher competency refers to the professional abilities and qualities demonstrated by teachers responsible for medical courses during instruction. It encompasses the deep-seated characteristics that distinguish outstanding medical teachers from ordinary practitioners. Current medical education emphasizes competency-based medical education; therefore, the corresponding competency possessed by teachers is critically important in medical education. Competency models can be used for assessment and quantitative evaluation research, primarily employing methods such as Behavioral Event Interviews, Factor Analysis, Delphi Technique, and structured questionnaire surveys. They focus on three aspects: competency model construction, competency model classification, and competency model application, which can be utilized for teacher competency evaluation. Consequently, constructing competency models for medical educators can promote further advancement in medical education evaluation; however, current research on medical teacher competency remains limited in scale and quantity, failing to meet the growing demands of medical education. Simultaneously, there is a lack of authoritative and effective competency models for medical educators. There is an urgent need for medical teacher competency models that align with the requirements of educational development in the new era. Furthermore, with the implementation and popularization of teaching reforms such as blended learning and ideological-political curricula, new demands are placed on competency models for medical university faculty.

Therefore, the current competency model for medical educators, designed for multiple disciplines, has certain shortcomings when applied to medical education, thereby affecting the quality of medical education. This leads us to the following questions: What are the dimensions of a teaching competency model for medical teachers? What is the current competency level of medical teachers?

This study aims to build upon commonly used competency models and, using a representative comprehensive medical institution—Southern Medical University—construct a tailored medical teacher competency model for reference. This research uses the competency of medical faculty at Southern Medical University as an empirical case, with all data collection and processing derived exclusively from this institution.

This study plans to first conduct a literature analysis to summarize the current state of

competency research, understand emerging trends and demands in medical education, and identify the domains and deficiencies of current medical teacher competency, thereby defining research objectives and directions.

After fully understanding the research status and existing issues, questionnaires and semi-structured interviews will be conducted with frontline faculty, administrators, and students on the theme of medical teacher competency. Through synthesis and analysis, and in combination with existing domains of medical teacher competency derived from literature research, a preliminary competency model framework will be developed.

Because this framework remains a simple collection of elements and cannot be directly applied to teacher evaluation, the Delphi method will be used to further refine the model framework, determine weights for all indicator levels in the medical teacher competency model, and establish a more mature model.

Finally, to validate the model's reliability and validity, a questionnaire based on the Delphi-optimized model will be developed to empirically assess the competency levels of medical faculty at Southern Medical University, thereby verifying the model's effectiveness and feasibility.

7.1 Research content

The research results show that, first, semi-structured interviews were conducted to explore the connotations of medical teacher competency with 6 faculty experts and 8 students from Southern Medical University. After the interviews, core elements were summarized, and a preliminary model framework of 6 dimensions and 38 basic elements was established.

The Delphi method was then employed, inviting 20 experts to score the importance of the aforementioned model indicators. After two rounds of consultation, the experts demonstrated high levels of engagement and authority. Ultimately, a model with 7 first-level indicators and 41 second-level indicators was finalized.

Finally, based on this model, a self-assessment scale was used to design a questionnaire investigating the current state of teacher competency at Southern Medical University. A total of 1,140 questionnaires were distributed, and 403 valid responses were collected. Reliability and validity analyses indicated good reliability and validity, and the model demonstrated good fit, suggesting it can be further applied in teaching management. The analysis of the current competency level of medical teachers shows that years of teaching experience, gender, age, primary teaching discipline, position type, professional title, and highest degree earned all have

positive effects of varying degrees on each dimension and the overall level of competency among medical teachers. The level of scientific research has a significant impact on professional competence, while other competency dimensions and overall competence are more influenced by other factors.

In summary, this study, based on the competency model and using the comprehensive medical university Southern Medical University as a typical case, constructed a competency model for medical teachers. The research initially developed a competency model framework comprising 6 dimensions and 38 competency elements. This framework was further refined to 7 dimensions and 41 competency elements.

Empirical analysis shows: First, the model demonstrates good reliability, validity, and model fit, forming a medical teacher competence model consisting of 7 primary and 41 secondary indicators. Second, medical teachers' competence and the levels of each dimension are relatively high, with small individual differences. Teachers' competence varies by teaching years, gender, age, teaching field, job type, professional title, and educational background. Among them, whether one has led a research project reflects only differences in professional level and has no significant impact on other dimensions or overall competence. International research on the competencies required for medical education often lacks an emphasis on transmitting research capability (Foroughi et al., 2025; Matsuyama et al., 2024). Domestic studies proposing clinical physician competency models, such as the "Petal Model," include five aspects, including research and teaching ability, but do not list research capability separately (Chen & Yu, 2015). Some literature does not categorize teachers' research capability under professional ability; instead, it groups rigor, research promoting teaching, and lifelong learning under the term "scientific literacy," emphasizing the role of research in enhancing teaching. Therefore, the research capability of medical teachers may be related to their professional competence but should not be considered a core factor in evaluating their overall competency. Moreover, it should be closely integrated with teaching, with particular emphasis on whether research capability has promoted medical education.

7.2 Research difficulties and limitations

This study also has some limitations and issues.

First, caution is needed when applying B3 Research Capability to evaluate medical teacher competency. In the Delphi study, after the second round of consultation, expert importance ratings for Research Capability did not meet the thresholds for full-score frequency, arithmetic

mean, and coefficient of variation. However, the expert panel in the second round generally agreed to retain the indicator temporarily (11 of 20 agreed). The research team recommended its retention, but its specific weight within medical teacher competency remains debatable. In subsequent empirical research, validity analysis suggested that the corrected item-total correlation for B3 Research Capability was slightly low. Deleting this item would lower the scale's Cronbach's alpha, indicating the item is valid but its association with other items is relatively weaker. Therefore, research capability appears independent of other elements. In applying the model, whether research capability is strong or weak must be closely linked to other competency model elements for evaluation; otherwise, it may not effectively assess teacher competency levels.

Second, caution is needed when interpreting the total score for the E3 Feedback Ability dimension. The Structural Equation Model (SEM) achieved an overall acceptable level of fit, and the measurement model performed well. The structural model revealed strong predictive effects of competency on most teaching and professional ability dimensions and a significant influence of developmental ability on management ability. However, the E3 Feedback Ability dimension showed a low correlation with the total score, and its deletion could significantly improve overall reliability. Furthermore, while the relationships between latent and observed variables in the measurement model were generally good, with most items effectively reflecting their respective latent variables, the factor loading for E3 Feedback Ability was relatively low, again suggesting that its measurement effectiveness within this dimension may be suboptimal. Therefore, from the perspective of optimizing scale reliability, the E3 item should be deleted. However, feedback ability refers to the teacher's capacity to provide timely, specific, and constructive evaluation information to students, colleagues, or team members regarding their performance, behavior, or outcomes, aimed at promoting their learning, improvement, and development. The core lies in "facilitating growth" rather than "judging right or wrong." Medical education emphasizes thinking and learning, not mere knowledge memorization. The E3 Feedback Ability dimension is crucial for students' comprehensive growth. If the E3 Feedback Ability dimension is retained, its total score must be interpreted cautiously when applying the model, as its internal consistency is affected by this weakly correlated item.

Third, the importance of Professional Ethics and Conduct for medical teacher competency should be emphasized. In the structural model analysis, the influence path from "Medical Teacher Competency" to the first-level indicator "Professional Ethics and Conduct" showed an unreasonably large negative coefficient and a negative R^2 value. This strongly suggests model misspecification: "Professional Ethics and Conduct" may not be suitable as an outcome variable

(dependent variable) of "Medical Teacher Competency." Theoretically, professional ethics and conduct are more likely to be the foundation or core component of teacher competency, or even its antecedent, rather than a result "influenced" by it. Furthermore, within the measurement scale for Professional Ethics and Conduct (Dimension A), its 6 items collectively form a measurement tool with excellent reliability. The overall Cronbach's alpha was as high as 0.891, and each item contributed effectively to overall reliability. Among them, A5 Sense of Professional Identity and A6 Sense of Professional Responsibility showed the strongest correlation with the overall scale, and all items were indispensable components. The consistency and reliability of this scale's measurements were among the highest across all dimensions. Therefore, the influence of "Professional Ethics and Conduct" on "Medical Teacher Competency" may be bidirectional. The influence of "Professional Ethics and Conduct" on "Medical Teacher Competency" should be added.

This study suggests that when evaluating medical teacher competency, research capability should be considered comprehensively; the educational value of feedback ability should be emphasized; professional ethics and conduct should be regarded as the core foundation; and future research should expand the sample and optimize measurement methods.

Additionally, data collection was limited to Southern Medical University, so the sample's representativeness is limited. To generalize further, the sample needs to be expanded. The empirical research used self-assessment scales, so it may be influenced by subjective bias.

7.3 Suggestions for further research

7.3.1 Model optimization and validation

Adjust the model structure by repositioning "Professional Ethics and Conduct" from an outcome variable to a core predictor or foundational dimension, and test its impact as an antecedent variable on overall competency. Second, expand the sample and conduct cross-institutional validation by collecting large-sample data from diverse regions and types of medical schools across the country (e.g., medical schools within comprehensive universities and independent medical universities) to verify the model's cross-sample stability and generalizability. Third, supplement with objective, multi-source evaluations. In addition to self-assessment questionnaires, combine student evaluations, peer reviews, teaching outcome data (e.g., student grades, project awards), and other objective or other-assessment data to reduce common method bias and improve the reliability of conclusions.

7.3.2 In-depth exploration of key dimensions

Further clarify the role of research capability within the overall competency level of medical teachers. Design studies to explore how research capability specifically translates into teaching innovation and clinical teaching improvement in medical education, clarifying its interaction mechanism and its reasonable weight relative to teaching ability.

Refine the measurement method for the feedback ability dimension. For this dimension, develop more contextualized behavioral observation scales (e.g., simulated teaching scenarios) or student-perception questionnaires, or optimize existing items to enhance their discriminability and internal consistency.

Combine qualitative methods, such as interviews or focus groups with teachers, students, and administrators, to explore the specific connotations and behavioral manifestations of competencies such as “research capability” and “feedback ability” in medical education, thereby enriching the context for subsequent quantitative tools. Based on the model, develop targeted teacher training programs (e.g., strengthening feedback skills and research-teaching integration workshops). Use pre- and post-tests or control group designs to examine the actual effect of training on competency enhancement, feeding back into the model’s application value.

Conduct in-depth research on the dynamic interaction between professional ethics and conduct and the overall competency level of medical teachers. Conduct longitudinal tracking studies to investigate how the influence of professional ethics and conduct on teacher competency changes over time at different career stages, or use case studies to uncover its specific behavioral manifestations.

7.3.3 Expansion and application research

Develop a phased evaluation system: Research whether the model applies to different career stages (e.g., novice, key, and expert teachers) and establish differentiated evaluation standards and development paths.

Cultural or professional comparisons: Compare the applicability of this model across national medical education systems or among teachers in different medical specialties (e.g., basic medical sciences, clinical, nursing) and explore its boundary conditions.

Construct dynamic assessment tools: Attempt to transform the model into an online assessment and feedback system for teacher professional development portfolios or continuous quality improvement, thereby enhancing its practicality.

7.4 Theoretical significance

7.4.1 Established a competency model specifically for medical teachers

Using a mixed-methods approach of "connotation clarification → Delphi method → empirical testing," the study developed a medical teacher competency evaluation model comprising 7 first-level factors and 41 second-level indicators. This addresses the blind spots of generic teacher evaluation models in medical education and provides a theoretical framework for the professional development of medical teachers.

7.4.2 Revealed the particularity of medical teacher competency structure

Research capability appears to be relatively independent within the model, suggesting it may function as a distinct dimension in medical teacher evaluation, requiring comprehensive judgment alongside other dimensions. Professional ethics and conduct may serve as the foundation or antecedent variable of competency, rather than merely an outcome variable, thereby expanding the structural positioning of "professional ethics" within teacher competency theory.

7.4.3 Provided evidence for the reliability and validity of the measurement tool

Tested the model's construct validity, reliability, and overall fit using empirical data, providing a measurable tool and a methodological basis for subsequent related research.

7.5 Practical significance

7.5.1 Provides a scientific tool for medical teacher evaluation and development

The constructed model and questionnaire can be directly applied by medical schools for teacher recruitment, assessment, training, and professional development, helping administrators systematically evaluate teachers' competency gaps and provide targeted support.

7.5.2 Emphasizes the evaluation of key abilities in medical education

The study emphasized retaining the feedback ability (E3) dimension, highlighting the importance of "formative assessment" and "promoting thinking growth" in medical education and guiding teachers to value interaction and feedback in the teaching process. It reminds

researchers to view research capability comprehensively in practical evaluation, avoiding extreme tendencies of "research-only" or "neglecting research."

7.5.3 Provides a basis for faculty management and policy formulation

The model suggests that professional ethics and conduct should form the core foundation for teacher development, recommending that the sense of professional identity and responsibility be strengthened in teacher selection and training. The research results can be used to design targeted training programs (e.g., feedback skills, research-teaching integration) to enhance overall teacher competency.

This study contributes to the field of medical education by theoretically enriching the teacher evaluation system and offering a practical, operational tool for assessment and improvement. Finally, through a reflection on the model's limitations, it identifies pathways for future research, such as refining the structure of professional ethics, optimizing the measurement of key dimensions, and expanding the sample scope. These contributions are significant for advancing the quality of medical education.

7.6 Implications for medical education

Shift from "generic evaluation" to "precise evaluation": The study confirms the need to develop specialized competency models for medical teachers. It implies that educational administrators should move away from a "one-size-fits-all" evaluation model and establish systems that reflect the specific requirements of medical education, such as cultivating higher-order thinking, integrating clinical practice, and demonstrating humanistic care.

Regarding research capability, evaluation should neither assign it an excessively high weight nor ignore it completely. Instead, one should examine how it transforms and promotes teaching and clinical work, considering it within a comprehensive competency network. Regarding feedback ability, despite its statistical measurement flaws, its educational value is paramount. This implies that evaluation systems should not rely solely on statistical optimization to eliminate core educational elements. Instead, the measurement of this ability should be improved (e.g., by introducing student evaluations and teaching observations), while scores from this dimension in existing tools must be interpreted cautiously.

Professional Ethics and Conduct (especially professional identity and responsibility) should be regarded as the cornerstone and driving force of teacher competency, not merely a result "caused" by other abilities. This implies that in teacher recruitment, admission, and honor

selection, this should be the primary and core dimension for assessment.

Promote the organic integration of "research and teaching": Given the independence and controversy surrounding research capability, this implies that teacher training should not solely focus on enhancing research output. Instead, workshops or case studies should be designed to discuss how to feedback research frontiers, thinking, and methods into teaching, achieving mutual enhancement between research and teaching.

Cultivate Professional Ethics and Conduct as the core: The high reliability and strong correlations of the professional ethics scale indicate that a sense of professional identity and responsibility are measurable and crucial. This implies that fostering professional ethics should be integrated throughout the entire teacher career cycle through role model promotion, ethical discussions, reflective practice, and other means for continuous cultivation.

Excellent medical education requires teachers not only to possess knowledge and skills but also to demonstrate comprehensive literacy centered on student growth, grounded in professional ethics, and capable of integrating research and teaching. This prompts a profound transformation in medical education culture, shifting emphasis from traditional teaching and research output to greater focus on the professionalism of pedagogy, the quality of teacher-student interaction, and the teacher’s nurturing role. This study provides a refined framework, supported by theory and empirical evidence, for the evaluation and development of medical teachers. It particularly cautions that while pursuing the "scientificity" of evaluation, the core values of medical education (such as professional ethics) must be safeguarded. Through multiple methods and continuous improvement, the goal of using evaluation to promote development and enhance the quality of medical education can truly be achieved.

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Annex A: Semi-structured Interview Tools

Part I: Informed consent form

You have been invited to participate in a study titled "Competencies for Medical Teachers: An Empirical Study at Southern Medical University." This informed consent form provides you with information and should be read carefully before you decide whether to participate in this study. It will help you understand the study, why it is being conducted, the procedures and duration of the study, and the possible benefits, risks, and discomforts of participation. Please read it carefully and ask the researchers any questions you may have. You can ask the researchers for an explanation until you fully understand the study.

1. Title of the research project

Competencies for Medical Teachers: An Empirical Study at Southern Medical University

2. Source of the research project

Teaching reform project of Undergraduate Colleges and Universities of Guangdong in 2023

3. Main researchers

WANG Fei, TONG Min, LI Yugang, LIU Hui, ZOU Yuying, LIN Jinna, DAI Jiaojiao, QU Shanshan, ZHANG Zhinan

4. Project background and research purpose

Medical teacher competency refers to the professional ability and quality demonstrated by teachers in the teaching process. At present, there are still some deficiencies in the construction of the evaluation system for medical teacher competency, especially in the formulation of teacher evaluation indexes, the distribution of weights, and the quantified assessment of teacher competency, which need to be further improved and explored.

5 Introduction to the research

Review the domains of medical teacher competency

Construct a competency evaluation model framework for medical teachers

Evaluate the overall level of teacher competency with Southern Medical University as an empirical case.

6. Research process

Interviews are conducted in the form of open-ended questions, with audio recordings on site, and the interview time per person is controlled at about 30 minutes.

7. Possible risks, discomforts and inconveniences of participation in this study and compensation

To keep your personal information confidential, we will use your nickname or pseudonym instead of your real name during the interview and when we publish the related interview content.

8. Possible benefits of participation in this study

You can receive fees for expert consultation.

9. Confidentiality of personal information and records

If you decide to participate in this study (survey), your personal information will be kept strictly confidential while you are participating in this study (survey) and throughout the course of the study (survey). All research team members are asked to keep your information confidential, and any information that identifies you will not be disclosed to anyone outside the research team without your permission.

10. You may voluntarily choose to participate in the study or withdraw from the study.

Participation in the study is entirely up to you. If you have any questions about this study, you may bring them to the attention of the researchers. You may also refuse to take part in the study or withdraw from the study at any time. This will not affect your relationship with the researchers or your rights.

As a research subject, you have the duty to provide the facts. If you fail to comply with this duty, the researcher may terminate your participation in this study.

11. Contacts

During the survey, if you have questions or concerns, or if you feel you have been treated unfairly, you may contact the person in charge of the survey at any time. The researchers will provide their email address so they can answer your questions. Contact: Zhang Zhinan (luuuuuna@163.com). The researchers will keep you informed if any important new information arises during the course of the study that may affect your willingness to continue participating.

Informed consent signature page

I have read the above description of this study and have been given the opportunity to ask the researchers questions about this study. All of the questions I asked have been answered in a satisfactory manner.

I am aware of the possible risks and benefits of participating in this study. I understand that participation in the study is voluntary, and I confirm that I have had sufficient time to consider this and that I have responsibilities and obligations as follows.

1. I can ask the researchers for more information at any time.

2. I can withdraw from this study at any time without discrimination or retaliation.

3. The researcher may terminate my participation in this study if I fail to comply with the research plan.

4. I will be given a signed and dated copy of the informed consent form.

Finally, I have decided to participate in this study.

(Note: A witness signature is required if the interviewee is illiterate and a proxy signature is required if the interviewee is incapacitated)

Signature of interviewee:

Data:

Researcher's statement

I confirm that I have fully explained the details of this study, including the possible risks and benefits, to the research subject (respondent) and have provided him/her with a copy of the signed informed consent form.

Signature of researcher:

Data:

Part II: Basic information

Name: Gender: Work unit:

1. How long have you been engaged in teaching, research or management?

A. Less than 5 years B. 5-10 years C. 11-20 years D. 20-25 E. More than 25 years

2. What is the type of your job position?

A. Teaching position B. Research position C. Teaching and research position D. Management position E. Assistant positions (lab technician, student instructor) D. Others

3. What is your professional title?

A. Junior B. Intermediate C. Senior D. Others

4. Are you interested in the research content of this topic?

A. Very interested B. Rather interested C. Interested D. Not too interested E. Not interested

5. Are you concerned about the abilities that medical teachers should possess?

A. Very concerned B. Comparatively concerned C. Concerned D. Not too concerned E. Not concerned

6. Are you familiar with the problems of the competencies that should be possessed by medical teachers?

A. Very much familiar B. Comparatively familiar C. Familiar D. Not much familiar

E. Not familiar

7. Have you ever thought about what competencies medical teachers should possess?

A. Always B. Often C. Sometimes D. Rarely E. Never

Part III: Interview outline

(1) From your personal point of view, what competencies do you think medical teachers should possess? What are the specific domains of these competencies?

(2) What professional qualities do you think medical teachers need to possess?

(3) Do you think the competencies currently possessed by medical teachers can meet the current needs of medical education?

(4) What do you think are the differences between the competencies required of medical teachers and non-medical teachers?

(5) In addition to the above competencies, is there anything else you would like to add?

Annex B: Empirical Study Tools

Survey on Medical Teacher Competencies

Dear Participant,

We sincerely appreciate your participation in this survey on Medical Teacher Competencies. Your valuable insights will provide critical references for cultivating and evaluating medical educators, while offering theoretical support for faculty management in medical institutions.

Please objectively assess your competency level as a medical educator based on your actual experience.

The survey takes approximately 5-10 minutes. There are no right or wrong answers. All data will remain confidential and used solely for research purposes. Thank you for your support!

Instructions

Medical Teacher Competency: The integrated knowledge, skills, and attitudes essential for medical education.

Self-Assessment: Evaluate your overall competency level and check () the corresponding option.

Demographic Information

1. **Affiliated Institution/Department:**_____
2. **Years of Teaching Experience:**_____
3. **Gender**:

   A. Male B. Female
4. **Age**:

   A. 21-30 B. 31-40 C. 41-50 D. 51-60 E. >60
5. **Primary Teaching Discipline**:

   A. Basic Medicine B. Clinical Medicine C. Preventive Medicine D. Stomatology E. Traditional Chinese Medicine/Integrated Medicine F. Medical Technology G. Public

Health H. Nursing I. Forensic Medicine J. Pharmacy K. Chinese Materia Medica L. Medical Education Management M. Other Medical Disciplines

6. **Primary Teaching Role**:
   A. Teaching-focused B. Clinical-focused C. Research-focused D. Administrative E. Academic support (Lab technician/Counselor) F. Other
7. **Academic Rank**:
   A. Junior B. Intermediate C. Associate Senior D. Full Senior E. Unranked
8. **Highest Degree**:
   A. Associate degree or below B. Bachelor's C. Master's D. Doctoral
9. **Discipline of Highest Degree**:
   A. Basic Medicine B. Clinical Medicine C. Preventive Medicine D. Stomatology E. Traditional Chinese Medicine/Integrated Medicine F. Medical Technology G. Public Health H. Nursing I. Forensic Medicine J. Pharmacy K. Chinese Materia Medica L. Medical Education Management M. Other Medical Disciplines
10. **Annual Performance Assessment (Past 3 Years)**:
    A. Excellent (≥1 year rated excellent) B. Qualified
11. **Research Projects Led**:
    A. None B. National C. Provincial D. Municipal

Competency Indicator	Descriptor	Self-Assessment				
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1.1 Exemplary Conduct	I model the ethical standards and professional behaviors expected in medicine	5	4	3	2	1
……	……	5	4	3	2	1

A. Professional ethics and conduct

A1. **Exemplary Conduct**: I model the ethical standards and professional behaviors expected in medicine.

A2. **Student Care**: I genuinely care about students' development and proactively provide academic/life support.

A3. **Dedication Spirit**: I devote myself to medical education without excessive concern for personal gains.

A4. **Personal Charisma**: I earn students' respect and trust through unique professionalism and character.

A5. **Professional Identity**: I recognize and value the significance of being a medical educator. (Reverse-scored: *I see no long-term value in this profession.*)

A6. **Professional Responsibility**: I consciously uphold the mission of cultivating medical talent.

B. Professional competence

B1. **Theoretical Proficiency** (formerly Clinical Theory): I systematically master disciplinary knowledge frameworks.

B2. **Practical Proficiency** (formerly Clinical Skills): I expertly execute discipline-specific procedures.

B3. **Research Capability**: I conduct medical research effectively.

B4. **Disciplinary Frontier Awareness**: I stay updated on cutting-edge developments. (Reverse-scored: *My knowledge lags behind disciplinary advances.*)

B5. **Medical Work Experience** (formerly Clinical Experience): I possess rich case-handling expertise.

C. General Teaching Literacy

C1. **Teaching Awareness**: I proactively transform work scenarios into teaching opportunities.

C2. **Classroom Management**: I maintain engaged, orderly learning environments.

C3. **Demonstration Ability**: I present key concepts clearly and accurately.

C4. **Teaching Evaluation**: I assess learning outcomes scientifically and adjust instruction. (Reverse-scored: *I won't change strategies despite poor outcomes.*)

C5. **Instructional Design**: I align content/methods with learning objectives.

C6. **Contemporary Teaching Adaptability**: I update pedagogies with societal/technological trends.

C7. **Knowledge Structuring Ability**: I integrate fragmented knowledge into coherent frameworks.

C8. **Knowledge Condensation Ability**: I distill complex medical concepts. (Reverse-scored: *I cannot identify teaching priorities.*)

C9. **Differentiated Instruction Ability**: I adapt teaching to diverse learner needs.

D. Medical Teaching Literacy

D1. **Medical Reasoning Instruction** (formerly Clinical Reasoning): I cultivate problem-solving thinking.

D2. **Medical Practice Teaching** (formerly Clinical Practice): I guide skill application in authentic contexts.

D3. **Research Thinking Cultivation**: I mentor students in medical research. (Reverse-scored: *I cannot provide coherent research guidance.*)

D4. **Medical Ethics Instruction**: I embed ethical decision-making in teaching.

D5. **Medical Knowledge Translation Ability**: I transform personal experience into teachable content.

D6. **Patient Communication Training** (Non-clinical teachers skip): I teach therapeutic relationship-building. (Reverse-scored: *I cannot integrate communication theory.*)

D7. **linical Psychological Education** (Non-clinical teachers skip): I teach psychological assessment/intervention.

E. Communication and guiding ability

E1. **Listening Ability**: I attentively understand students' needs. (Reverse-scored: *I resent repeated explanations.*)

E2. **Expressive Ability**: I communicate medical knowledge clearly.

E3. **Feedback Ability**: I provide timely, actionable guidance.

E4. **Communication Ability**: I maintain effective verbal/non-verbal interactions.

E5. **Mentoring and Guidance Ability**: I design systematic teaching plans.

F. Management ability

F1. **Team Command Ability**: I effectively organize and motivate teams.

F2. **Team Collaboration Ability**: I collaborate proactively in team settings.

F3. **Organizational Ability**: I allocate resources and personnel rationally.

F4. **Coordination Ability**: I resolve conflicts and balance interests.

G. Developmental ability

G1. **Self-Assessment Ability**: I objectively evaluate my strengths/weaknesses.

G2. **Reflective Ability**: I improve through critical self-review. (Reverse-scored: *I apply identical solutions to all problems.*)

G3. **Innovative Ability**: I pioneer new approaches beyond conventions.

G4. **Lifelong Learning Ability**: I continuously update knowledge/skillIs ths.

G5. **"Internet+" Ability**: I leverage digital tools (such as blended learning, AI.).

Note: Red text indicates reverse-scored items. **Non-clinical teachers** skip D6 and D7 per instrument design.

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Annex C: Tables of Chapter 6

Table C.1 Frequency analysis results of sample characteristics

Name	Option	Frequency	Percentage (%)	Cumulative Percentage (%)
Years of Teaching Experience	<5 years	75	18.61	18.61
	5-10 years	99	24.57	43.18
	10-15 years	83	20.60	63.77
	15-20 years	59	14.64	78.41
	20-25 years	87	21.59	100.00
Gender	Male	160	39.70	39.70
	Female	243	60.30	100.00
Age	21-30	8	1.99	1.99
	31-40	167	41.44	43.42
	41-50	167	41.44	84.86
	51-60	59	14.64	99.50
	>60	2	0.50	100.00
Primary Teaching Discipline	Basic Medicine	27	6.70	6.70
	Clinical Medicine	121	30.02	36.72
	Preventive Medicine	7	1.74	38.46
	Stomatology	37	9.18	47.64
	Traditional Chinese Medicine/Integrated Medicine	41	10.17	57.82
	Psychiatry/Applied Psychology	4	0.99	58.81
	Rehabilitation Medicine	11	2.73	61.54
	Nursing	44	10.92	72.46
	Medical Technology	24	5.96	78.41
	Biostatistics	6	1.49	79.90
	Forensic Medicine	1	0.25	80.15
	Pharmacy	35	8.68	88.83
	Chinese Materia Medica	7	1.74	90.57

Name	Option	Frequency	Percentage (%)	Cumulative Percentage (%)
Primary Teaching Role	Medical Education Management	5	1.24	91.81
	Other Medical Disciplines	33	8.19	100.00
	Teaching-focused	110	27.30	27.30
	Clinical-focused	208	51.61	78.91
	Research-focused	35	8.68	87.59
	Administrative	29	7.20	94.79
	Academic support (Lab technician/Counselor)	15	3.72	98.51
	Other	6	1.49	100.00
Academic Rank	Junior	29	7.20	7.20
	Intermediate	179	44.42	51.61
	Associate Senior	120	29.78	81.39
	Full Senior	75	18.61	100.00
Highest Degree	Bachelor’s	88	21.84	21.84
	Master’s	127	31.51	53.35
	Doctoral	188	46.65	100.00
Discipline of Highest Degree	Basic Medicine	35	8.68	8.68
	Clinical Medicine	121	30.02	38.71
	Preventive Medicine	8	1.99	40.69
	Stomatology	31	7.69	48.39
	Traditional Chinese Medicine/Integrated Medicine	44	10.92	59.31
	Psychiatry/Applied Psychology	5	1.24	60.55
	Rehabilitation Medicine	8	1.99	62.53
	Nursing	43	10.67	73.20
	Medical Technology	36	8.93	82.13
	Biostatistics	4	0.99	83.13
	Forensic Medicine	2	0.50	83.62
	Pharmacy	29	7.20	90.82
	Chinese Materia Medica	8	1.99	92.80
	Medical Education Management	8	1.99	94.79
	Other Medical Disciplines	21	5.21	100.00
Annual Performance Assessment (Past 3 Years)	Excellent (≥1 year rated excellent)	239	59.31	59.31
	Qualified	164	40.69	100.00

Name	Option	Frequency	Percentage (%)	Cumulative Percentage (%)
Research Projects Led	National	140	34.74	34.74
	Provincial	92	22.83	57.57
	Municipal	44	10.92	68.49
	None	127	31.51	100.00
Total		403	100.0	100.0

Table C.2 Years of teaching experience

Items	Frequency	Percentage	Cumulative Percentage
<5 years	75	18.61%	18.61%
5-10 years	99	24.57%	43.18%
10-15 years	83	20.60%	63.77%
15-20 years	59	14.64%	78.41%
20-25 years	87	21.59%	100.00%
Total	403	100.0%	

Table C.3 Gender

Items	Frequency	Percentage	Cumulative Percentage
Male	160	39.70%	39.70%
Female	243	60.30%	100.00%
Total	403	100.0%	

Table C.4 Age

Items	Frequency	Percentage	Cumulative Percentage
21-30	8	1.99%	1.99%
31-40	167	41.44%	43.42%
41-50	167	41.44%	84.86%
51-60	59	14.64%	99.50%
>60	2	0.50%	100.00%
Total	403	100.0%	

Table C.5 Primary teaching discipline

Items	Frequency	Percentage	Cumulative Percentage
Basic Medicine	27	6.70%	6.70%
Clinical Medicine	121	30.02%	36.72%
Preventive Medicine	7	1.74%	38.46%
Stomatology	37	9.18%	47.64%

Traditional Chinese Medicine/Integrated Medicine	41	10.17%	57.82%
Psychiatry/Applied Psychology	4	0.99%	58.81%
Rehabilitation Medicine	11	2.73%	61.54%
Nursing	44	10.92%	72.46%
Medical Technology	24	5.96%	78.41%
Biostatistics	6	1.49%	79.90%
Forensic Medicine	1	0.25%	80.15%
Pharmacy	35	8.68%	88.83%
Chinese Materia Medica	7	1.74%	90.57%
Medical Education Management	5	1.24%	91.81%
Other Medical Disciplines	33	8.19%	100.00%
Total	403	100.0%	

Table C.6 Primary teaching role

Items	Frequency	Percentage	Cumulative Percentage
Teaching-focused	110	27.30%	27.30%
Clinical-focused	208	51.61%	78.91%
Research-focused	35	8.68%	87.59%
Administrative	29	7.20%	94.79%
Academic support (Lab technician/Counselor)	15	3.72%	98.51%
Other	6	1.49%	100.00%
Total	403	100.0%	

Table C.7 Academic rank

Items	Frequency	Percentage	Cumulative Percentage
Junior	29	7.20%	7.20%
Intermediate	179	44.42%	51.61%
Associate Senior	120	29.78%	81.39%
Full Senior	75	18.61%	100.00%
Total	403	100.0%	

Table C.8 Highest degree

Items	Frequency	Percentage	Cumulative Percentage
Bachelor’s	88	21.84%	21.84%
Master’s	127	31.51%	53.35%
Doctoral	188	46.65%	100.00%

Total	403	100.0%

Table C.9 Discipline of highest degree

Items	Frequency	Percentage	Cumulative Percentage
Basic Medicine	35	8.68%	8.68%
Clinical Medicine	121	30.02%	38.71%
Preventive Medicine	8	1.99%	40.69%
Stomatology	31	7.69%	48.39%
Traditional Chinese Medicine/Integrated Medicine	44	10.92%	59.31%
Psychiatry/Applied Psychology	5	1.24%	60.55%
Rehabilitation Medicine	8	1.99%	62.53%
Nursing	43	10.67%	73.20%
Medical Technology	36	8.93%	82.13%
Biostatistics	4	0.99%	83.13%
Forensic Medicine	2	0.50%	83.62%
Pharmacy	29	7.20%	90.82%
Chinese Materia Medica	8	1.99%	92.80%
Medical Education Management	8	1.99%	94.79%
Other Medical Disciplines	21	5.21%	100.00%
Total	403	100.0%	

Table C.10 Annual performance assessment (Past 3 years)

Items	Frequency	Percentage	Cumulative Percentage
Excellent (≥1 year rated excellent)	239	59.31%	59.31%
Qualified	164	40.69%	100.00%
Total	403	100.0%	

Table C.11 Research projects led

Items	Frequency	Percentage	Cumulative Percentage
National	140	34.74%	34.74%
Provincial	92	22.83%	57.57%
Municipal	44	10.92%	68.49%
None	127	31.51%	100.00%
Total	403	100.0%	

Table C.12 Basic indicators

Name	Sample Size	Minimum	Maximum	Mean	Standard Deviation	Median
Teacher Competency	403	2.924	5.000	4.431	0.456	4.398
A. Professional ethics and conduct	403	1.000	5.000	4.538	0.589	4.667
B. Professional competence	403	1.000	5.000	4.389	0.575	4.400
C. General Teaching Literacy	403	2.444	5.000	4.408	0.526	4.444
D. Medical Teaching Literacy	403	1.000	5.000	4.372	0.577	4.400
E. Communication and guiding ability	403	1.800	5.000	4.462	0.532	4.400
F. Management ability	403	1.000	5.000	4.459	0.566	4.500
G. Developmental ability	403	1.000	5.000	4.386	0.564	4.400
D. Medical Teaching Literacy (Clinical Specialists)	320	1.000	5.000	4.361	0.695	4.500

Table C.13 Cronbach's reliability analysis of A. professionalethics and conduct

Name	Corrected item-total correlation (CITC)	Cronbach's α if Item Deleted	Cronbach's α Coefficient
A1. Exemplary Conduct: I model the ethical standards and professional behaviors expected in medicine	0.599	0.888	
A2. Student Care: I genuinely care about students' development and proactively provide academic/life support	0.687	0.876	
A3. Dedication Spirit: I devote myself to medical education without excessive concern for personal gains	0.653	0.882	0.891
A4. Personal Charisma: I earn students' respect and trust through unique	0.765	0.863	
Professional Identity: I recognize and value the significance of being a medical educator. (I see no long-term value in this profession.)	0.788	0.860	
A6. Professional Responsibility: I consciously uphold the mission of cultivating medical talent	0.789	0.860	

Note: Standardized α Coefficient = 0.893

Table C.14 Cronbach's reliability analysis of B. professional competence

Name	Corrected item-total correlation (CITC)	Cronbach's α if Item Deleted	Cronbach's α Coefficient
B1. Theoretical Proficiency (formerly Clinical Theory): I systematically master disciplinary knowledge frameworks	0.642	0.743	0.796
B2. Practical Proficiency (formerly Clinical Skills): I expertly	0.653	0.740	

execute discipline-specific procedures		
B3. Research Capability: I conduct medical research effectively	0.559	0.765
B4. Disciplinary Frontier Awareness: I stay updated on cutting-edge developments (My knowledge lags behind disciplinary advances)	0.678	0.730
Medical Work Experience (formerly Clinical Experience): I possess rich case-handling expertise	0.460	0.813

Note: Standardized α Coefficient = 0.816

Table C.15 Cronbach's reliability analysis of C. general teaching literacy

Name	Corrected item-total correlation (CITC)	Cronbach's α if Item Deleted	Cronbach's α Coefficient
C1. Teaching Awareness: I proactively transform work scenarios into teaching	0.669	0.920	
C2. Classroom Management: I maintain engaged, orderly learning environments	0.713	0.917	
C3. Demonstration Ability: I present key concepts clearly and accurately	0.692	0.918	
C4. Teaching Evaluation: I assess learning outcomes scientifically and adjust instruction (I won't change strategies despite poor outcomes)	0.758	0.914	
C5. Instructional Design: I align content/methods with learning objectives	0.708	0.917	
C6. Contemporary Teaching Adaptability: I update pedagogies with societal/technological trends	0.766	0.913	0.924
C7. Knowledge Structuring Ability: I integrate fragmented knowledge into coherent frameworks	0.738	0.915	
C8. Knowledge Condensation Ability: I distill complex medical concepts (I cannot identify teaching priorities)	0.768	0.913	
C9. Differentiated Instruction Ability: I adapt teaching to diverse learner needs	0.735	0.915	

Note: Standardized α Coefficient = 0.925

Table C.16 Cronbach's reliability analysis of D. Medical Teaching Literacy

Name	Corrected item-total correlation (CITC)	Cronbach's α if Item Deleted	Cronbach's α Coefficient
D1. Medical Reasoning Instruction (formerly Clinical Reasoning): I cultivate problem-solving thinking	0.739	0.820	
D2. Medical Practice Teaching (formerly Clinical Practice): I guide skill application in authentic contexts	0.693	0.830	0.862
D3. Research Thinking Cultivation: I mentor students in medical research (I cannot provide coherent research guidance)	0.630	0.851	

D4. Medical Ethics Instruction: I embed ethical decision-making in teaching	0.701	0.829
D5. Medical Knowledge Translation Ability: I transform personal experience into teachable content	0.667	0.838

Note: Standardized α Coefficient = 0.866

Table C.17 Cronbach's reliability analysis of E. communication and guiding ability

Name	Corrected item-total correlation (CITC)	Cronbach's α if Item Deleted	Cronbach's α Coefficient
E1. Listening Ability: I attentively understand students' needs (I resent repeated explanations)	0.587	0.781	0.810
E2. Expressive Ability: I communicate medical knowledge clearly	0.710	0.743	
E3. Feedback Ability: I provide timely, actionable guidance	0.438	0.853	
E4. Communication Ability: I maintain effective verbal/non-verbal interactions	0.733	0.739	
E5. Mentoring and Guidance Ability: I design systematic teaching plans	0.655	0.756	

Note: Standardized α Coefficient = 0.834

Table C.18 Cronbach's reliability analysis of F. management ability

Name	Corrected item-total correlation (CITC)	Cronbach's α if Item Deleted	Cronbach's α Coefficient
F1. Team Command Ability: I effectively organize and motivate teams	0.793	0.867	0.901
F2. Team Collaboration Ability: I collaborate proactively in team settings	0.732	0.889	
F3. Organizational Ability: I allocate resources and personnel rationally	0.784	0.871	
F4. Coordination Ability: I resolve conflicts and balance interests	0.811	0.860	

Note: Standardized α Coefficient = 0.901

Table C.19 Cronbach's reliability analysis of G. developmental ability

Name	Corrected item-total correlation (CITC)	Cronbach's α if Item Deleted	Cronbach's α Coefficient
G1. Self-Assessment Ability: I objectively evaluate my strengths/weaknesses	0.621	0.862	0.870
G2. Reflective Ability: I improve through critical self-review	0.781	0.824	

(I apply identical solutions to all problems)		
G3. Innovative Ability: I pioneer new approaches beyond conventions	0.761	0.827
G4. Lifelong Learning Ability: I continuously update knowledge/skills	0.723	0.837
G5. "Internet+" Ability: I leverage digital tools (such as blended learning, AI.)	0.612	0.865

Note: Standardized α Coefficient = 0.873

Table C.20 KMO and Bartlett's test

KMO Measure		0.953
Bartlett's Test of Sphericity	Approximate Chi-Square	11273.954
	df	741
	p-value	0.000

Table C.21 Table of factor load coefficients after rotation

Item	Factor loading coefficient							Commonality (variance of common factors)
	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	
A1 Being a role model	0.008	0.127	0.709	0.080	-0.108	0.130	0.112	0.567
A2 Caring for students	0.131	0.140	0.753	0.019	0.067	0.110	0.024	0.622
A3 Dedication	0.229	0.247	0.702	0.116	0.051	-0.073	-0.123	0.643
A4 Personal charisma	0.178	0.193	0.783	0.115	0.194	0.087	-0.068	0.744
A5 Professional identity	0.152	0.022	0.843	0.102	0.111	0.090	0.108	0.776
A6 Professional responsibility	0.091	0.015	0.834	0.140	0.148	0.172	0.137	0.794
B1 Theoretical ability	0.251	0.272	0.294	0.393	-0.116	0.525	0.113	0.679
B2 Practical ability	0.201	0.211	0.256	0.625	-0.061	0.382	0.127	0.706
B3 Research ability	0.235	0.127	0.155	0.074	0.263	0.774	0.094	0.777
B4 Ability to grasp disciplinary frontiers	0.291	0.264	0.251	0.209	0.191	0.608	0.026	0.667
B5 Medical work experience	0.174	0.107	0.126	0.747	0.157	0.060	-0.036	0.645
C1 Mentoring awareness	0.341	0.394	0.147	0.412	0.166	0.274	0.020	0.565

C2 Classroom management ability	0.262	0.690	0.133	0.284	0.128	0.215	-0.040	0.708
C3 Presentation ability	0.200	0.469	0.206	0.484	0.125	0.214	0.239	0.655
C4 Teaching effectiveness evaluation ability	0.287	0.564	0.198	0.210	0.334	0.250	0.062	0.661
C5 Instructional design ability	0.250	0.674	0.175	0.240	0.125	0.247	-0.036	0.683
C6 Ability to keep teaching updated	0.364	0.422	0.201	0.141	0.453	0.334	0.032	0.688
C7 Knowledge system construction ability	0.422	0.373	0.155	0.138	0.443	0.333	-0.071	0.672
C8 Knowledge condensation ability	0.402	0.441	0.160	0.211	0.385	0.266	0.087	0.653
C9 Ability to teach according to aptitude	0.469	0.425	0.160	0.205	0.383	0.151	0.071	0.642
D1 Medical thinking teaching ability	0.294	0.436	0.153	0.345	0.452	0.203	0.136	0.683
D2 Medical practice teaching ability	0.314	0.191	0.044	0.603	0.445	-0.027	0.137	0.718
D3 Research thinking teaching ability	0.244	0.207	0.065	0.131	0.639	0.374	0.139	0.692
D4 Medical ethics teaching ability	0.324	0.279	0.172	0.290	0.596	-0.007	0.205	0.694
D5 Medical education transformation ability	0.250	0.261	0.135	0.519	0.282	0.127	0.395	0.669
E1 Listening ability	0.424	0.484	0.142	0.154	0.083	0.128	0.273	0.556
E2 Expression ability	0.404	0.571	0.152	0.149	0.166	-0.044	0.323	0.669
E3 Feedback ability	0.182	0.167	0.064	0.122	0.135	0.093	0.775	0.708
E4 Communication ability	0.375	0.658	0.183	0.035	0.158	0.001	0.305	0.726

E5 Planning and guidance ability	0.410	0.505	0.205	-0.041	0.322	0.113	0.241	0.642
F1 Team command ability	0.726	0.227	0.150	0.212	0.210	0.014	0.026	0.691
F2 Team collaboration ability	0.732	0.319	0.152	0.126	0.049	0.051	0.119	0.696
F3 Organizational ability	0.745	0.185	0.152	0.220	0.204	0.060	0.083	0.712
F4 Coordination ability	0.793	0.131	0.145	0.227	0.210	0.063	0.028	0.768
G1 Self-assessment	0.635	0.245	0.163	0.078	-0.062	0.180	0.156	0.557
G2 Reflective ability	0.722	0.306	0.139	0.106	0.071	0.228	0.107	0.714
G3 Innovation ability	0.729	0.170	0.100	0.047	0.298	0.251	0.063	0.728
G4 Lifelong learning ability	0.709	0.141	0.090	0.224	0.143	0.189	0.111	0.650
G5 Internet+ ability	0.585	0.183	0.045	0.085	0.189	0.356	-0.002	0.548

Table C.22 Pearson correlation and the square root of AVE

	A Professional Ethics and Conduct	B Professional Competence	C General Teaching Literacy	D Medical Teaching Literacy	E Communication and Guiding Ability	F Management Ability	G Developmental Ability
A Professional Ethics and Conduct	0.768						
B Professional Competence	0.487	0.693					
C General Teaching Literacy	0.482	0.734	0.761				
D Medical Teaching Literacy	0.386	0.668	0.794	0.751			
E Communication and Guiding Ability	0.404	0.559	0.746	0.684	0.726		
F Management Ability	0.390	0.569	0.710	0.645	0.675	0.835	
G Developmental Ability	0.378	0.599	0.742	0.650	0.653	0.796	0.768

Table C.23 Factor loading coefficient table

Factor(latent variable)	Measurement item (variable)	Coef.	Std.Error	*z*(CR)	*p*	Std.Estimate	SMC
A Professional Ethics and Conduct	A1 Being a role model	1.000	-	-	-	0.628	0.395
A Professional Ethics and Conduct	A2 Caring for students	1.377	0.115	12.018	0.000	0.709	0.503
A Professional Ethics and Conduct	A3 Dedication	1.353	0.115	11.750	0.000	0.689	0.474
A Professional Ethics and Conduct	A4 Personal charisma	1.433	0.107	13.407	0.000	0.822	0.675
A Professional Ethics and Conduct	A5 Professional identity	1.421	0.103	13.782	0.000	0.855	0.732
A Professional Ethics and Conduct	A6 Professional responsibility	1.459	0.105	13.951	0.000	0.872	0.760
B Professional Competence	B1 Theoretical ability	1.000	-	-	-	0.729	0.532
B Professional Competence	B2 Practical ability	0.961	0.072	13.323	0.000	0.702	0.492
B Professional Competence	B3 Research ability	1.251	0.095	13.142	0.000	0.692	0.479
B Professional Competence	B4 Ability to grasp disciplinary frontiers	1.117	0.076	14.752	0.000	0.778	0.606
B Professional Competence	B5 Medical work experience	1.105	0.108	10.220	0.000	0.539	0.291
C General Teaching Literacy	C1 Mentoring awareness	1.000	-	-	-	0.710	0.503
C General Teaching Literacy	C2 Classroom management ability	1.039	0.072	14.414	0.000	0.736	0.542
C General Teaching Literacy	C3 Presentation ability	0.941	0.067	14.108	0.000	0.721	0.519
C General Teaching Literacy	C4 Teaching effectiveness evaluation ability	1.015	0.066	15.349	0.000	0.784	0.615
C General Teaching Literacy	C5 Instructional design ability	0.969	0.068	14.282	0.000	0.730	0.532
C General Teaching Literacy	C6 Ability to keep teaching updated	1.064	0.068	15.618	0.000	0.798	0.637
C General Teaching Literacy	C7 Knowledge system construction ability	1.082	0.071	15.166	0.000	0.775	0.600
C General Teaching Literacy	C8 Knowledge condensation ability	1.079	0.068	15.794	0.000	0.807	0.651
C General Teaching Literacy	C9 Ability to teach according to aptitude	1.050	0.069	15.297	0.000	0.781	0.611
D Medical Teaching Literacy	D1 Medical thinking teaching ability	1.000	-	-	-	0.838	0.703
D Medical Teaching Literacy	D2 Medical practice teaching ability	0.962	0.059	16.257	0.000	0.723	0.522
D Medical Teaching Literacy	D3 Research thinking teaching ability	1.014	0.066	15.331	0.000	0.692	0.479
D Medical Teaching Literacy	D4 Medical ethics teaching ability	0.921	0.053	17.339	0.000	0.757	0.573
D Medical Teaching Literacy	D5 Medical education transformation ability	0.857	0.051	16.778	0.000	0.739	0.547
E Communication and Guiding Ability	E1 Listening ability	1.000	-	-	-	0.693	0.481
E Communication and Guiding Ability	E2 Expression ability	1.299	0.088	14.753	0.000	0.808	0.652
E Communication and Guiding Ability	E3 Feedback ability	1.126	0.126	8.959	0.000	0.476	0.227
E Communication and Guiding Ability	E4 Communication ability	1.271	0.085	14.864	0.000	0.815	0.664
E Communication and Guiding Ability	E5 Planning and guidance ability	1.369	0.095	14.368	0.000	0.784	0.615

F Management Ability	F1 Team command ability	1.000	-	-	-	0.831	0.690
F Management Ability	F2 Team collaboration ability	0.861	0.046	18.869	0.000	0.799	0.638
F Management Ability	F3 Organizational ability	1.000	0.049	20.522	0.000	0.845	0.714
F Management Ability	F4 Coordination ability	1.044	0.049	21.292	0.000	0.865	0.749
G Developmental Ability	G1 Self-assessment	1.000	-	-	-	0.675	0.456
G Developmental Ability	G2 Reflective ability	1.129	0.075	15.090	0.000	0.844	0.712
G Developmental Ability	G3 Innovation ability	1.187	0.080	14.879	0.000	0.830	0.689
G Developmental Ability	G4 Lifelong learning ability	1.067	0.074	14.379	0.000	0.797	0.636
G Developmental Ability	G5 Internet+ ability	1.019	0.082	12.408	0.000	0.675	0.456

Note: The horizontal bar '-' indicates that this item is a reference item.

Table C.24 Structural equation modeling (SEM) summary table of model regression coefficients

X	→	Y	Unstandardized Regression Coefficient	SE	z (CR Value)	p	Standardized Regression Coefficient
A. Professional ethics and conduct	→	Medical Teacher Competency	-2.965	0.181	-16.337	0.000	-2.327
E. Communication and guiding ability	→	G. Developmental ability	0.286	0.099	2.894	0.004	0.246
G. Developmental ability	→	F. Management ability	0.864	0.095	9.135	0.000	0.759
Medical Teacher Competency	→	A. Professional ethics and conduct	1.000	-	-	-	1.274
Medical Teacher Competency	→	B. Professional competence	0.764	0.072	10.663	0.000	0.843
Medical Teacher Competency	→	C. General Teaching Literacy	0.932	0.082	11.441	0.000	0.993
Medical Teacher Competency	→	D. Medical Teaching Literacy	0.961	0.080	12.036	0.000	0.905
Medical Teacher Competency	→	E. Communication and guiding ability	0.687	0.063	10.853	0.000	0.854
Medical Teacher Competency	→	F. Management ability	0.172	0.072	2.373	0.018	0.162
Medical Teacher Competency	→	G. Developmental ability	0.573	0.092	6.247	0.000	0.615
A. Professional ethics	→	A6. Professional	1.458	0.105	13.889	0.000	0.870

X	→	Y	Unstandardized Regression Coefficient	SE	z (CR Value)	p	Standardized Regression Coefficient
and conduct		Responsibility: I consciously uphold the mission of cultivating medical talent					
A. Professional ethics and conduct	→	A5. Professional Identity: I recognize and value the significance of being a medical educator	1.423	0.104	13.739	0.000	0.855
A. Professional ethics and conduct	→	A4. Personal Charisma: I earn students' respect and trust through unique	1.437	0.107	13.376	0.000	0.822
A. Professional ethics and conduct	→	A3. Dedication Spirit: I devote myself to medical education without excessive concern for personal gains	1.360	0.116	11.754	0.000	0.691
A. Professional ethics and conduct	→	A2. Student Care: I genuinely care about students' development and proactively provide academic/life support	1.382	0.115	12.005	0.000	0.710
A. Professional ethics and conduct	→	A1. Exemplary Conduct: I model the ethical standards and professional behaviors expected in medicine	1.000	-	-	-	0.627
B. Professional competence	→	B5. Medical Work Experience: I possess rich case-handling expertise	1.111	0.108	10.313	0.000	0.545
B. Professional competence	→	B4. Disciplinary Frontier Awareness: I stay updated on cutting-edge developments	1.099	0.075	14.579	0.000	0.769
B. Professional competence	→	B3. Research Capability: I conduct medical research effectively	1.240	0.094	13.245	0.000	0.689
B. Professional competence	→	B2. Practical Proficiency: I expertly execute discipline-	0.970	0.072	13.506	0.000	0.711

X	→	Y	Unstandardized Regression Coefficient	SE	z (CR Value)	p	Standardized Regression Coefficient
		specific procedures					
B. Professional competence	→	B1. Theoretical Proficiency: I systematically master disciplinary knowledge frameworks	1.000	-	-	-	0.733
C. General Teaching Literacy	→	C9. Differentiated Instruction Ability: I adapt teaching to diverse learner needs	1.049	0.068	15.324	0.000	0.782
C. General Teaching Literacy	→	C8. Knowledge Condensation Ability: I distill complex medical concepts	1.055	0.068	15.493	0.000	0.791
C. General Teaching Literacy	→	C7. Knowledge Structuring Ability: I integrate fragmented knowledge into coherent frameworks	1.030	0.071	14.521	0.000	0.742
C. General Teaching Literacy	→	C6. Contemporary Teaching Adaptability: I update pedagogies with societal/technological trends	1.038	0.068	15.287	0.000	0.780
C. General Teaching Literacy	→	C5. Instructional Design: I align content/methods with learning objectives	0.967	0.068	14.264	0.000	0.729
C. General Teaching Literacy	→	C4. Teaching Evaluation: I assess learning outcomes scientifically and adjust instruction	1.018	0.066	15.445	0.000	0.788
C. General Teaching Literacy	→	C3. Demonstration Ability: I present key concepts clearly and accurately	0.953	0.067	14.303	0.000	0.731
C. General Teaching Literacy	→	C2. Classroom Management: I maintain engaged, orderly learning environments	1.052	0.072	14.627	0.000	0.747
C. General Teaching	→	C1. Teaching Awareness: I	1.000	-	-	-	0.711

X	→	Y	Unstandardized Regression Coefficient	SE	z (CR Value)	p	Standardized Regression Coefficient
Literacy		proactively transform work scenarios into teaching					
D. Medical Teaching Literacy	→	D5. Medical Knowledge Translation Ability: I transform personal experience into teachable content	0.863	0.052	16.738	0.000	0.741
D. Medical Teaching Literacy	→	D4. Medical Ethics Instruction: I embed ethical decision-making in teaching	0.932	0.054	17.404	0.000	0.762
D. Medical Teaching Literacy	→	D3. Research Thinking Cultivation: I mentor students in medical research	1.035	0.066	15.646	0.000	0.696
D. Medical Teaching Literacy	→	D2. Medical Practice Teaching: I guide skill application in authentic contexts	0.979	0.060	16.430	0.000	0.731
D. Medical Teaching Literacy	→	D1. Medical Reasoning Instruction: I cultivate problem-solving thinking	1.000	-	-	-	0.834
E. Communication and guiding ability	→	E5. Mentoring and Guidance Ability: I design systematic teaching plans	1.322	0.096	13.800	0.000	0.806
E. Communication and guiding ability	→	E4. Communication Ability: I maintain effective verbal/non-verbal interactions	1.183	0.075	15.801	0.000	0.807
E. Communication and guiding ability	→	E3. Feedback Ability: I provide timely, actionable guidance	1.038	0.115	9.061	0.000	0.468
E. Communication and guiding ability	→	E2. Expressive Ability: I communicate medical knowledge clearly	1.208	0.077	15.652	0.000	0.800
E. Communication and guiding ability	→	E1. Listening Ability: I attentively understand	1.000	-	-	-	0.738

X	→	Y	Unstandardized Regression Coefficient	SE	z (CR Value)	p	Standardized Regression Coefficient
		students' needs					
F. Management ability	→	F4. Coordination Ability: I resolve conflicts and balance interests	1.034	0.048	21.675	0.000	0.869
F. Management ability	→	F3. Organizational Ability: I allocate resources and personnel rationally	0.984	0.048	20.664	0.000	0.843
F. Management ability	→	F2. Team Collaboration Ability: I collaborate proactively in team settings	0.850	0.045	19.064	0.000	0.800
F. Management ability	→	F1. Team Command Ability: I effectively organize and motivate teams	1.000	-	-	-	0.835
G. Developmental ability	→	G5. "Internet+" Ability: I leverage digital tools (such as blended learning, AI.)	1.010	0.081	12.416	0.000	0.673
G. Developmental ability	→	G4. Lifelong Learning Ability: I continuously update knowledge/skills	1.059	0.073	14.422	0.000	0.795
G. Developmental ability	→	G3. Innovative Ability: I pioneer new approaches beyond conventions	1.178	0.079	14.930	0.000	0.827
G. Developmental ability	→	G2. Reflective Ability: I improve through critical self-review	1.124	0.074	15.182	0.000	0.844
G. Developmental ability	→	G1. Self-Assessment Ability: I objectively evaluate my strengths/weaknesses	1.000	-	-	-	0.678

Note: → indicates a regression impact relationship or measurement relationship

Hyphen '-' indicates that the item is a reference category

The current analysis shows excessively strong correlations among data, resulting in regression coefficients >1. The results may not be applicable. It is recommended to identify and remove strongly/weakly correlated items before re-analyzing.

Table C.25 Model fit indices

Common Indices	χ2	df	p	Chi-Square/Degrees of Freedom Ratio (χ2/df)	GFI	RMSEA	RMR	CFI	NFI	NNFI
Judgment Criteria	-	-	>0.05	<3	>0.9	<0.10	<0.05	>0.9	>0.9	>0.9
Value	1734.232	686	0.000	2.528	0.814	0.062	0.023	0.904	0.852	0.897
Other Indices	TLI	AGFI	IFI	PGFI	PNFI	PCFI	SRMR	RMSEA 90% CI		
Judgment Criteria	>0.9	>0.9	>0.9	>0.5	>0.5	>0.5	<0.1	-		
Value	0.897	0.789	0.905	0.716	0.789	0.837	0.046	0.058 ~ 0.065		

Note: Default Model: $\chi2(741) = 11704.775$, $p = 1.000$
AIC = 179.393, BIC = 555.293

Table C.26 Model fit R^2 summary table

Items	R-squared Value
A. Professional ethics and conduct	-0.258
B. Professional competence	0.711
C. General Teaching Literacy	0.987
D. Medical Teaching Literacy	0.819
E. Communication and guiding ability	0.729
F. Management ability	0.806
G. Developmental ability	0.697
G5. “Internet+” Ability: I leverage digital tools (such as blended learning, AI.)	0.452
G4. Lifelong Learning Ability: I continuously update knowledge/skills	0.632
G3. Innovative Ability: I pioneer new approaches beyond conventions	0.685
G2. Reflective Ability: I improve through critical self-review	0.712
G1. Self-Assessment Ability: I objectively evaluate my strengths/weaknesses	0.460
F4. Coordination Ability: I resolve conflicts and balance interests	0.755
F3. Organizational Ability: I allocate resources and personnel rationally	0.710
F2. Team Collaboration Ability: I collaborate proactively in team settings	0.639
F1. Team Command Ability: I effectively organize and motivate teams	0.697
E5. Mentoring and Guidance Ability: I design systematic teaching plans	0.650
E4. Communication Ability: I maintain effective verbal/non-verbal interactions	0.652
E3. Feedback Ability: I provide timely, actionable guidance	0.219

Items	R-squared Value
E2. Expressive Ability: I communicate medical knowledge clearly	0.639
E1. Listening Ability: I attentively understand students' needs	0.544
D5. Medical Knowledge Translation Ability: I transform personal experience into teachable content	0.549
D4. Medical Ethics Instruction: I embed ethical decision-making in teaching	0.581
D3. Research Thinking Cultivation: I mentor students in medical research	0.484
D2. Medical Practice Teaching: I guide skill application in authentic contexts	0.534
D1. Medical Reasoning Instruction: I cultivate problem-solving thinking	0.695
C9. Differentiated Instruction Ability: I adapt teaching to diverse learner needs	0.612
C8. Knowledge Condensation Ability: I distill complex medical concepts	0.626
C7. Knowledge Structuring Ability: I integrate fragmented knowledge into coherent frameworks	0.551
C6. Contemporary Teaching Adaptability: I update pedagogies with societal/technological trends	0.609
C5. Instructional Design: I align content/methods with learning objectives	0.532
C4. Teaching Evaluation: I assess learning outcomes scientifically and adjust instruction	0.622
C3. Demonstration Ability: I present key concepts clearly and accurately	0.535
C2. Classroom Management: I maintain engaged, orderly learning environments	0.558
C1. Teaching Awareness: I proactively transform work scenarios into teaching	0.506
B5. Medical Work Experience: I possess rich case-handling expertise	0.297
B4. Disciplinary Frontier Awareness: I stay updated on cutting-edge developments	0.591
B3. Research Capability: I conduct medical research effectively	0.475
B2. Practical Proficiency: I expertly execute discipline-specific procedures	0.506
B1. Theoretical Proficiency: I systematically master disciplinary knowledge frameworks	0.537
A6. Professional Responsibility: I consciously uphold the mission of cultivating medical talent	0.757
A5. Professional Identity: I recognize and value the significance of being a medical educator	0.732
A4. Personal Charisma: I earn students' respect and trust through unique	0.676
A3. Dedication Spirit: I devote myself to medical education without excessive concern for personal gains	0.478
A2. Student Care: I genuinely care about students' development and proactively provide academic/life support	0.504
A1. Exemplary Conduct: I model the ethical standards and professional behaviors expected in medicine	0.393
Medical Teacher Competency	-7.908

Note: Analysis Recommendations

The goodness-of-fit R-squared summary table displays R-squared values as fit indices:

First: Each affected item (dependent variable) corresponds to one R-squared value; multiple affected items yield multiple R-squared values.

Second: If the research objective is to examine impact relationships, the R-squared fit index is less critical.

Table C.27 Covariance table

X	Y	Unstandardized Estimate (Coef.)	Standard Error (Std. Error)	z	p	Standardized Estimate (Std. Estimate)
E1. Listening Ability: I attentively understand students' needs	F1. Team Command Ability: I effectively organize and motivate teams	-0.032	0.008	-3.750	0.000	-0.083
E1. Listening Ability: I attentively understand students' needs	E5. Mentoring and Guidance Ability: I design systematic teaching plans	-0.055	0.010	-5.588	0.000	-0.138
C7. Knowledge Structuring Ability: I integrate fragmented knowledge into coherent frameworks	C8. Knowledge Condensation Ability: I distill complex medical concepts	0.056	0.010	5.729	0.000	0.125
C6. Contemporary Teaching Adaptability: I update pedagogies with societal/technological trends	C7. Knowledge Structuring Ability: I integrate fragmented knowledge into coherent frameworks	0.067	0.010	6.455	0.000	0.148
C3. Demonstration Ability: I present key concepts clearly and accurately	C5. Instructional Design: I align content/methods with learning objectives	0.009	0.011	0.888	0.375	0.022
B3. Research Capability: I conduct medical research effectively	D3. Research Thinking Cultivation: I mentor students in medical research	0.178	0.022	7.955	0.000	0.250

Table C.28 Residual term estimates

Items	Unstandardized Estimate (Coef.)	Standard Error (Std. Error)	z	p	Standardized Estimate (Std. Estimate)
A. Professional ethics and conduct	0.214	0.034	6.355	0.000	1.258
B. Professional competence	0.066	0.010	6.295	0.000	0.289
C. General Teaching Literacy	0.003	0.004	0.716	0.474	0.013
D. Medical Teaching Literacy	0.056	0.009	6.114	0.000	0.181
E. Communication and guiding ability	0.048	0.007	6.568	0.000	0.271
F. Management ability	0.060	0.009	6.693	0.000	0.194
G. Developmental ability	0.073	0.011	6.568	0.000	0.303
G5. "Internet+" Ability: I leverage digital	0.297	0.022	13.213	0.000	0.548

Items	Unstandardized Estimate (Coef.)	Standard Error (Std. Error)	z	p	Standardized Estimate (Std. Estimate)
tools (such as blended learning, AI.)					
G4. Lifelong Learning Ability: I continuously update knowledge/skills	0.157	0.013	12.125	0.000	0.368
G3. Innovative Ability: I pioneer new approaches beyond conventions	0.154	0.013	11.561	0.000	0.315
G2. Reflective Ability: I improve through critical self-review	0.123	0.011	11.182	0.000	0.288
G1. Self-Assessment Ability: I objectively evaluate my strengths/weaknesses	0.282	0.021	13.182	0.000	0.540
F4. Coordination Ability: I resolve conflicts and balance interests	0.108	0.010	10.651	0.000	0.245
F3. Organizational Ability: I allocate resources and personnel rationally	0.123	0.011	11.386	0.000	0.290
F2. Team Collaboration Ability: I collaborate proactively in team settings	0.127	0.010	12.178	0.000	0.361
F1. Team Command Ability: I effectively organize and motivate teams	0.135	0.012	11.534	0.000	0.303
E5. Mentoring and Guidance Ability: I design systematic teaching plans	0.168	0.015	10.851	0.000	0.350
E4. Communication Ability: I maintain effective verbal/non-verbal interactions	0.134	0.011	11.676	0.000	0.348
E3. Feedback Ability: I provide timely, actionable guidance	0.689	0.050	13.837	0.000	0.781
E2. Expressive Ability: I communicate medical knowledge clearly	0.147	0.012	11.817	0.000	0.361
E1. Listening Ability: I attentively understand students' needs	0.150	0.013	11.886	0.000	0.456
D5. Medical Knowledge Translation Ability: I transform personal experience into teachable content	0.191	0.015	12.503	0.000	0.451
D4. Medical Ethics Instruction: I embed ethical decision-making in teaching	0.196	0.016	12.265	0.000	0.419

Items	Unstandardized Estimate (Coef.)	Standard Error (Std. Error)	z	p	Standardized Estimate (Std. Estimate)
D3. Research Thinking Cultivation: I mentor students in medical research	0.356	0.028	12.881	0.000	0.516
D2. Medical Practice Teaching: I guide skill application in authentic contexts	0.261	0.021	12.602	0.000	0.466
D1. Medical Reasoning Instruction: I cultivate problem-solving thinking	0.137	0.012	10.977	0.000	0.305
C9. Differentiated Instruction Ability: I adapt teaching to diverse learner needs	0.170	0.013	12.909	0.000	0.388
C8. Knowledge Condensation Ability: I distill complex medical concepts	0.162	0.013	12.824	0.000	0.374
C7. Knowledge Structuring Ability: I integrate fragmented knowledge into coherent frameworks	0.210	0.016	13.375	0.000	0.449
C6. Contemporary Teaching Adaptability: I update pedagogies with societal/technological trends	0.169	0.013	12.918	0.000	0.391
C5. Instructional Design: I align content/methods with learning objectives	0.201	0.015	13.215	0.000	0.468
C4. Teaching Evaluation: I assess learning outcomes scientifically and adjust instruction	0.154	0.012	12.855	0.000	0.378
C3. Demonstration Ability: I present key concepts clearly and accurately	0.193	0.015	13.204	0.000	0.465
C2. Classroom Management: I maintain engaged, orderly learning environments	0.214	0.016	13.171	0.000	0.442
C1. Teaching Awareness: I proactively transform work scenarios into teaching	0.238	0.018	13.366	0.000	0.494
B5. Medical Work Experience: I possess rich case-handling expertise	0.666	0.050	13.350	0.000	0.703
B4. Disciplinary Frontier Awareness: I stay updated on cutting-edge developments	0.190	0.017	11.241	0.000	0.409
B3. Research Capability: I conduct medical	0.387	0.031	12.335	0.000	0.525

Items	Unstandardized Estimate (Coef.)	Standard Error (Std. Error)	z	p	Standardized Estimate (Std. Estimate)
research effectively					
B2. Practical Proficiency: I expertly execute discipline-specific procedures	0.209	0.017	12.117	0.000	0.494
B1. Theoretical Proficiency: I systematically master disciplinary knowledge frameworks	0.196	0.017	11.838	0.000	0.463
A6. Professional Responsibility: I consciously uphold the mission of cultivating medical talent	0.117	0.012	9.994	0.000	0.243
A5. Professional Identity: I recognize and value the significance of being a medical educator	0.127	0.012	10.507	0.000	0.268
A4. Personal Charisma: I earn students' respect and trust through unique	0.168	0.015	11.388	0.000	0.324
A3. Dedication Spirit: I devote myself to medical education without excessive concern for personal gains	0.345	0.027	12.986	0.000	0.522
A2. Student Care: I genuinely care about students' development and proactively provide academic/life support	0.320	0.025	12.847	0.000	0.496
A1. Exemplary Conduct: I model the ethical standards and professional behaviors expected in medicine	0.263	0.020	13.341	0.000	0.607
Medical Teacher Competency	2.465	0.128	19.291	0.000	8.908

Table C.29 ANOVA results of differences in medical teacher competency by teaching experience (years)

Years of Teaching Experience(Mean ± Standard Deviation)	Teacher Competency	A. Professional ethics and conduct	B. Professional competence	C. General Teaching Literacy	D. Medical Teaching Literacy	E. Communication and guiding ability	F. Management ability	G. Developmental ability	D. Medical Teaching Literacy (Clinical Specialists)
<5 years(n=75)	4.27±0.52	4.39±0.74	4.13±0.68	4.23±0.64	4.15±0.71	4.38±0.59	4.40±0.58	4.23±0.63	4.17±0.80
5-10 years(n=99)	4.46±0.40	4.56±0.53	4.47±0.46	4.42±0.47	4.40±0.50	4.49±0.46	4.47±0.60	4.41±0.59	4.40±0.71

10-15 years(n=83)	4.39±0.48	4.51±0.47	4.38±0.59	4.32±0.55	4.38±0.54	4.38±0.61	4.42±0.56	4.33±0.55	4.38±0.65
15-20 years(n=59)	4.47±0.39	4.55±0.60	4.39±0.55	4.50±0.43	4.44±0.52	4.53±0.43	4.44±0.54	4.43±0.51	4.39±0.64
20-25 years(n=87)	4.55±0.45	4.66±0.58	4.53±0.53	4.56±0.47	4.48±0.56	4.53±0.52	4.54±0.54	4.52±0.50	4.46±0.64
F	4.172	2.174	6.074	5.171	3.931	1.667	0.816	3.070	1.647
p	0.003**	0.071	0.000**	0.000**	0.004**	0.157	0.516	0.016*	0.162

Note: * p<0.05 ** p<0.01

Table C.30 t-Test analysis results of differences in medical teacher competency by gender

Gender (Mean± Standard Deviation)	Teacher Competency	A. Professional ethics and conduct	B. Professional competence	C. General Teaching Literacy	D. Medical Teaching Literacy	E. Communication and guiding ability	F. Management ability	G. Developmental ability	D. Medical Teaching Literacy (Clinical Specialists)
Male(n=160)	4.47±0.45	4.46±0.75	4.46±0.62	4.47±0.51	4.47±0.51	4.51±0.55	4.50±0.60	4.46±0.57	4.37±0.74
Female(n=243)	4.40±0.46	4.59±0.44	4.34±0.54	4.37±0.53	4.31±0.61	4.43±0.52	4.43±0.54	4.34±0.56	4.36±0.67
t	1.575	-1.987	2.104	1.819	2.784	1.447	1.134	2.035	0.154
p	0.116	0.048*	0.036*	0.070	0.006**	0.149	0.257	0.043*	0.878

Note: *p<0.05 ** p<0.01

Table C.31 ANOVA results of differences in medical teacher competency by age

Age (Mean ± Standard Deviation)	Teacher Competency	A. Professional ethics and conduct	B. Professional competence	C. General Teaching Literacy	D. Medical Teaching Literacy	E. Communication and guiding ability	F. Management ability	G. Developmental ability	D. Medical Teaching Literacy (Clinical Specialists)
21-30(n=8)	4.27±0.50	4.50±0.43	4.08±0.49	4.08±0.79	4.00±0.58	4.40±0.50	4.50±0.53	4.30±0.73	3.50±1.00
31-40(n=167)	4.38±0.47	4.49±0.57	4.32±0.60	4.35±0.54	4.30±0.61	4.43±0.53	4.44±0.60	4.36±0.60	4.33±0.69
41-50(n=167)	4.43±0.45	4.53±0.66	4.43±0.55	4.42±0.51	4.40±0.54	4.44±0.55	4.44±0.55	4.37±0.55	4.34±0.72

51-60(n=59)	4.57±0.43	4.71±0.41	4.51±0.55	4.58±0.44	4.53±0.55	4.60±0.48	4.56±0.52	4.51±0.48	4.57±0.52
>60(n=2)	4.66±0.48	4.83±0.24	4.60±0.57	4.61±0.55	4.70±0.42	4.60±0.57	4.50±0.71	4.80±0.28	4.50±0.71
F	2.289	1.696	2.112	3.102	2.923	1.295	0.615	1.150	2.681
p	0.059	0.150	0.079	0.016*	0.021*	0.271	0.652	0.333	0.032*

Note: * p<0.05 ** p<0.01

Table C.32 ANOVA results of differences in medical teacher competency by primary teaching discipline

Primary Teaching Discipline (Mean ± Standard Deviation)	Teacher Competency	A. Professional ethics and conduct	B. Professional competence	C. General Teaching Literacy	D. Medical Teaching Literacy	E. Communication and guiding ability	F. Management ability	G. Developmental ability	D. Medical Teaching Literacy (Clinical Specialists)
Basic Medicine(n=27)	4.17±0.53	4.41±0.47	4.06±0.64	4.06±0.62	4.05±0.70	4.16±0.56	4.22±0.61	4.21±0.61	3.61±0.87
Clinical Medicine(n=121)	4.49±0.47	4.58±0.57	4.47±0.61	4.48±0.51	4.50±0.51	4.50±0.57	4.50±0.62	4.42±0.64	4.56±0.51
Preventive Medicine(n=7)	4.47±0.36	4.55±0.31	4.60±0.40	4.40±0.34	4.43±0.45	4.43±0.44	4.43±0.62	4.49±0.54	4.21±0.76
Stomatology (n=37)	4.52±0.46	4.53±0.68	4.52±0.54	4.51±0.53	4.51±0.56	4.58±0.48	4.54±0.53	4.45±0.52	4.53±0.55
Traditional Chinese Medicine/ Integrated Medicine(n=41)	4.47±0.42	4.59±0.40	4.46±0.49	4.46±0.45	4.43±0.50	4.44±0.57	4.44±0.51	4.42±0.49	4.55±0.48
Psychiatry/ Applied Psychology(n=4)	4.30±0.02	4.29±0.37	4.40±0.37	4.06±0.19	4.30±0.12	4.30±0.48	4.38±0.25	4.40±0.28	4.13±0.48
Rehabilitation Medicine(n=11)	4.25±0.57	4.33±0.58	4.11±0.81	4.16±0.68	4.22±0.61	4.33±0.58	4.34±0.64	4.29±0.55	4.18±0.78
Nursing(n=44)	4.34±0.44	4.61±0.48	4.21±0.55	4.22±0.57	4.17±0.56	4.44±0.48	4.52±0.49	4.24±0.51	4.32±0.52
Medical Technology(n=24)	4.47±0.46	4.63±0.38	4.36±0.57	4.46±0.55	4.44±0.54	4.51±0.51	4.50±0.60	4.39±0.57	null±null
Biostatistics(n=6)	4.29±0.17	4.39±0.44	4.50±0.11	4.28±0.32	4.10±0.39	4.37±0.34	4.13±0.21	4.30±0.37	null±null

Primary Teaching Discipline (Mean ± Standard Deviation)	Teacher Competency	A. Professional ethics and conduct	B. Professional competence	C. General Teaching Literacy	D. Medical Teaching Literacy	E. Communication and guiding ability	F. Management ability	G. Developmental ability	D. Medical Teaching Literacy (Clinical Specialists)
Forensic Medicine(n=1)	4.15±null	4.50±null	4.80±null	4.22±null	4.00±null	3.80±null	3.50±null	4.20±null	null±null
Pharmacy(n=35)	4.46±0.45	4.49±0.74	4.40±0.50	4.48±0.46	4.39±0.61	4.48±0.53	4.49±0.55	4.51±0.52	null±null
Chinese Materia Medica(n=7)	4.31±0.37	4.40±0.35	4.43±0.47	4.37±0.37	4.46±0.41	4.17±0.42	4.43±0.43	3.94±0.63	null±null
Medical Education Management(n=5)	4.13±0.22	3.50±1.41	4.20±0.55	4.16±0.13	4.12±0.30	4.36±0.48	4.35±0.29	4.24±0.43	null±null
Other Medical Disciplines(n=33)	4.49±0.41	4.64±0.76	4.39±0.55	4.57±0.49	4.26±0.78	4.62±0.45	4.46±0.57	4.48±0.49	3.89±1.07
F	1.538	1.694	1.718	2.331	2.036	1.441	0.902	1.071	8.428
p	0.095	0.054	0.050*	0.004**	0.015*	0.131	0.557	0.383	0.000**

Note: * p<0.05 ** p<0.01

Table C.33 ANOVA results of differences in medical tacher competency by position type

Primary Teaching Role (Mean ± Standard Deviation)	Teacher Competency	A. Professional ethics and conduct	B. Professional competence	C. General Teaching Literacy	D. Medical Teaching Literacy	E. Communication and guiding ability	F. Management ability	G. Developmental ability	D. Medical Teaching Literacy (Clinical Specialists)
Teaching-focused(n=110)	4.49±0.41	4.60±0.54	4.42±0.53	4.48±0.46	4.45±0.53	4.53±0.48	4.47±0.53	4.50±0.49	4.31±0.72
Clinical-focused(n=208)	4.44±0.49	4.53±0.63	4.41±0.62	4.41±0.56	4.41±0.56	4.47±0.56	4.48±0.59	4.36±0.61	4.46±0.55
Research-focused(n=35)	4.31±0.46	4.47±0.46	4.32±0.54	4.32±0.54	4.15±0.80	4.35±0.59	4.32±0.63	4.22±0.61	3.68±1.10
Administrative(n=29)	4.41±0.34	4.47±0.76	4.30±0.44	4.38±0.42	4.32±0.44	4.48±0.46	4.52±0.45	4.41±0.41	4.53±0.44
Academic support (Lab technician/Counselor) (n=15)	4.26±0.48	4.53±0.39	4.17±0.59	4.19±0.65	4.09±0.65	4.24±0.44	4.35±0.45	4.27±0.59	3.33±1.51
Other(n=6)	4.22±0.06	4.31±0.27	4.40±0.46	4.13±0.41	4.13±0.16	4.20±0.44	4.21±0.43	4.13±0.27	4.50±0.71
F	1.634	0.647	0.797	1.509	2.554	1.463	0.906	2.063	8.156
p	0.150	0.664	0.552	0.186	0.027*	0.201	0.477	0.069	0.000**

Note: * p<0.05 ** p<0.01

Table C.34 ANOVA results of differences in medical teacher competency by academic rank

Academic Rank (Mean ± Standard Deviation)	Teacher Competency	A. Professional ethics and conduct	B. Professional competence	C. General Teaching Literacy	D. Medical Teaching Literacy	E. Communication and guiding ability	F. Management ability	G. Developmental ability	D. Medical Teaching Literacy (Clinical Specialists)
Junior(n=29)	4.14±0.25	4.08±0.66	4.06±0.69	4.07±0.52	4.08±0.48	4.28±0.38	4.28±0.36	4.11±0.44	4.09±0.78
Intermediate (n=179)	4.41±0.46	4.57±0.47	4.34±0.57	4.38±0.53	4.33±0.60	4.48±0.50	4.44±0.61	4.37±0.59	4.36±0.71
Associate Senior(n=120)	4.41±0.47	4.50±0.70	4.38±0.57	4.40±0.52	4.37±0.57	4.41±0.60	4.46±0.54	4.38±0.55	4.32±0.70
Full Senior(n=75)	4.61±0.40	4.71±0.53	4.67±0.43	4.61±0.44	4.60±0.48	4.58±0.53	4.57±0.56	4.55±0.52	4.50±0.60
F	8.665	8.727	10.313	8.507	7.085	2.971	2.034	4.606	1.769
p	0.000**	0.000**	0.000**	0.000**	0.000**	0.032*	0.109	0.003**	0.153

Note: * p<0.05 ** p<0.01

Table C.35 ANOVA results of differences in medical teacher competency by highest degree

Highest Degree (Mean ± Standard Deviation)	Teacher Competency	A. Professional ethics and conduct	B. Professional competence	C. General Teaching Literacy	D. Medical Teaching Literacy	E. Communication and guiding ability	F. Management ability	G. Developmental ability	D. Medical Teaching Literacy (Clinical Specialists)
Bachelor's(n=88)	4.34±0.49	4.57±0.52	4.21±0.61	4.25±0.59	4.25±0.57	4.43±0.51	4.40±0.66	4.25±0.66	4.32±0.59
Master's(n=127)	4.43±0.46	4.49±0.60	4.41±0.53	4.42±0.51	4.40±0.53	4.43±0.57	4.47±0.53	4.39±0.54	4.47±0.56
Doctoral(n=188)	4.48±0.43	4.56±0.62	4.46±0.57	4.48±0.49	4.41±0.60	4.50±0.51	4.48±0.54	4.45±0.52	4.31±0.81
F	2.941	0.752	6.136	5.768	2.686	0.924	0.661	4.007	1.899
p	0.054	0.472	0.002**	0.003**	0.069	0.398	0.517	0.019*	0.151

Note: * p<0.05 ** p<0.01

Table C.36 ANOVA results of differences in medical teacher competency by discipline of highest degree

Discipline of Highest Degree (Mean ± Standard Deviation)	Teacher Competency	A. Professional ethics and conduct	B. Professional competence	C. General Teaching Literacy	D. Medical Teaching Literacy	E. Communication and guiding ability	F. Management ability	G. Developmental ability	D. Medical Teaching Literacy (Clinical Specialists)
Basic Medicine(n=35)	4.34±0.55	4.54±0.51	4.26±0.68	4.29±0.59	4.27±0.68	4.36±0.57	4.36±0.63	4.29±0.59	4.00±0.94
Clinical Medicine(n=121)	4.50±0.46	4.58±0.55	4.48±0.59	4.48±0.51	4.51±0.50	4.52±0.56	4.51±0.62	4.44±0.64	4.58±0.49
Preventive Medicine(n=8)	4.32±0.48	4.46±0.36	4.45±0.59	4.14±0.76	4.20±0.72	4.40±0.45	4.22±0.59	4.40±0.50	4.06±0.98
Stomatology (n=31)	4.52±0.47	4.52±0.72	4.57±0.53	4.50±0.55	4.49±0.58	4.54±0.52	4.54±0.54	4.44±0.52	4.48±0.60
Traditional Chinese Medicine/ Integrated Medicine(n=44)	4.44±0.48	4.58±0.45	4.45±0.60	4.40±0.55	4.40±0.53	4.40±0.62	4.43±0.55	4.40±0.53	4.50±0.60
Psychiatry/ Applied Psychology(n=5)	4.37±0.25	4.57±0.28	4.24±0.41	4.40±0.48	4.36±0.22	4.36±0.38	4.40±0.49	4.28±0.46	4.33±0.29
Rehabilitation Medicine(n=8)	4.41±0.31	4.52±0.24	4.30±0.45	4.46±0.27	4.38±0.41	4.48±0.35	4.44±0.42	4.30±0.51	4.25±0.65
Nursing(n=43)	4.35±0.45	4.64±0.46	4.20±0.55	4.24±0.57	4.16±0.58	4.44±0.49	4.52±0.49	4.26±0.51	4.29±0.53
Medical Technology(n=36)	4.48±0.43	4.60±0.74	4.37±0.57	4.56±0.52	4.29±0.78	4.56±0.53	4.57±0.56	4.44±0.56	3.75±1.09
Biostatistics(n=4)	4.32±0.19	4.62±0.34	4.50±0.12	4.44±0.20	4.10±0.42	4.25±0.41	4.13±0.14	4.20±0.43	3.50±null
Forensic Medicine(n=2)	4.18±0.04	4.08±0.12	4.40±0.28	4.00±0.16	4.10±0.14	4.20±0.57	4.38±0.53	4.10±0.42	5.00±null
Pharmacy(n=29)	4.47±0.45	4.48±0.78	4.43±0.52	4.46±0.46	4.39±0.63	4.51±0.53	4.52±0.53	4.53±0.54	4.67±0.29
Chinese Materia Medica(n=8)	4.18±0.36	4.33±0.47	4.13±0.44	4.13±0.40	4.33±0.49	4.13±0.32	4.06±0.50	4.15±0.67	4.10±0.42
Medical Education Management(n=8)	4.17±0.19	3.67±1.10	4.23±0.41	4.19±0.14	4.20±0.26	4.33±0.37	4.38±0.30	4.20±0.45	3.90±0.42
Other Medical	4.35±0.43	4.45±0.46	4.26±0.58	4.38±0.48	4.31±0.52	4.43±0.43	4.25±0.56	4.39±0.46	3.86±1.12

Discipline of Highest Degree (Mean ± Standard Deviation)	Teacher Competency	A. Professional ethics and conduct	B. Professional competence	C. General Teaching Literacy	D. Medical Teaching Literacy	E. Communication and guiding ability	F. Management ability	G. Developmental ability	D. Medical Teaching Literacy (Clinical Specialists)
Disciplines(n=21)									
F	1.048	1.695	1.235	1.472	1.347	0.765	1.079	0.735	3.952
p	0.405	0.054	0.247	0.118	0.177	0.707	0.375	0.739	0.000**

Note: * p<0.05 ** p<0.01

Table C.37 t-Test analysis results of differences in medical teacher competency by annual performance assessment (Past 3 years)

	Annual Performance Assessment (Past 3 Years)(Mean ± Standard Deviation)		t	p
	Excellent (≥1 year rated excellent)(n=239)	Qualified(n=164)		
Teacher Competency	4.46±0.44	4.38±0.47	1.794	0.074
A. Professional ethics and conduct	4.59±0.52	4.46±0.67	2.001	0.046*
B. Professional competence	4.44±0.54	4.32±0.61	2.113	0.035*
C. General Teaching Literacy	4.43±0.52	4.38±0.54	0.798	0.426
D. Medical Teaching Literacy	4.40±0.59	4.34±0.56	0.991	0.322
E. Communication and guiding ability	4.49±0.54	4.42±0.52	1.238	0.216
F. Management ability	4.50±0.57	4.40±0.56	1.622	0.105
G. Developmental ability	4.42±0.57	4.34±0.55	1.246	0.214
D. Medical Teaching Literacy (Clinical Specialists)	4.38±0.72	4.33±0.65	0.678	0.498

Note: * p<0.05 ** p<0.01

Table C.38 ANOVA results of differences in medical teacher competency by leadership of research projects

Research Projects Led (Mean ± Standard Deviation)	Teacher Competency	A. Professional ethics and conduct	B. Professional competence	C. General Teaching Literacy	D. Medical Teaching Literacy	E. Communication and guiding ability	F. Management ability	G. Developmental ability	D. Medical Teaching Literacy (Clinical Specialists)
National (n=140)	4.47±0.41	4.60±0.50	4.47±0.50	4.45±0.48	4.39±0.61	4.49±0.50	4.47±0.53	4.43±0.51	4.29±0.78
Provincial (n=92)	4.49±0.45	4.48±0.69	4.53±0.49	4.49±0.48	4.48±0.53	4.47±0.54	4.52±0.52	4.47±0.51	4.47±0.61
Municipal	4.34±0.39	4.35±0.80	4.17±0.74	4.36±0.48	4.39±0.45	4.39±0.61	4.45±0.49	4.29±0.49	4.28±0.77

(n=44)									
None(n=127)	4.37±0.51	4.58±0.51	4.27±0.60	4.32±0.61	4.27±0.61	4.45±0.54	4.40±0.65	4.30±0.66	4.37±0.65
F	2.227	2.533	6.984	2.240	2.556	0.424	0.750	2.470	1.109
p	0.085	0.057	0.000**	0.083	0.055	0.736	0.523	0.062	0.346

Note: * $p<0.05$ ** $p<0.01$

Annex D: Figures of Differential Analysis in Section 6.2.5

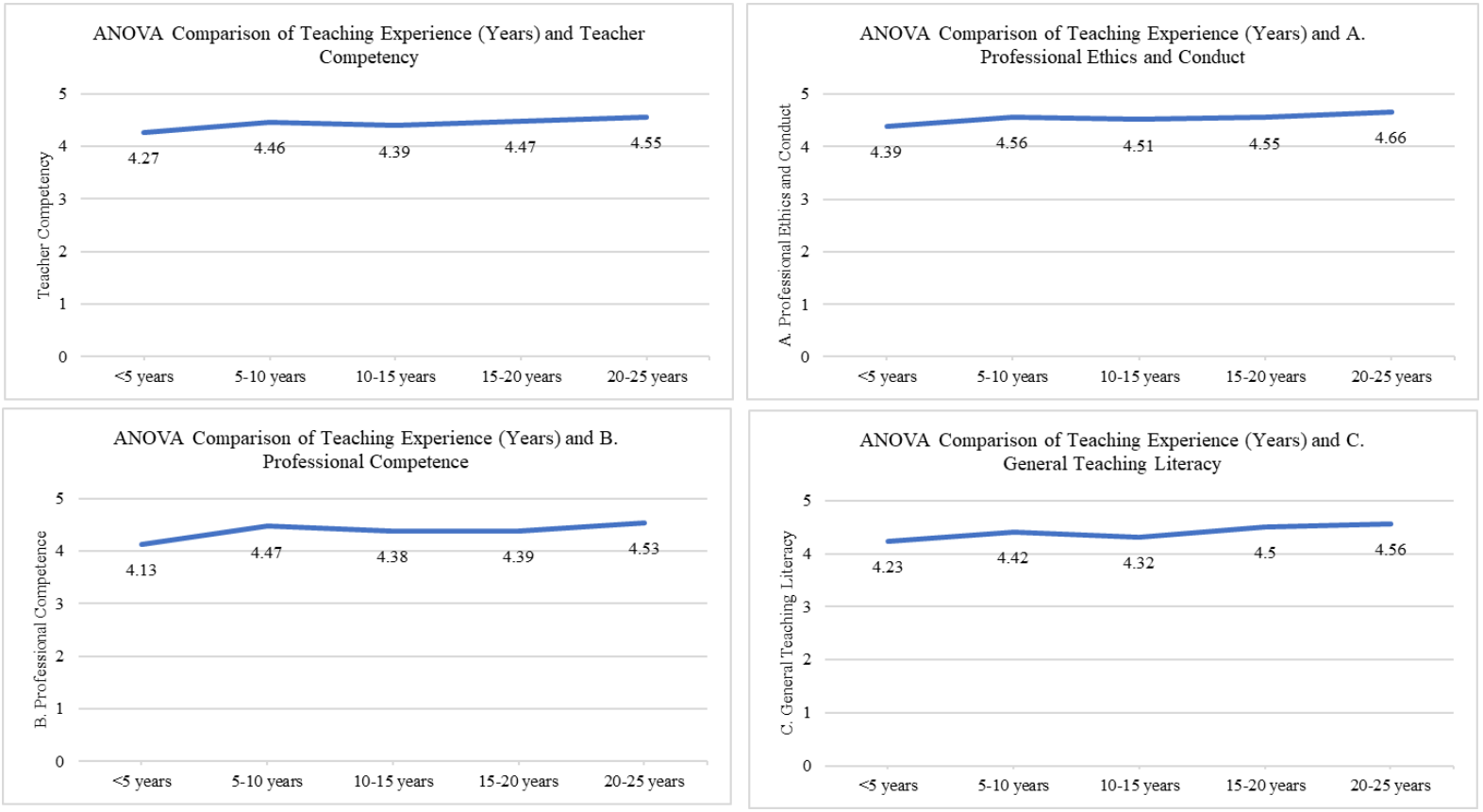


Figure D.1 Differences in medical teacher competency by teaching experience (Years) in overall competence, A professional ethics and conduct, B professional competence, C general literacy

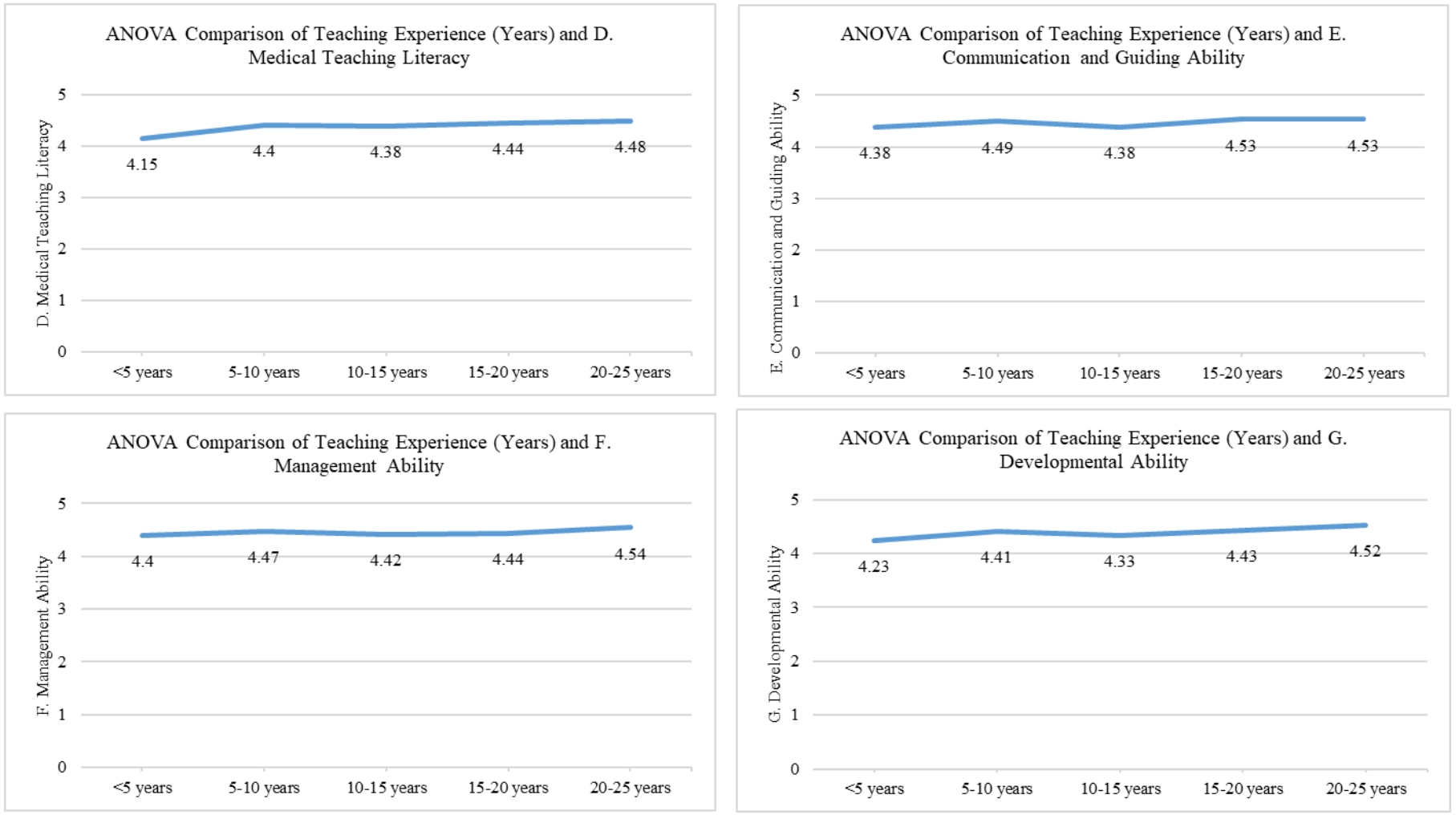


Figure D.2 Differences in medical teacher competency by teaching experience (Years) in D Medical Teaching Literacy, E communication and guiding ability, F management ability, G developmental ability

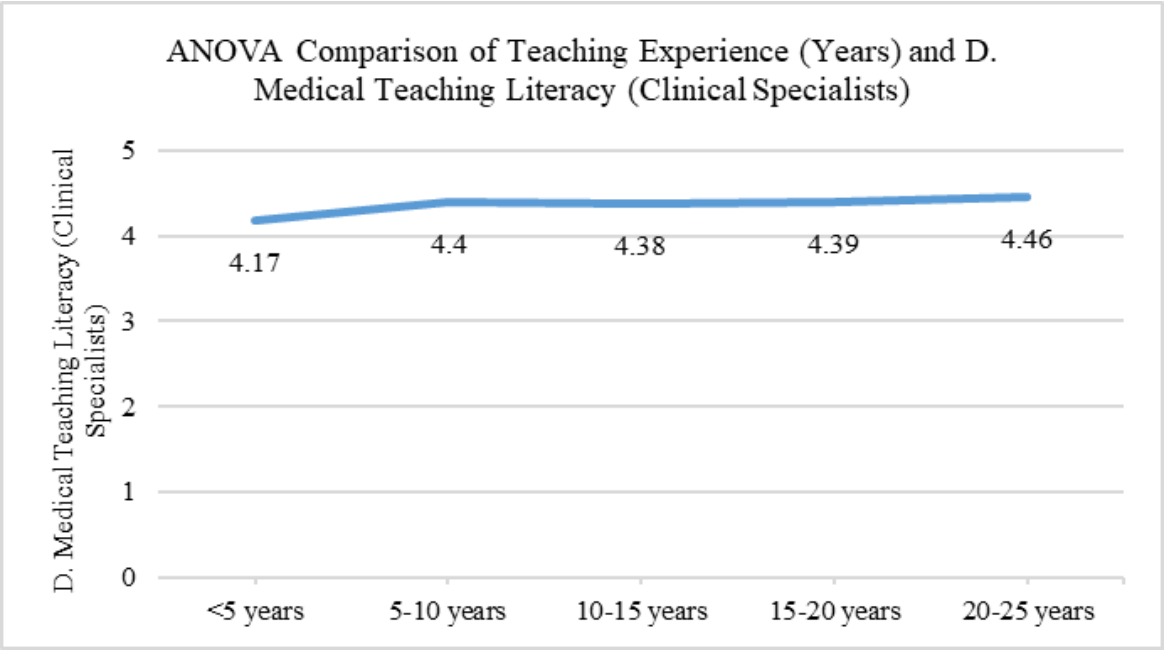


Figure D.3 Differences in medical teacher competency by teaching experience (Years) in D Medical Teaching Literacy (Clinical Specialists) 7

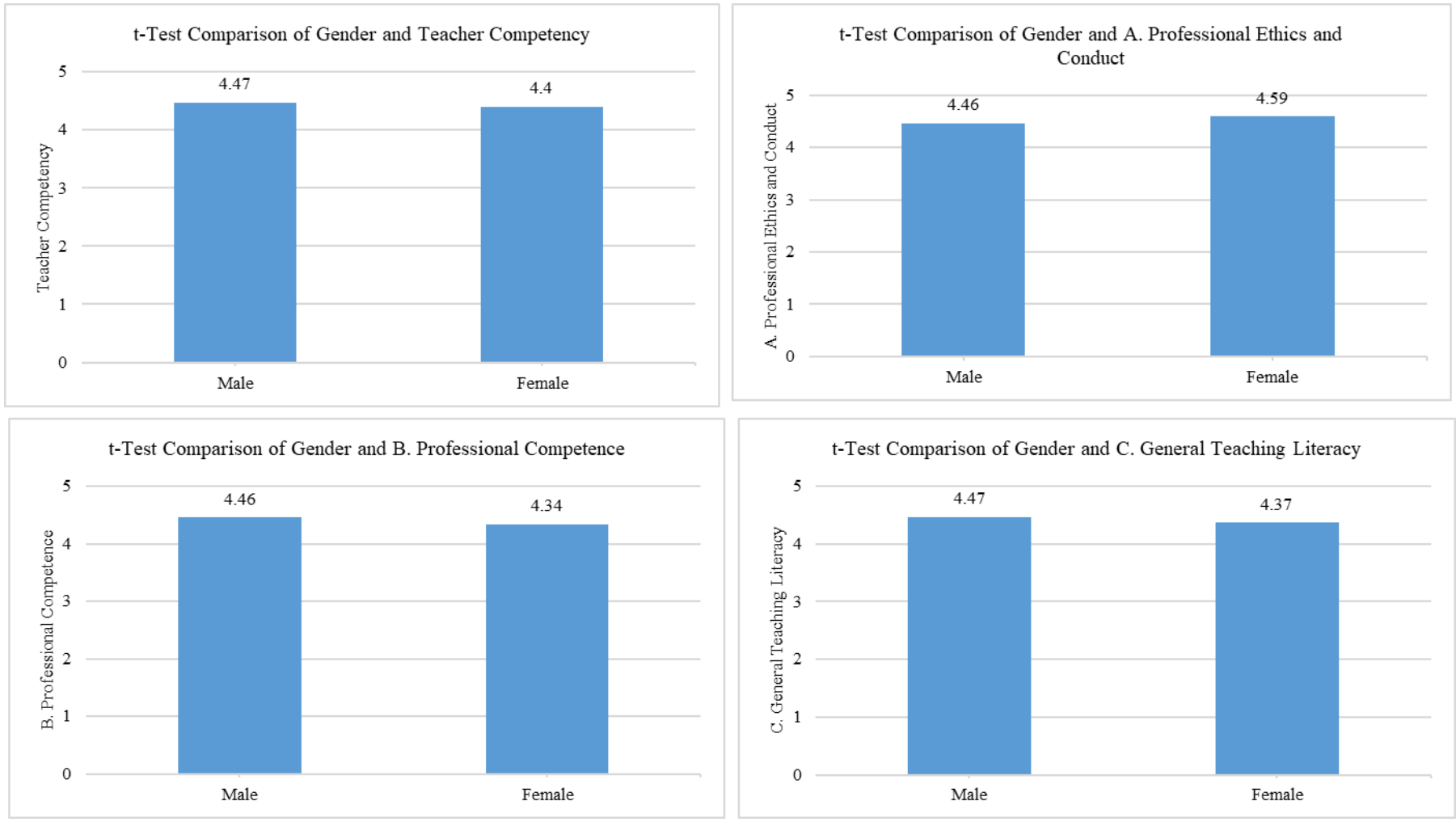
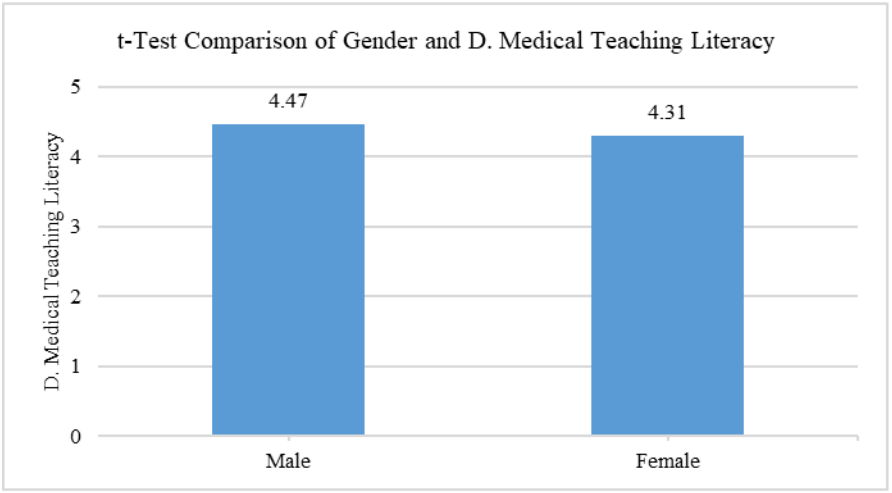
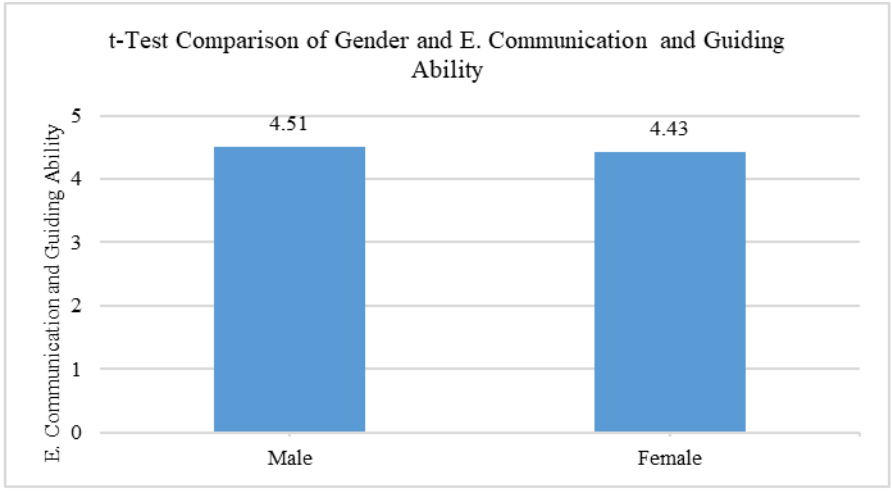
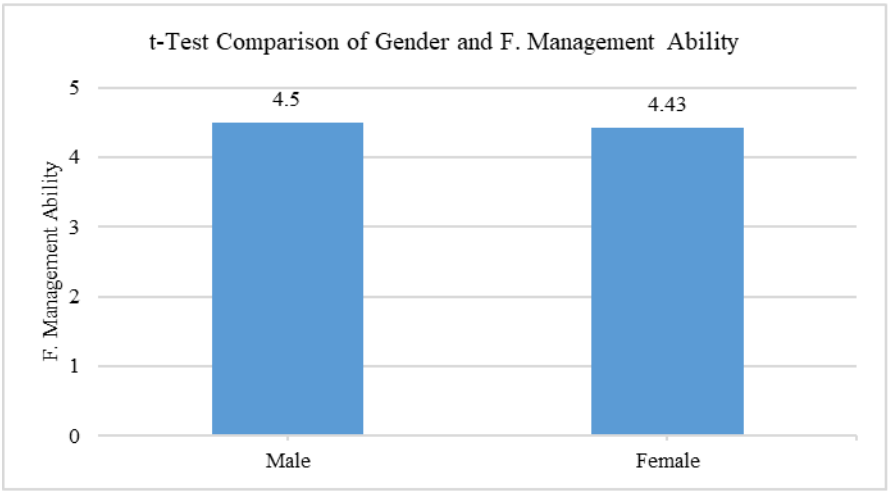


Figure D.4 Differences in medical teacher competency by gender in overall competence, A professional ethics and conduct, B professional competence, C general literacy







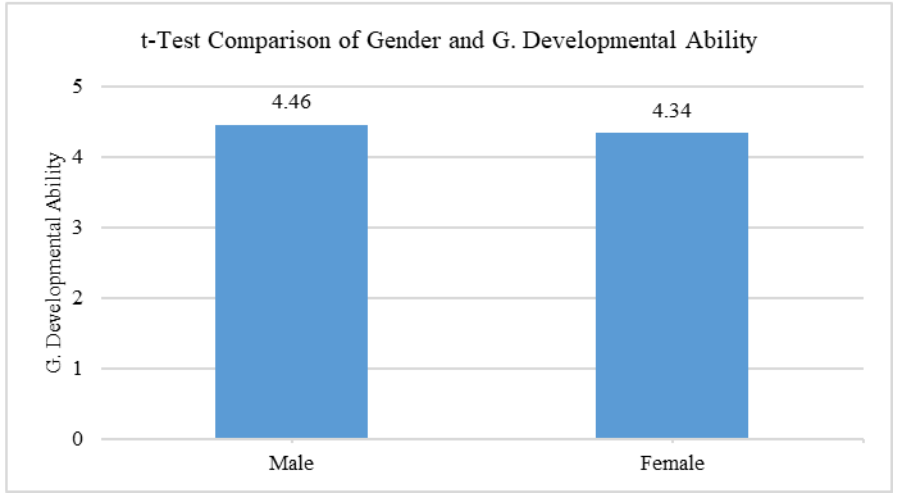


Figure D.5 Differences in medical teacher competency by gender in D Medical Teaching Literacy, E communication and guiding ability, F management ability, G developmental ability

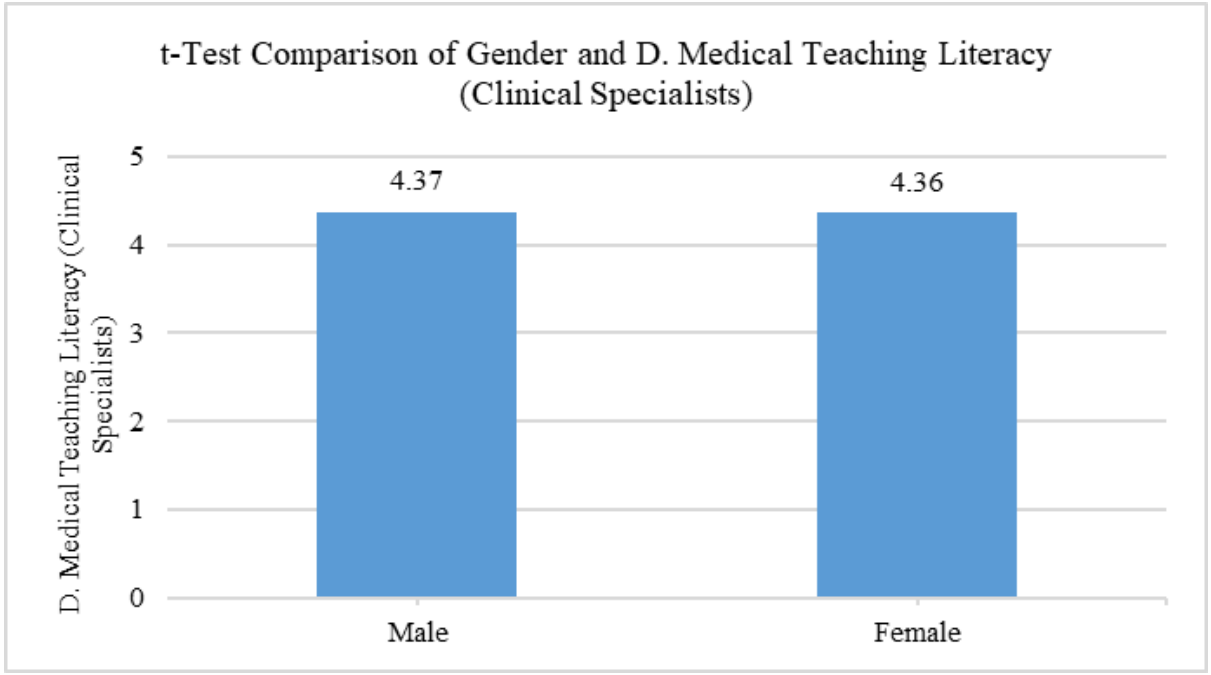


Figure D.6 Differences in medical teacher competency by gender in D Medical Teaching Literacy (Clinical Specialists) 7

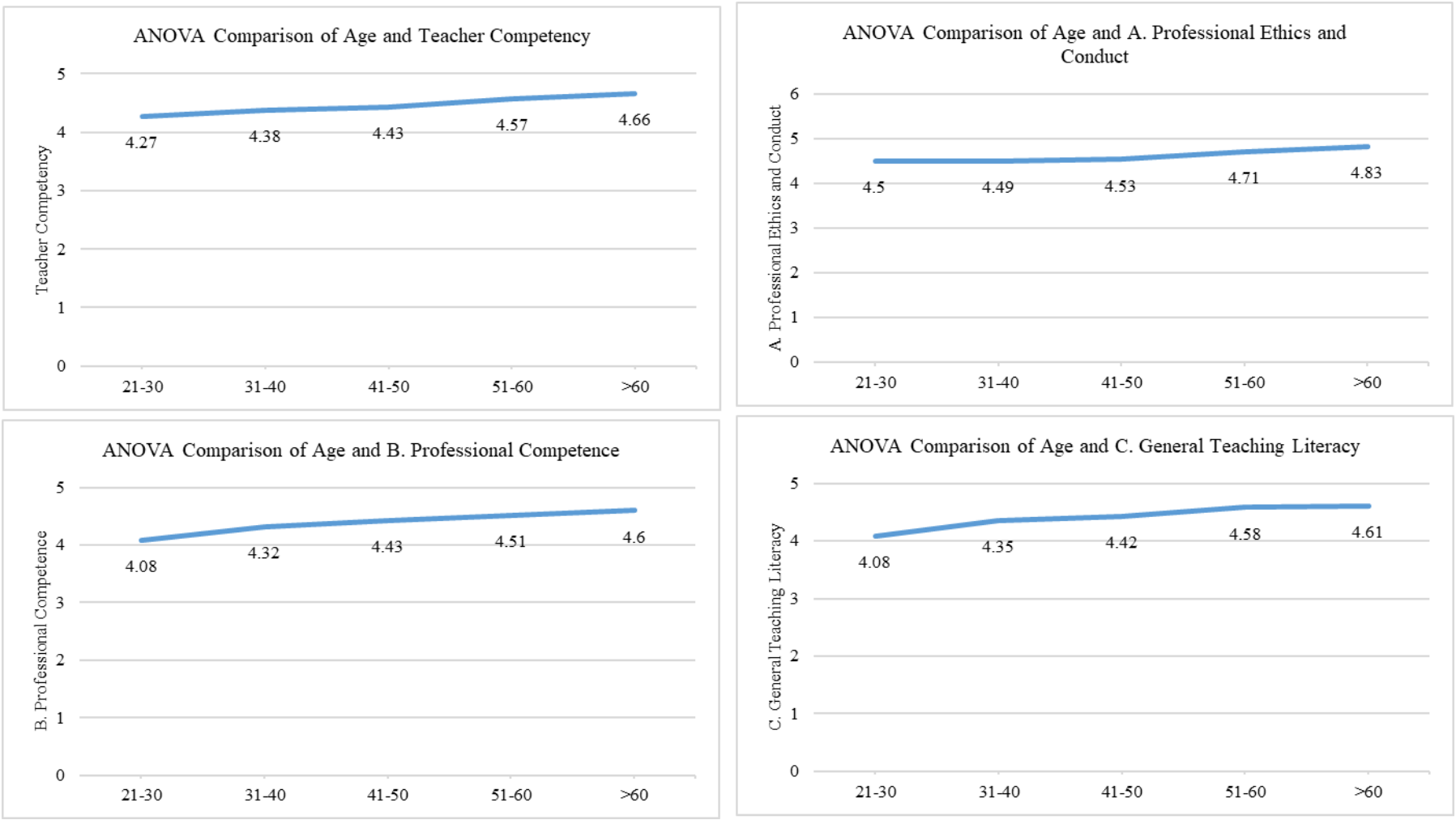


Figure D.7 Differences in medical teacher competency by age in overall competence, A professional ethics and conduct, B professional competence, C general literacy

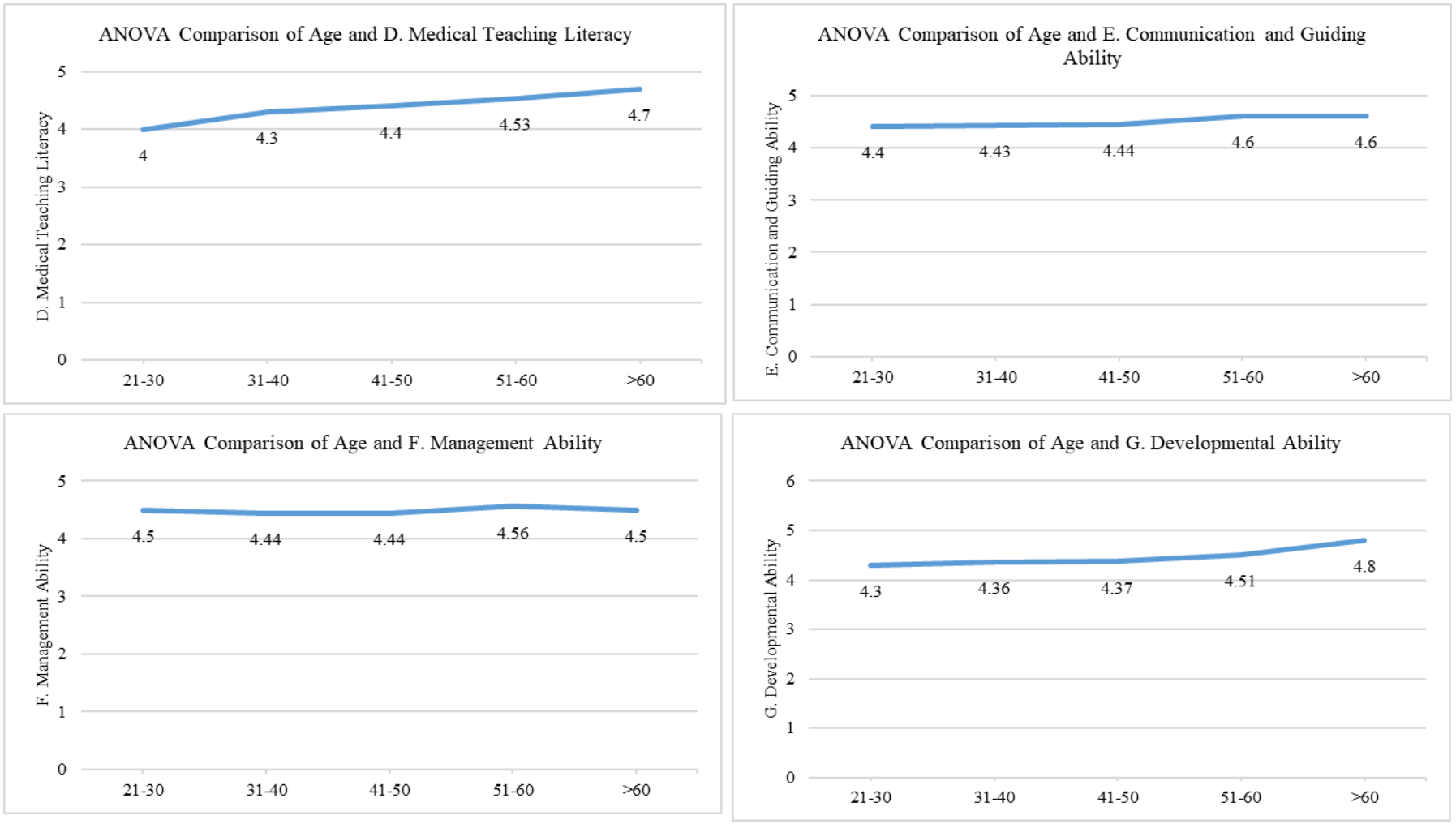


Figure D.8 Differences in medical teacher competency by age in D Medical Teaching Literacy, E communication and guiding ability, F management ability, G developmental ability

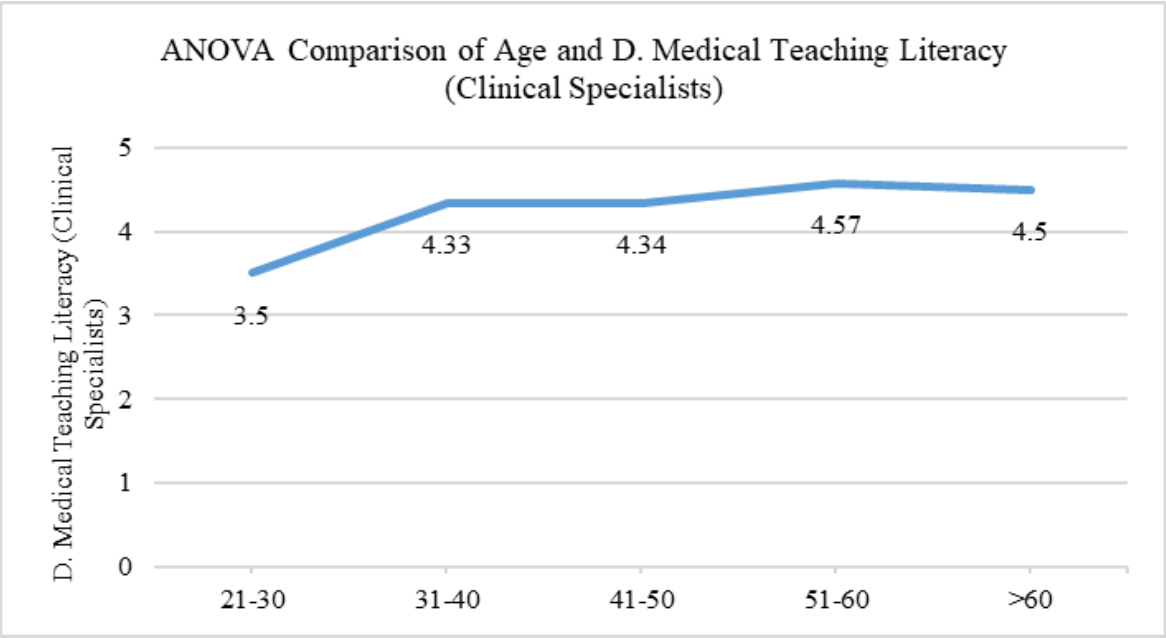


Figure D.9 Differences in medical teacher competency by age in D Medical Teaching Literacy (Clinical Specialists) 7

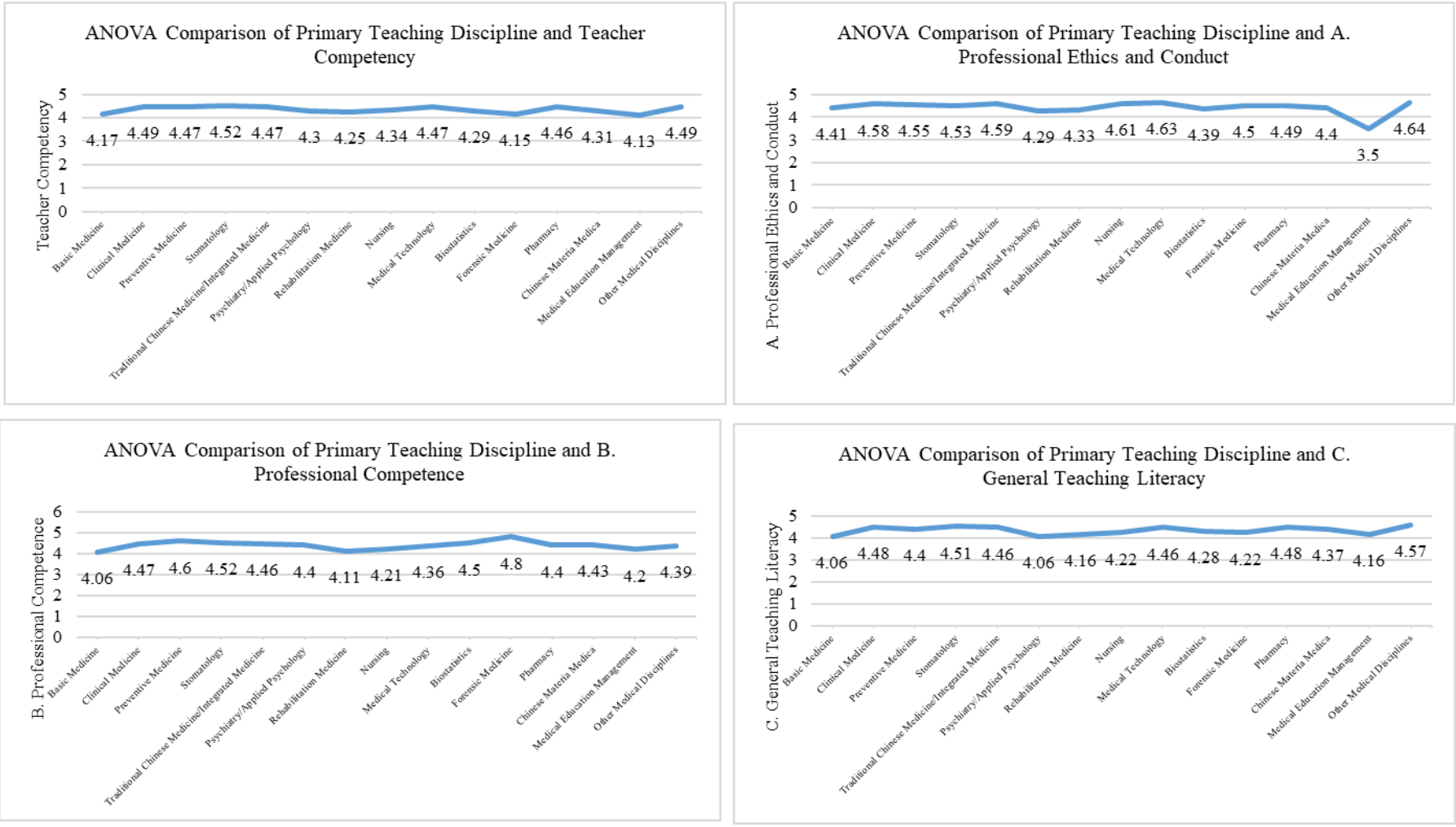


Figure D.10 Differences in medical teacher competency by primary teaching discipline in overall competence, A professional ethics and conduct, B professional competence, C general literacy

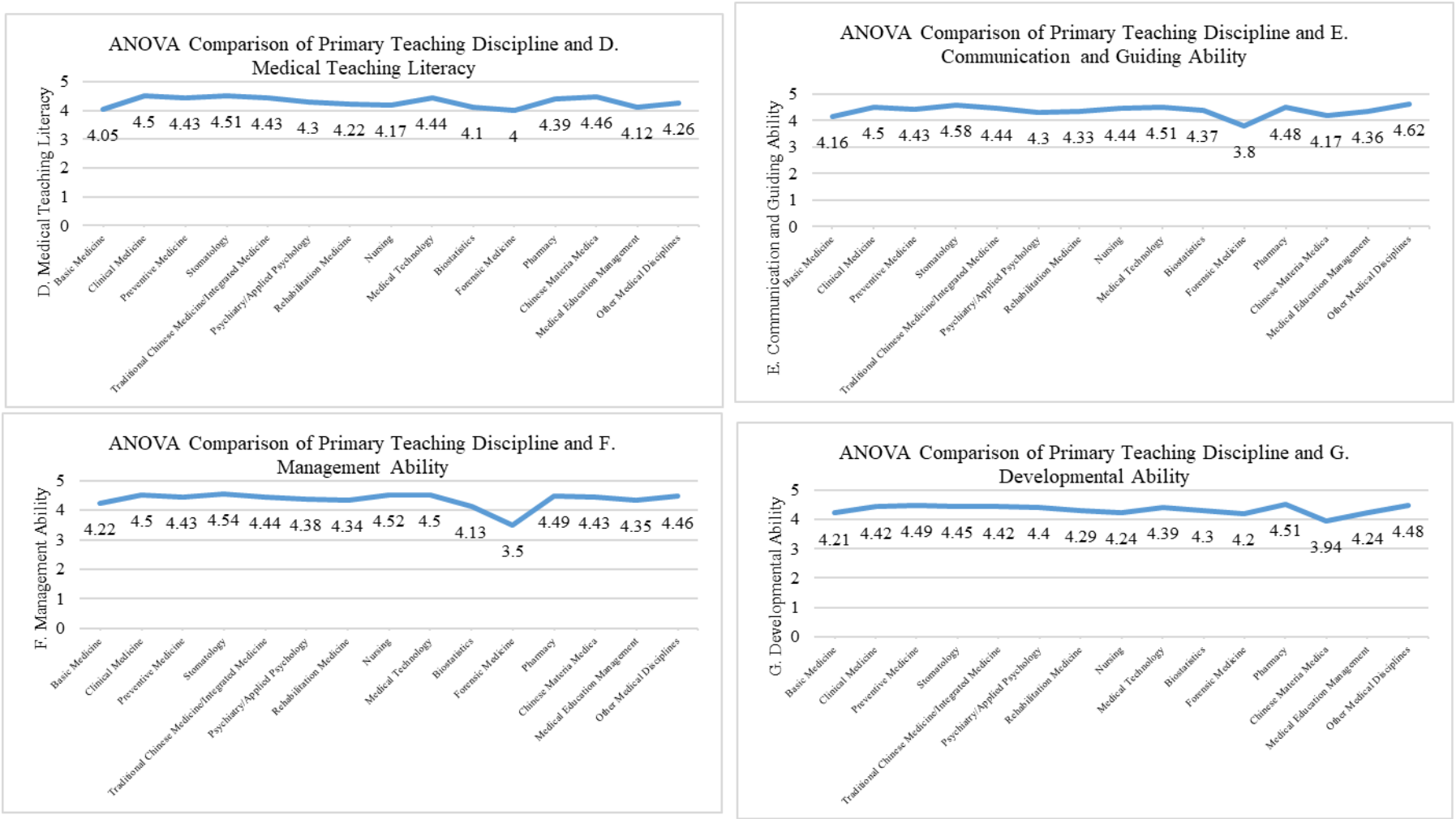


Figure D.11 Differences in medical teacher competency by primary teaching discipline in D Medical Teaching Literacy, E communication and guiding ability, F management ability, G developmental ability

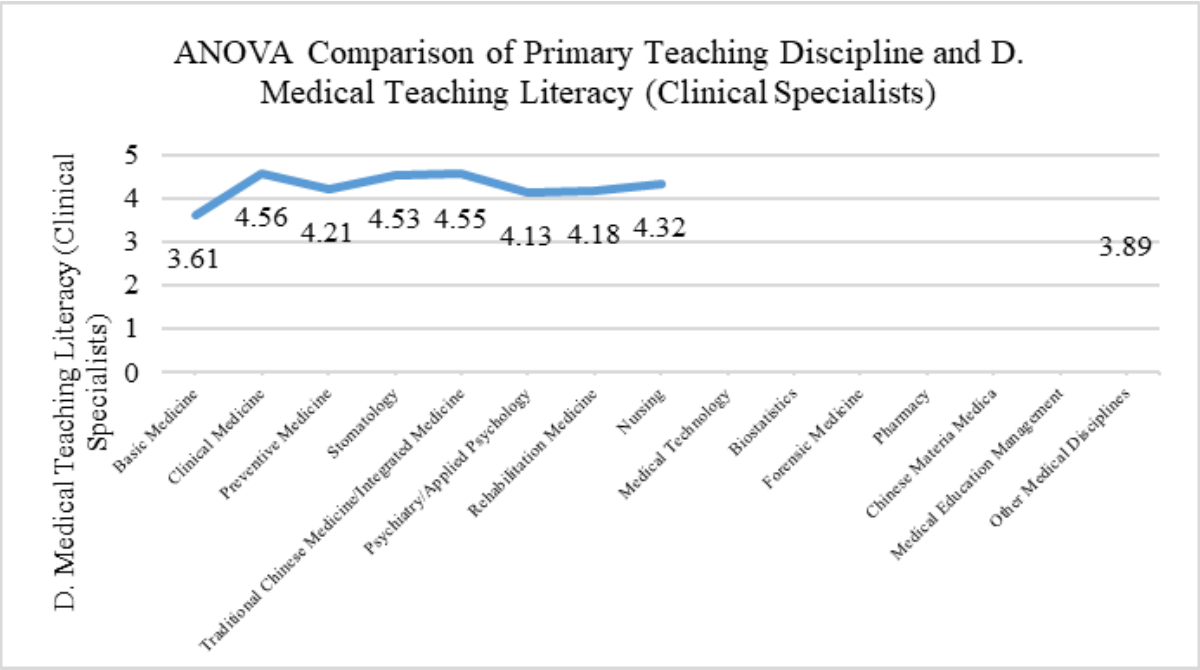


Figure D.12 Differences in medical teacher competency by primary teaching discipline in D Medical Teaching Literacy (Clinical Specialists) 7

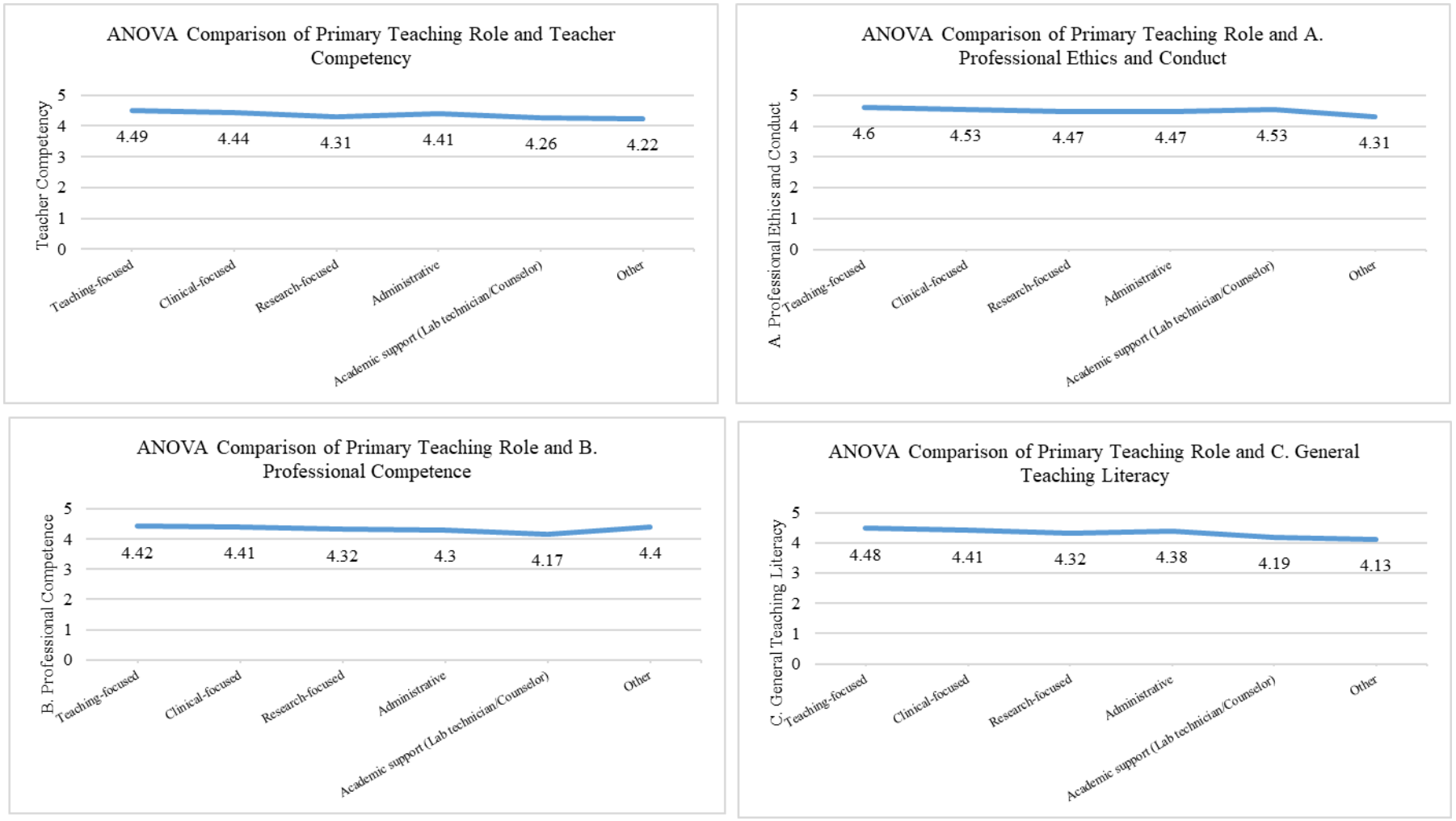


Figure D.13 Differences in medical teacher competency by position type in overall competence, A professional ethics and conduct, B professional competence, C general literacy

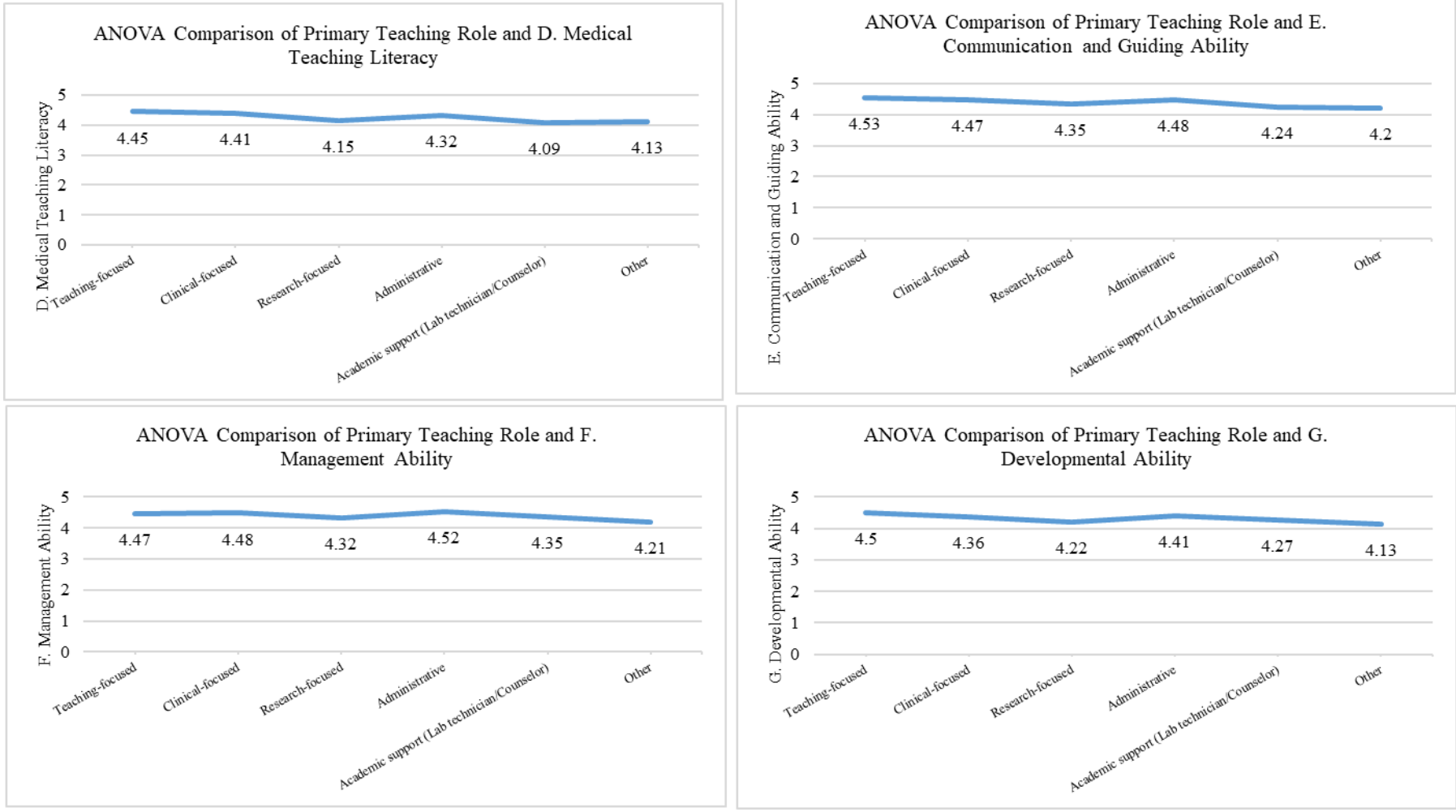


Figure D.14 Differences in medical teacher competency by position type in D Medical Teaching Literacy, E communication and guiding ability, F management ability, G developmental ability

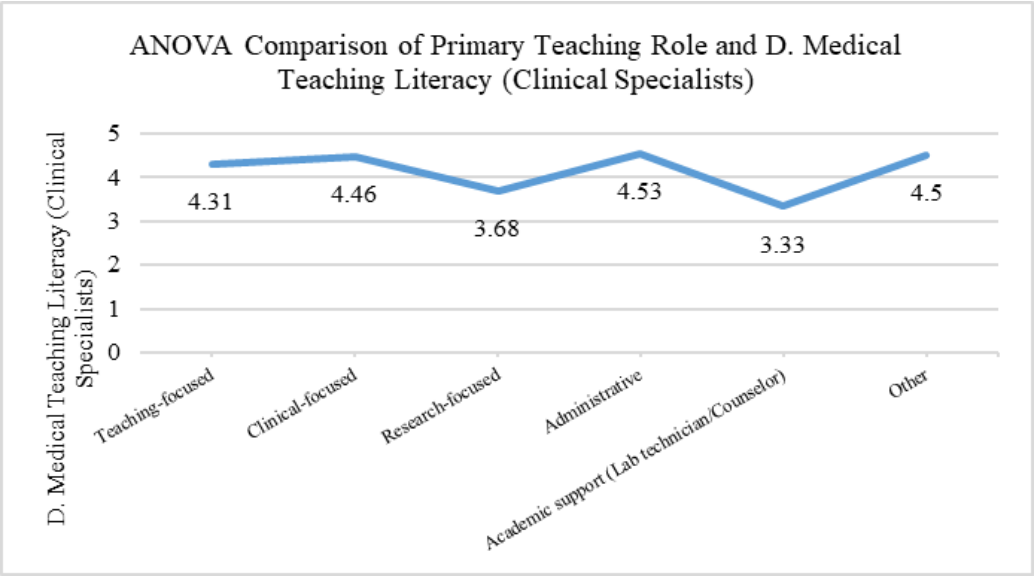


Figure D.15 Differences in medical teacher competency by position type in D Medical Teaching Literacy (Clinical Specialists) 7

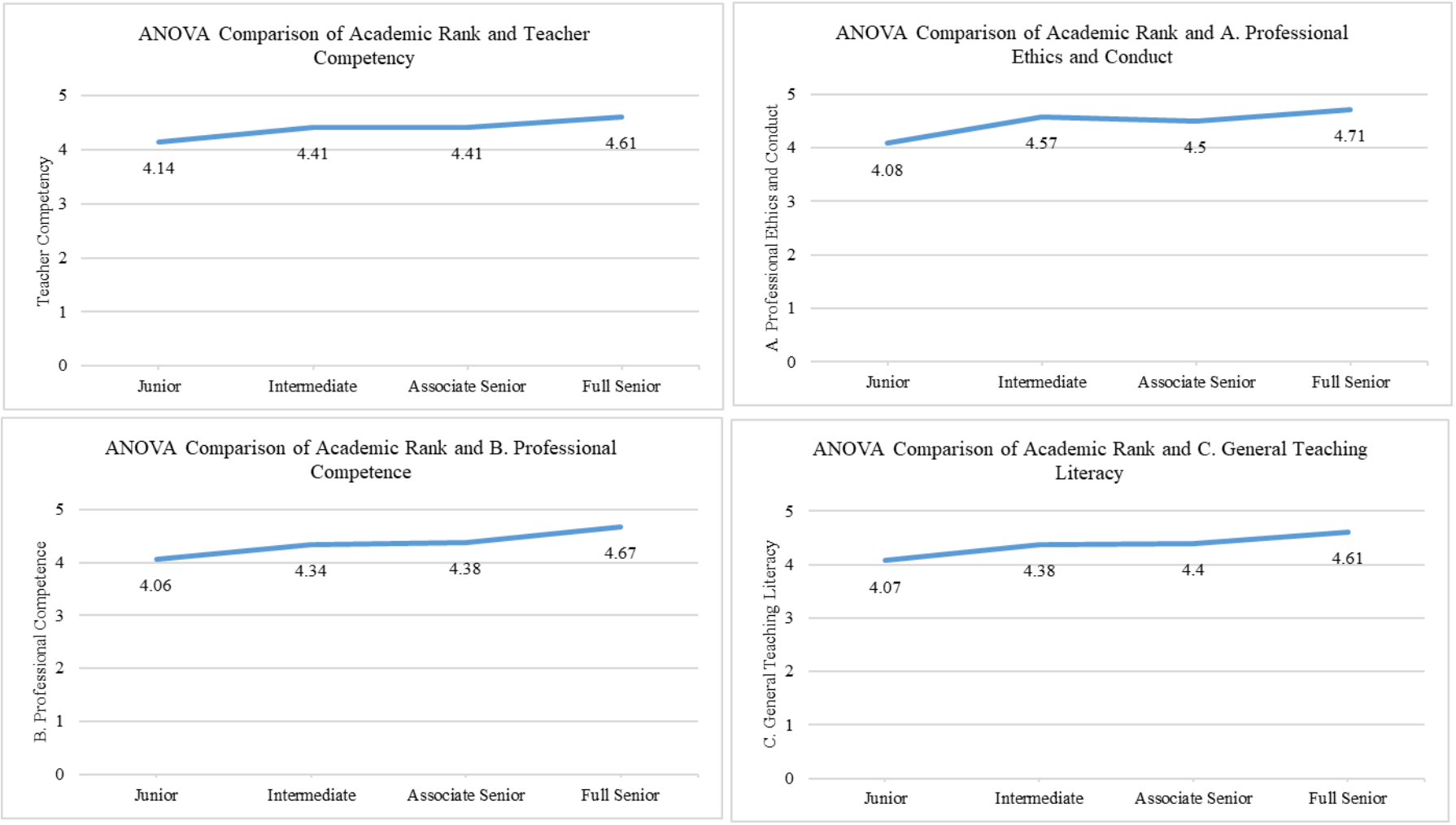


Figure D.16 Differences in medical teacher competency by academic rank in overall competence, A professional ethics and conduct, B professional competence, C general literacy

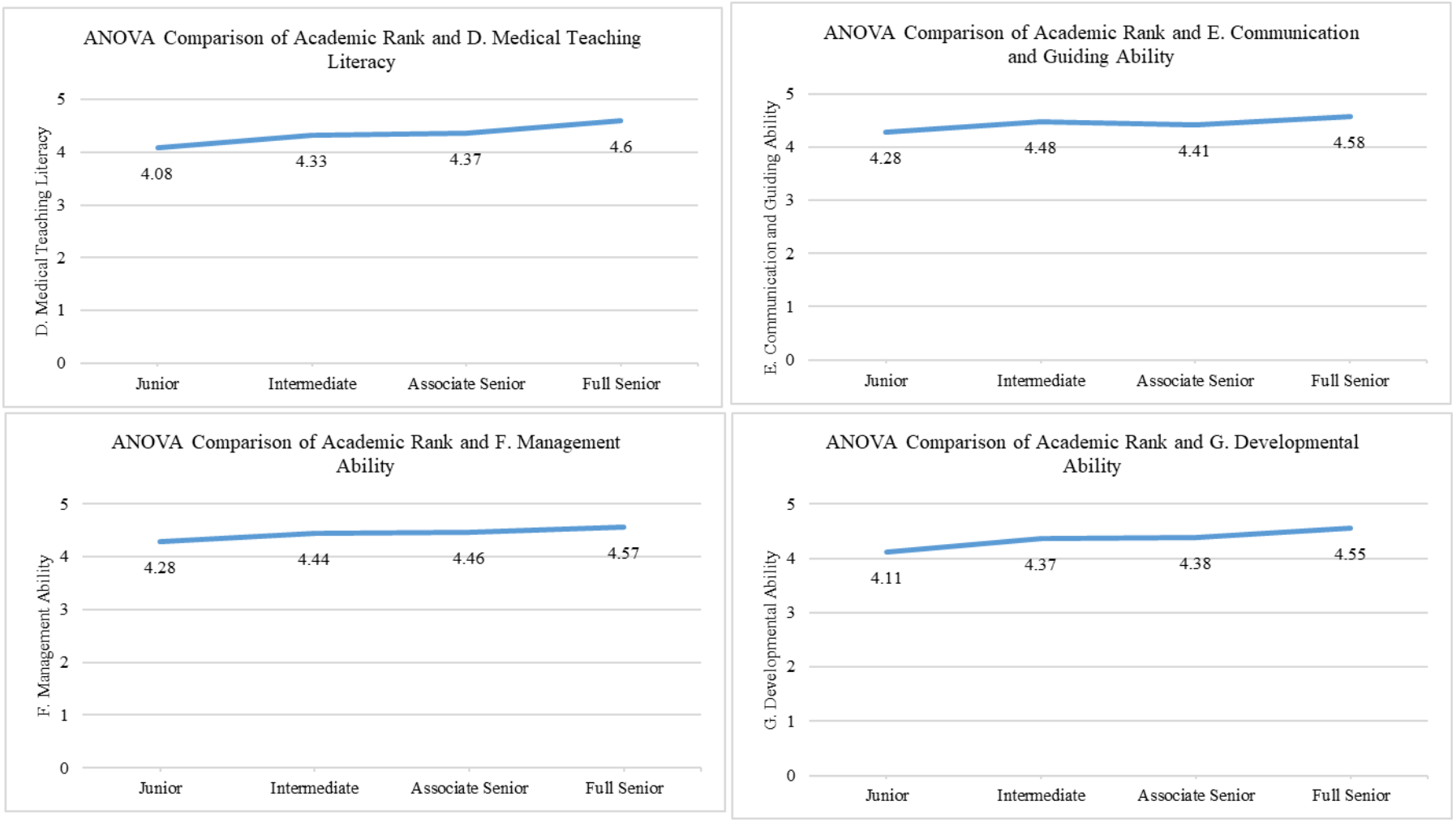


Figure D.17 Differences in medical teacher competency by academic rank in D Medical Teaching Literacy, E communication and guiding ability, F management ability, G developmental ability

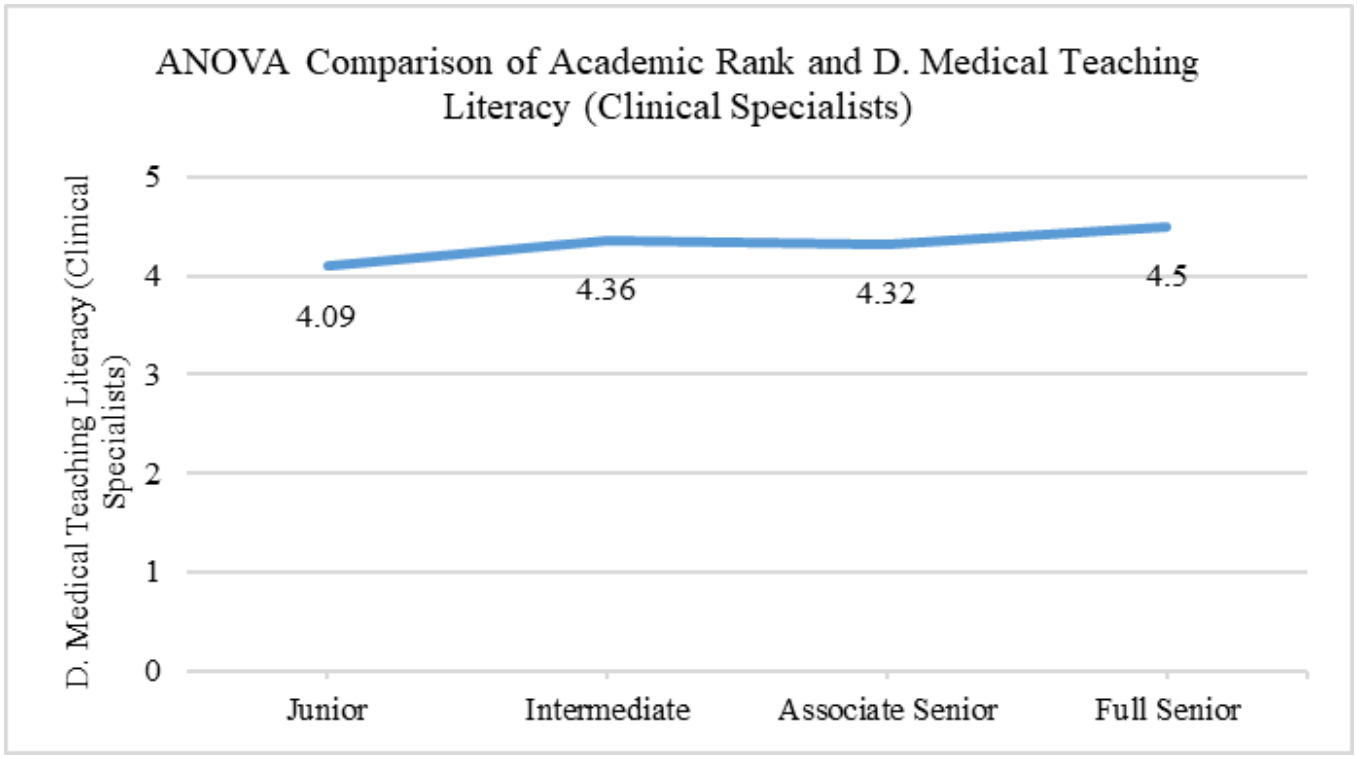


Figure D.18 Differences in medical teacher competency by academic rank in D Medical Teaching Literacy (Clinical Specialists) 7

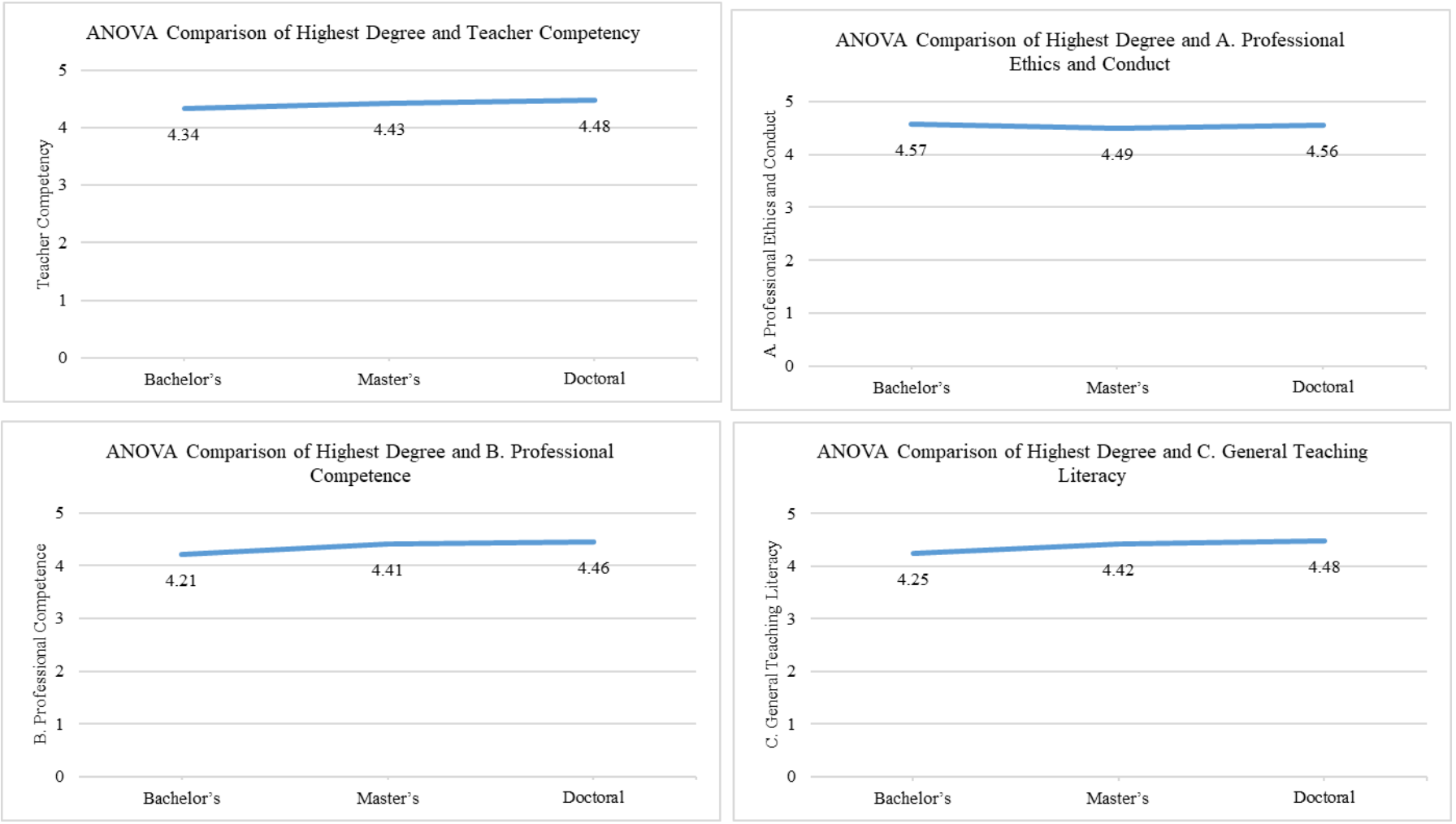


Figure D.19 Differences in medical teacher competency by highest degree in overall competence, A professional ethics and conduct, B professional competence, C general literacy

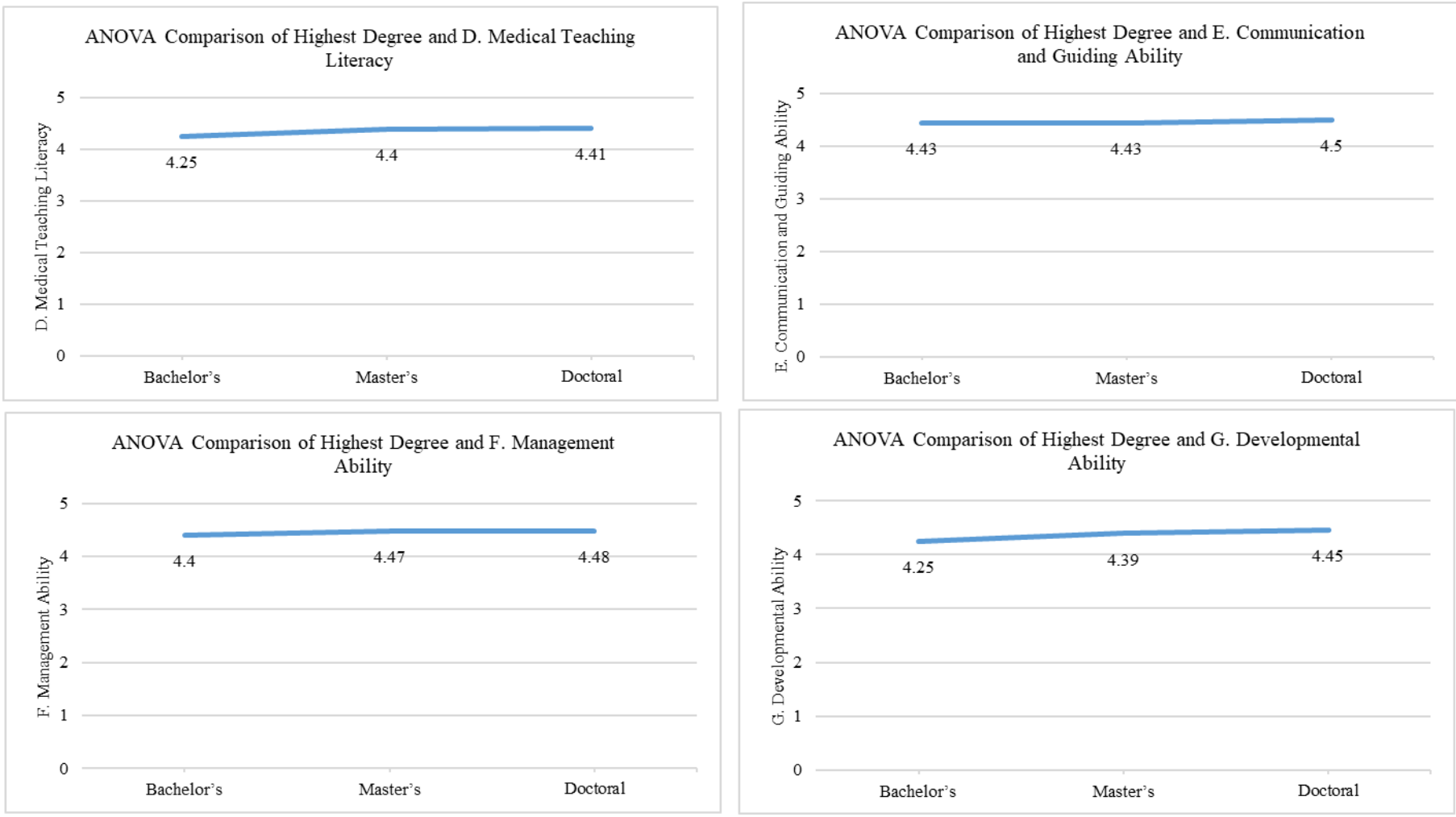


Figure D.20 Differences in medical teacher competency by highest degree in D Medical Teaching Literacy, E communication and guiding ability, F management ability, G developmental ability

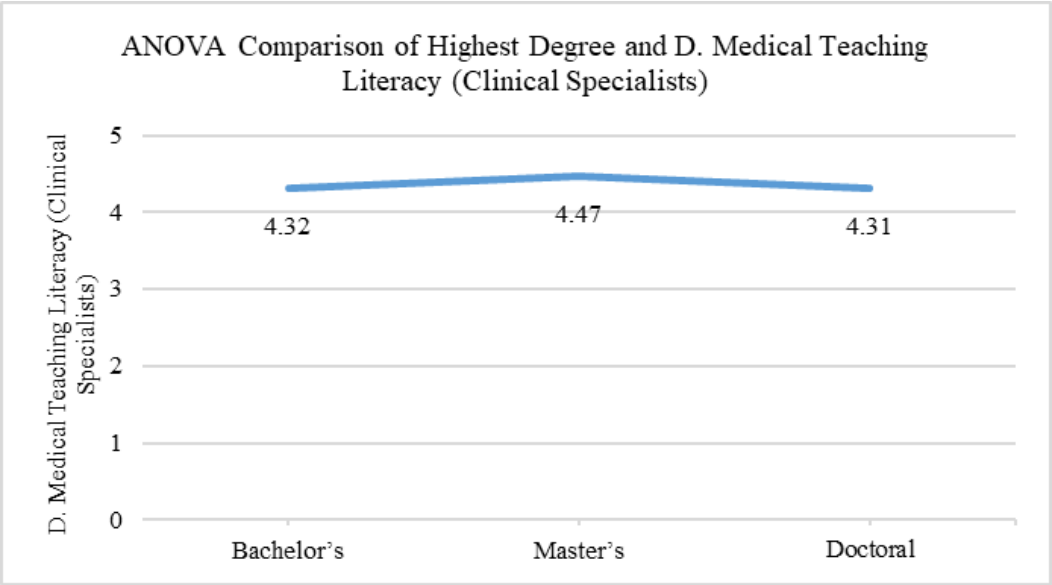


Figure D.21 Differences in medical teacher competency by highest degree in D Medical Teaching Literacy (Clinical Specialists) 7

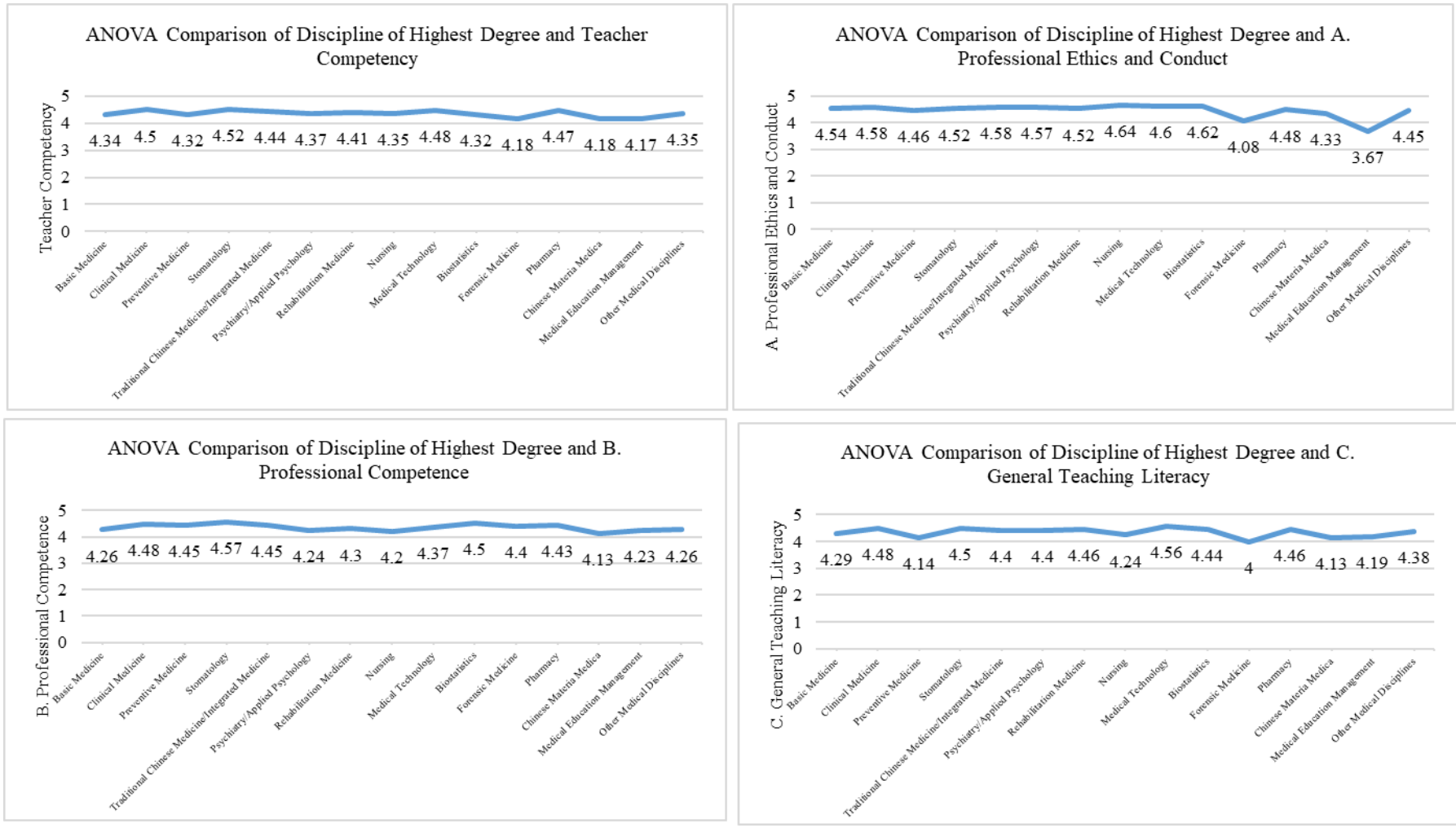


Figure D.22 Differences in medical teacher competency by discipline of highest degree in overall competence, A professional ethics and conduct, B professional competence, C general literacy

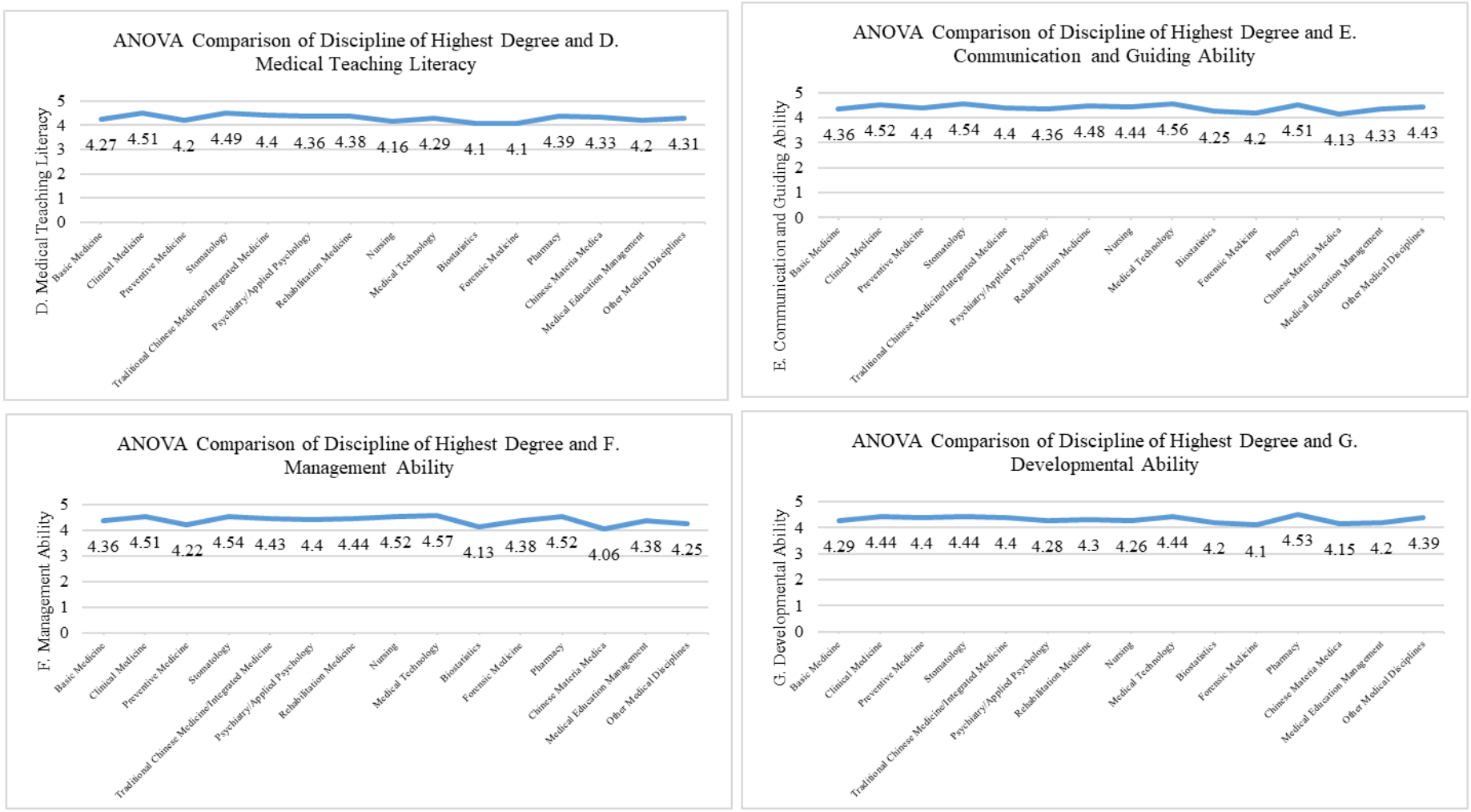


Figure D.23 Differences in medical teacher competency by discipline of highest degree in D Medical Teaching Literacy, E communication and guiding ability, F management ability, G developmental ability

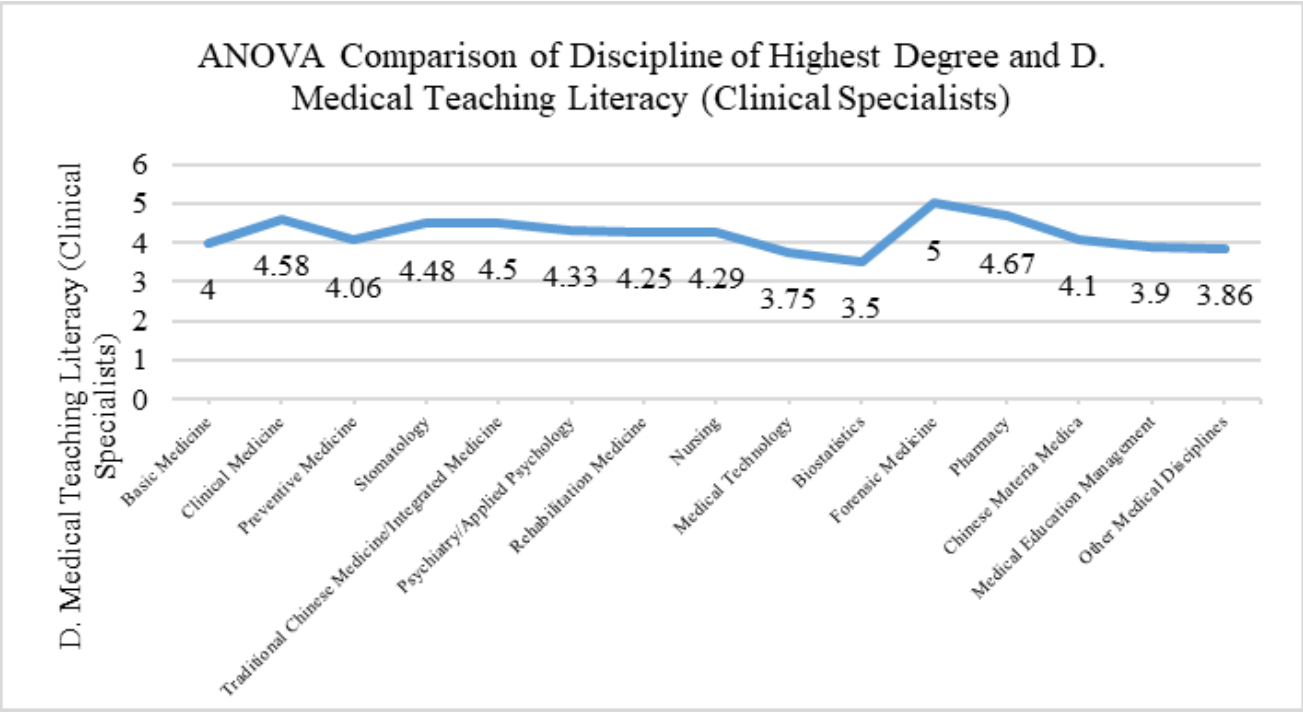
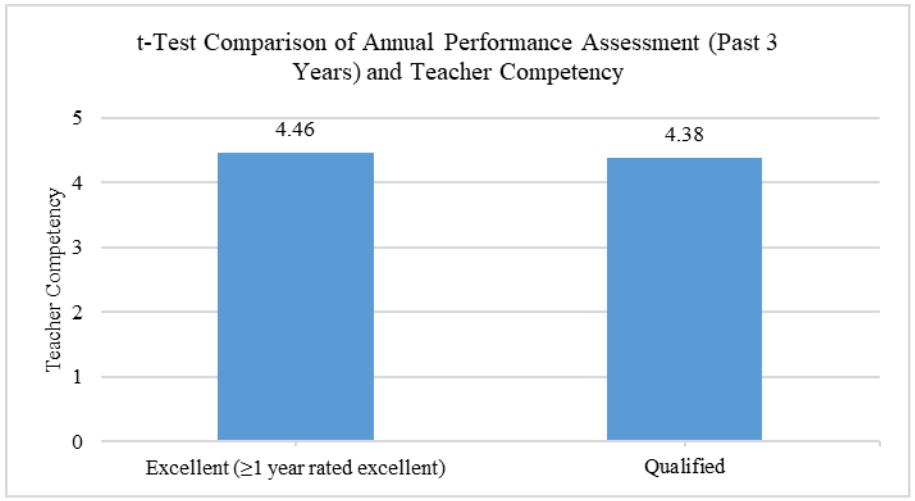
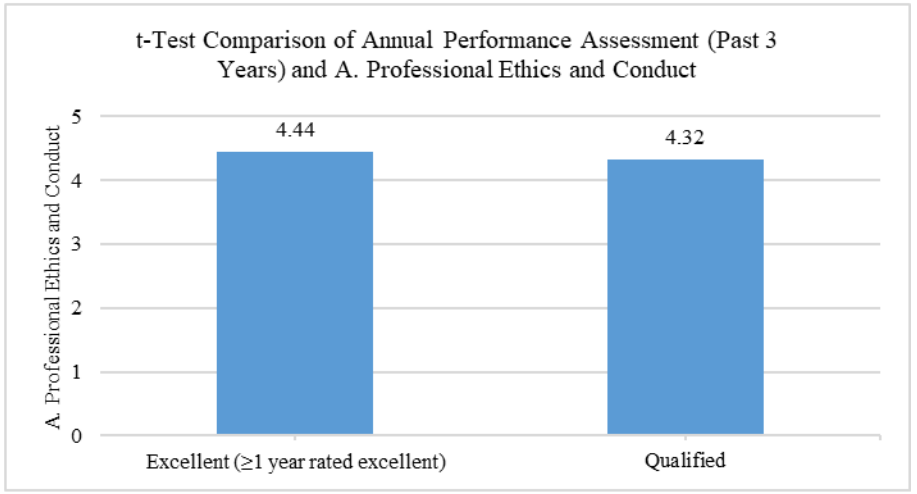
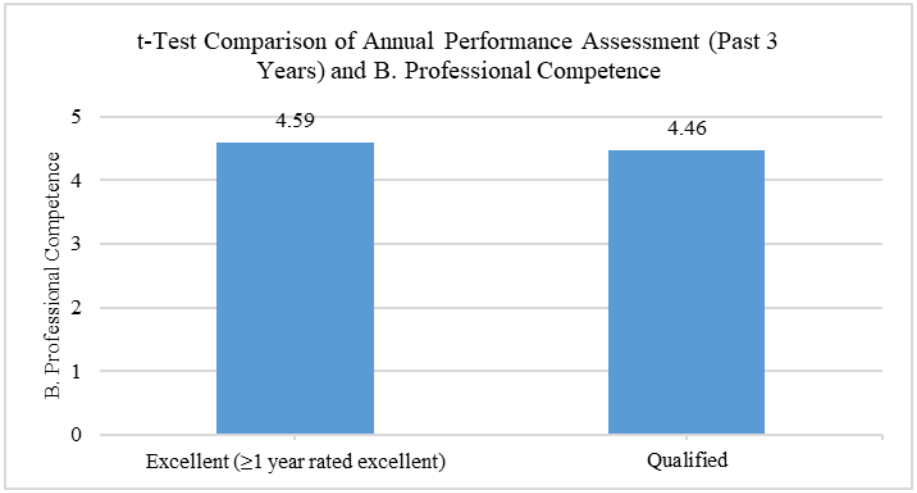


Figure D.24 Differences in medical teacher competency by discipline of highest degree in D Medical Teaching Literacy (Clinical Specialists) 7







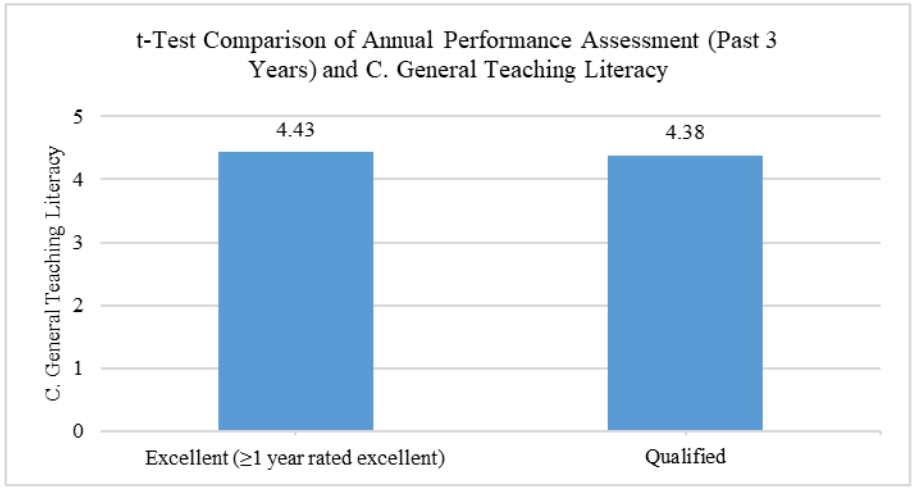
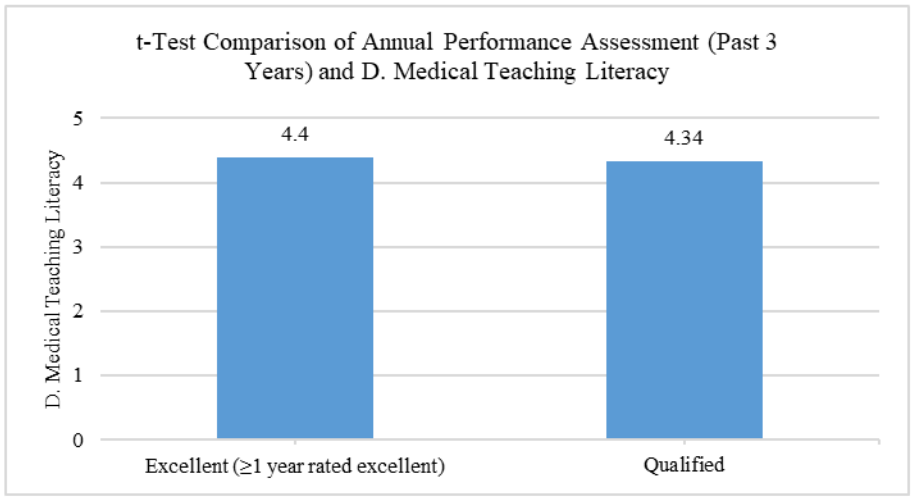
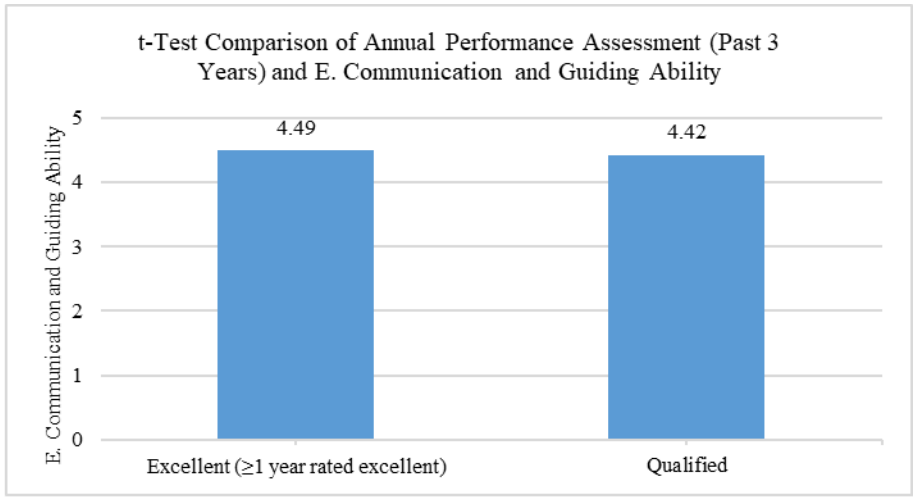
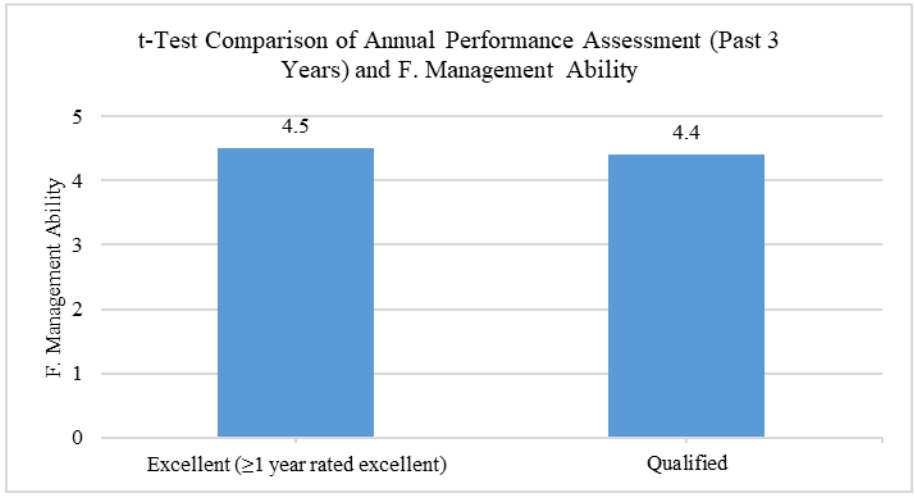


Figure D.25 Differences in medical teacher competency by annual performance assessment (Past 3 years) in overall competence, A professional ethics and conduct, B professional competence, C general literacy







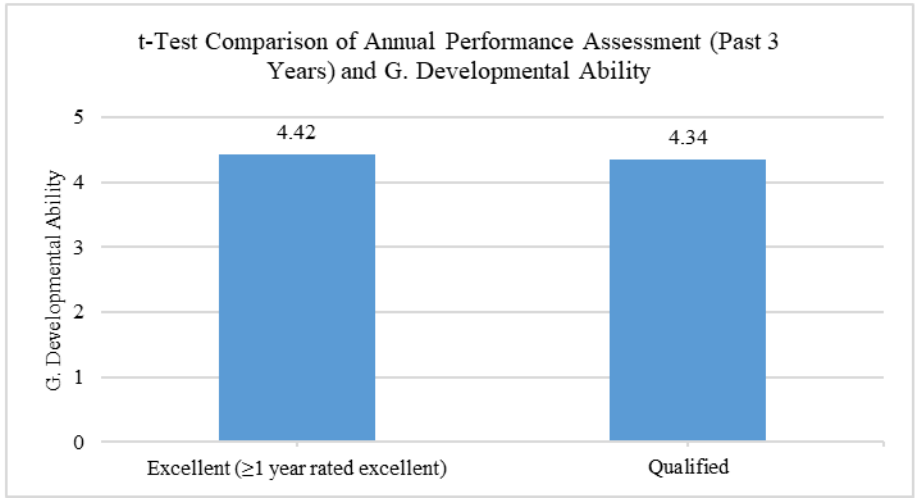


Figure D.26 Differences in medical teacher competency by annual performance assessment (Past 3 years)

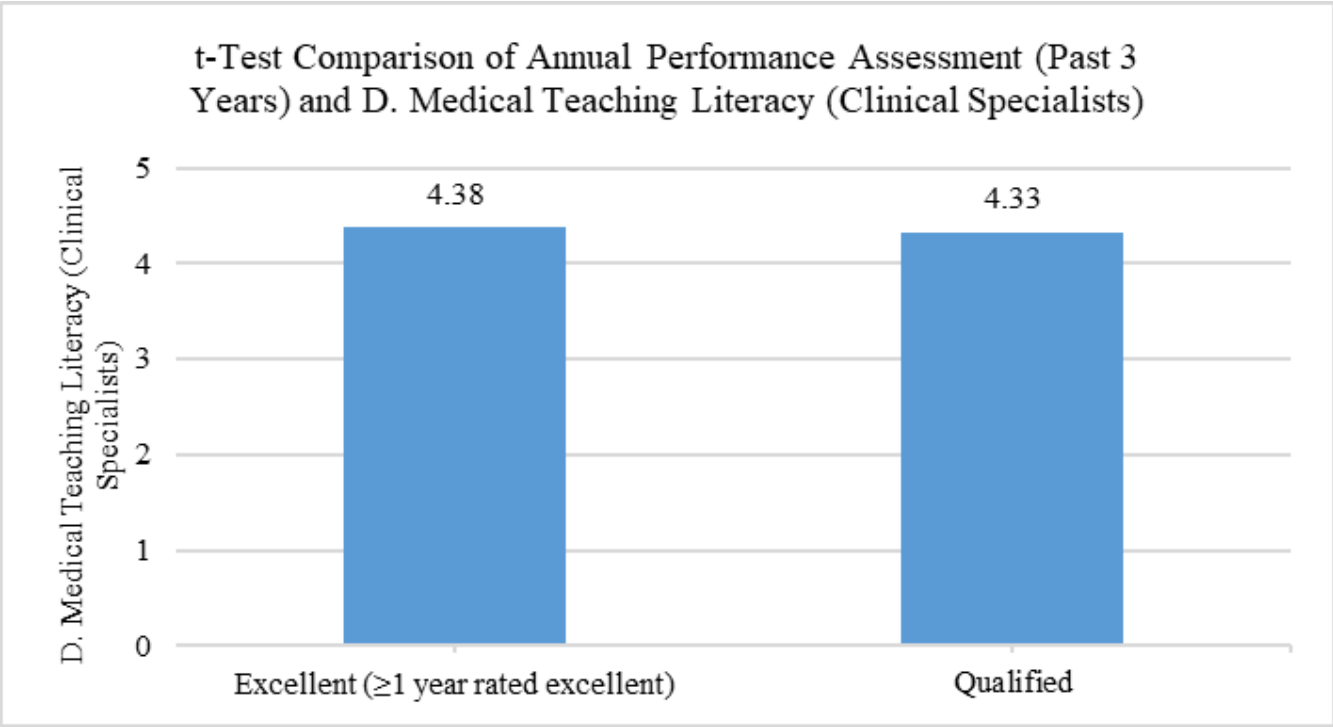


Figure D.27 Differences in medical teacher competency by annual performance assessment (Past 3 years) in D Medical Teaching Literacy (Clinical Specialists) 7

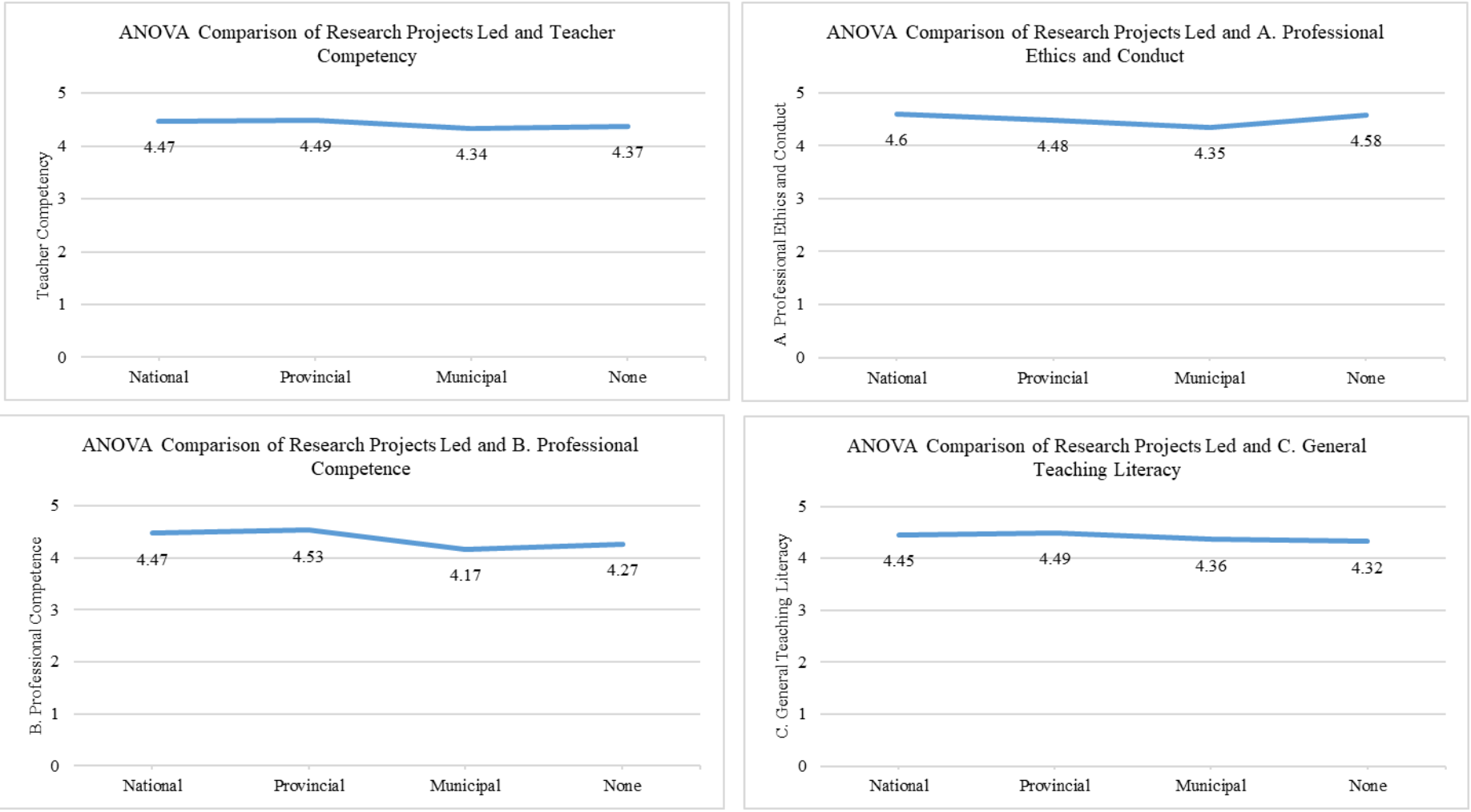


Figure D.28 Differences in medical teacher competency by leadership of research projects in overall competence, A professional ethics and conduct, B professional competence, C general literacy

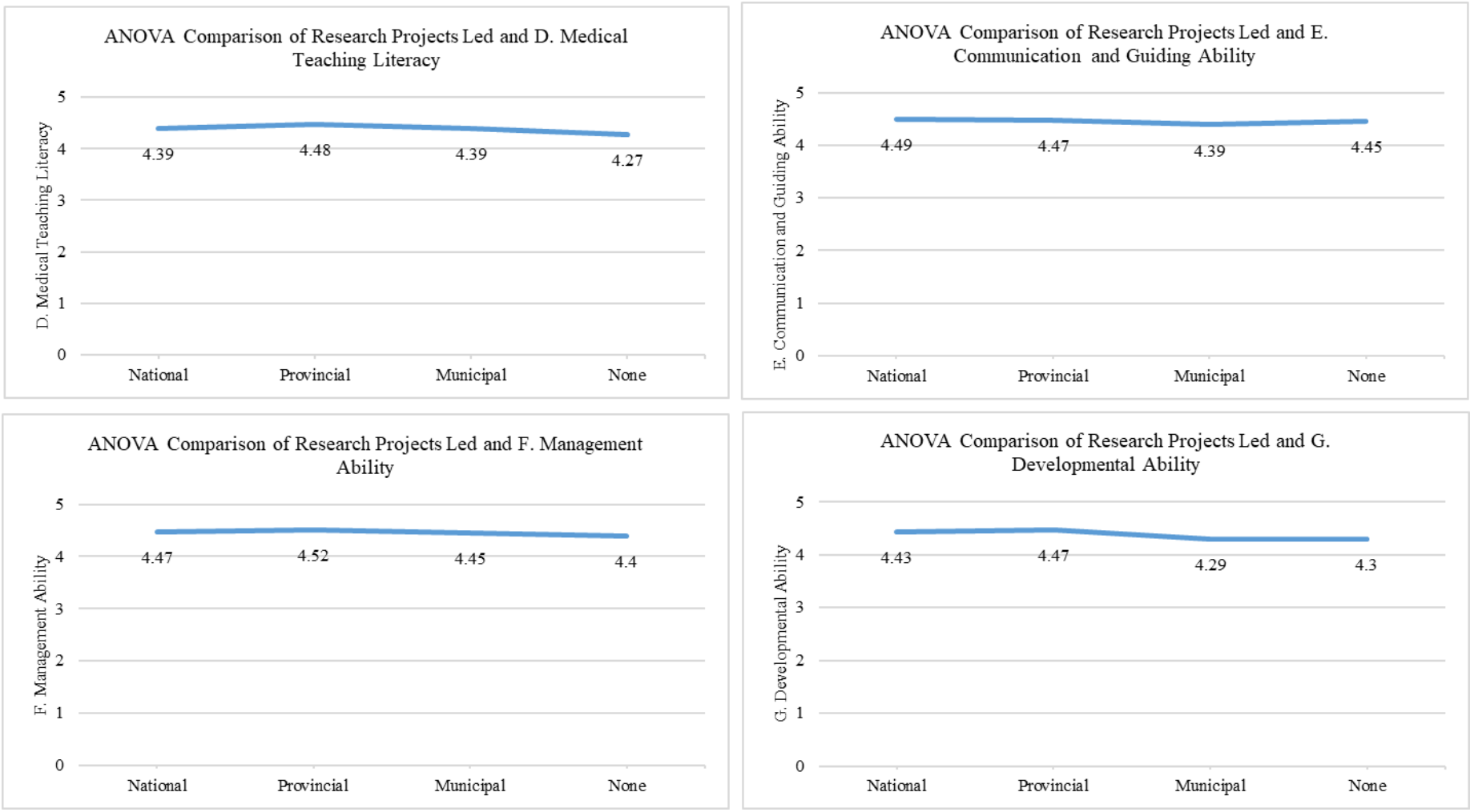


Figure D.29 Differences in medical teacher competency by leadership of research projects in D Medical Teaching Literacy, E communication and guiding ability, F management ability, G developmental ability

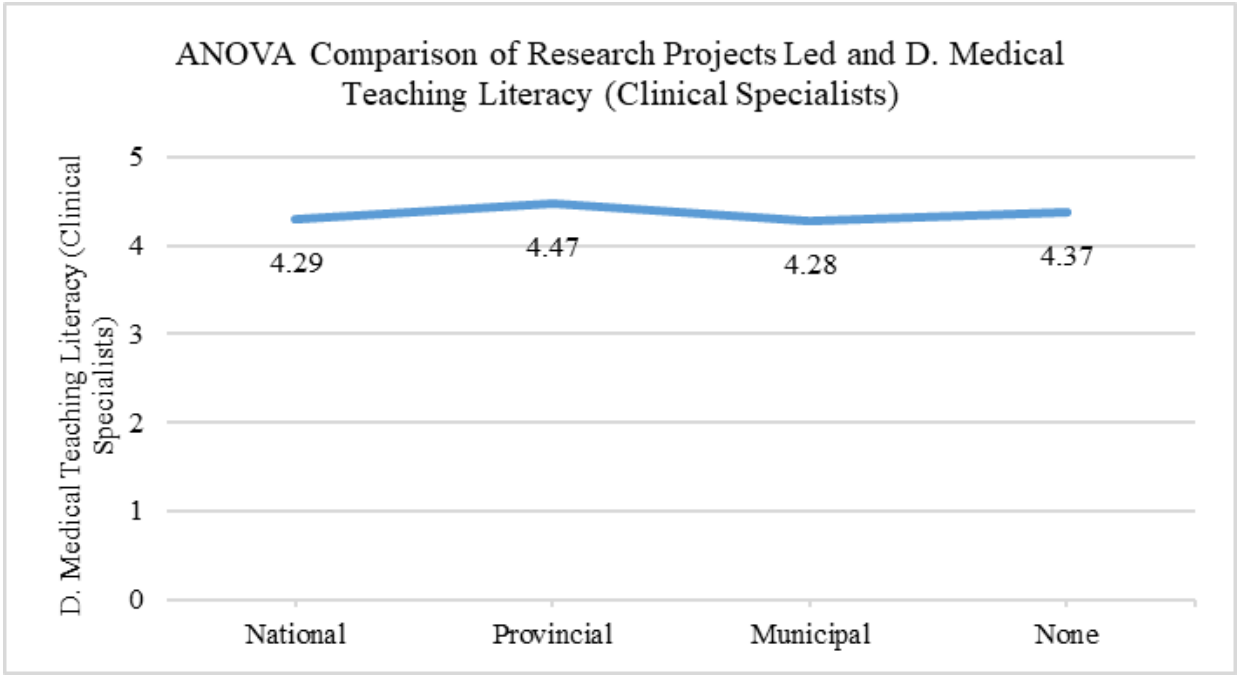


Figure D.30 Differences in medical teacher competency by leadership of research projects in D Medical Teaching Literacy (Clinical Specialists) 7