Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Embedding career development into clinical clerkships: an action research project with a cross-sectional mixed-methods evaluation among Chinese medical students

Shanzhi Yi[1]

yicoco1986@gmail.com

Zhengzhou Health College

Research Article

Keywords: career development, clinical clerkship, vocational medical education, action research, mixed methods, professional identity, reflective practice

Posted Date: November 10th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11099288/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Embedding career development into clinical clerkships: an action research project with a cross-sectional mixed-methods evaluation among Chinese medical students

Shanzhi Yi[1]

[1]Zhengzhou Health College, Zhengzhou 450064, Henan, China

*Corresponding author: Shanzhi Yi, Email: yicoco1986@gmail.com

Abstract

Background: In China, three-year vocational medical programmes supply much of the grassroots health workforce, yet career support is confined to classrooms and absent from clinical clerkships—a "functional isolation" contributing to indecisive career choices and workforce mismatch. We report the implementation of a career-embedded clerkship support system and a descriptive evaluation of students' career development after a 16-week clerkship.

Methods: Using action research (four 4-week plan–act–observe–reflect cycles), we implemented a structured Career Development Log (task record, career reflection, competency evidence, mentor feedback) and a tri-mentor mechanism (clinical preceptor, career mentor, industry role model) in three tertiary hospitals and five community health centres. A cross-sectional mixed-methods evaluation comprised a survey of 1,000 final-year students (12 Likert items in three dimensions; two open-ended questions), 37 student interviews, and process records. Non-parametric tests with effect sizes were primary; open responses were LLM-assisted coded; interviews were thematically analysed. No causal inference was attempted.

Results: Internal consistency was excellent (α=0.950). Self-perceived competence (3.92) and professional identity (3.83) exceeded career decision-making readiness (3.58); plan formulation had the lowest agreement (46.6%). Rural-origin students and women reported lower career decision-making readiness (p=0.013, p=0.007; $|r|\approx0.10$), scores rose with parental education; self-perceived competence showed no subgroup differences—all effects were small. Tertiary hospitals were the most frequently selected employer (61.8%); primary care was selected by 54.1% but ranked first by only 15.8%. In open-ended responses (n=909), 18.0% reported a specific direction and 59.6% no obvious change. Of students naming one most influential element (n=558), career mentors (57.5%) far outweighed role models (28.1%) and the log (14.3%). Process indicators improved across cycles (log submission 52%→71%; preceptor comment participation 21%→46%). Interviews revealed shifts from idealised to

realistic views, technique-first to whole-person care, and conformity to active planning.

Conclusions: Embedding structured career development support in vocational medical clerkships is feasible and acceptable, and iterative refinement was essential. Students valued human guidance—especially career mentors—over the reflective tool itself, suggesting that reflective instruments work best within responsive interpersonal feedback loops. Given the cross-sectional design, findings are descriptive; controlled, longitudinal studies are needed.

Keywords: career development; clinical clerkship; vocational medical education; action research; mixed methods; professional identity; reflective practice

Background

The final-year clinical clerkship is widely regarded as a critical window in medical students' professional socialisation. Working in authentic clinical settings, novices move from peripheral observation towards fuller participation in a community of practice, and it is precisely through this graded participation that occupational identities and career horizons take shape [1,2]. Career construction theory offers a complementary lens: individuals build careers by organising their experiences into an evolving life narrative, supported by adaptability resources—concern, control, curiosity, and confidence—that can be cultivated rather than merely possessed [3,4]. Structured reflection during authentic practice is therefore a promising lever for career development, because writing converts episodic clinical experiences into a coherent vocational story [3,5–8].

In China, three-year higher vocational (junior college) medical programmes train a substantial proportion of nurses, allied health technicians, and community-level practitioners, and national policy explicitly expects medical education to cultivate not only technical competence but also sustainable career development capacity [9–11]. In practice, however, career education in most medical colleges is delivered as a standalone classroom course in the early years, built around lectures, tests, and generic planning worksheets, while the clerkship year is organised almost exclusively around clinical tasks and skill assessment [12]. The result is a structural "functional isolation": the phase in which students encounter real occupational worlds for the first time is precisely the phase in which formal career support disappears. Prior Chinese studies describe the consequences—herd-like choices in which students follow peers into popular specialties or cities without exploring fit, low decision clarity at graduation, and a persistent gap between graduates' preference for large urban hospitals and the staffing needs of primary care [13–17].

Three research gaps follow. First, although career adaptability has been validated among Chinese college students and shown to be amenable to structured interventions [18–20], this literature has rarely been connected to the design of clinical practica. Second, reflective logs in health professions education have been studied mainly as tools for critical thinking, humanistic competence, or portfolio-based assessment [21–24], seldom as instruments of career exploration. Third, the international career-development curricula that do exist—such as specialty-choice seminars and mentoring programmes in North American medical schools—were designed for university-based doctoral-track students [25] and offer limited guidance for short-cycle vocational programmes in which students face immediate employment decisions after a single clerkship year.

To address these gaps, an education-reform project at a health sciences college in central China developed and implemented a career-embedded clerkship support system: a structured Medical Career Development Log (CDL) with three student-facing modules and mentor feedback sections; a tri-mentor mechanism linking clinical preceptors, career mentors, and industry role models; and a small set of modular career micro-courses. The system was implemented over a 16-week clerkship period (March–June 2026) and refined through four action research cycles. This paper reports the implementation process and a cross-sectional mixed-methods evaluation. We ask: (1) How feasible and acceptable was it to embed structured career development support into routine clerkships, and how did the system evolve through iterative cycles? (2) What were the levels of career decision-making readiness, professional identity, and self-perceived competence among final-year students at the end of the clerkship, and how did these differ across demographic subgroups? (3) How did students perceive the functions and relative influence of the different support elements, and what developmental processes did they describe?

Methods

Study design

The project employed an action research design following the plan–act–observe–reflect spiral [26] for process development and iterative refinement of the intervention. An embedded cross-sectional mixed-methods evaluation [27,28] was conducted at the end of the implementation period. The evaluation is explicitly cross-sectional and descriptive: it characterises implementation and end-of-clerkship student status, but does not test causal effects of the intervention; no control group or within-cohort pre–post comparison is reported

here. Qualitative reporting was informed by the COREQ checklist [29].

Setting and participants

The study was conducted at a health sciences college in central China. Clerkship bases were three tertiary hospitals and five community health service centres. Participants were all final-year students of the graduating cohort placed in these bases (n = 1,000) across seven majors: nursing (24.7%), clinical medicine (16.6%), dental medicine (15.6%), rehabilitation technology (9.8%), medical laboratory technology (5.2%), traditional Chinese medicine rehabilitation (4.7%), and other majors (23.4%). The survey used a cross-sectional design: an online questionnaire was distributed via class-based WeChat groups to approximately 4,500 final-year students, and 1,000 completed responses were collected. The support team comprised 12 career mentors (faculty career educators who completed a three-day training programme), 18 industry role models (practitioners with at least five years of experience, recommended by the teaching bases or through the alumni network), and the clinical preceptors at each base, of whom 28 participated in the structured journal-comment scheme.

The intervention: a career-embedded clerkship support system

Career Development Log (CDL). The CDL is a structured, rotation-aligned reflective workbook whose design integrates three theoretical anchors: the reflective cycle's progression from description to action planning [30], the career adaptability dimensions of concern, control, curiosity, and confidence [3], and a competency framework for physicians [31]. It contains three student-facing modules plus feedback sections: (1) *Clinical task record and observation*—brief structured records of key clinical events and the student's feelings, plus a deliberately low-threshold prompt to observe one staff member whose professional conduct was instructive; (2) *Career deep reflection*—guided prompts mapping onto career concern ("What did this experience teach me about my professional future?"), control ("Where did I exercise autonomous judgement?"), curiosity ("What new directions did this experience spark?"), and confidence ("Which successful experience strengthened my confidence?"), organised along professional-value, self-knowledge, and career-pathway dimensions; and (3) *Competency evidence*—students record concrete behavioural evidence (situation–task–action–result format) of capabilities such as communication, collaboration, and professional ethics. Each entry closes with preceptor and career-mentor feedback areas and a short student improvement plan. Core entries were required weekly (expected burden 10–15 minutes) and extended entries biweekly. After the implementation period, the CDL's module and item design was reviewed by a six-expert panel (specialising in medical education, nursing, career

education, and curriculum and instruction; one professor, four associate professors, and one senior experimentalist; two from external institutions) using a content-validity index procedure: each of nine design items was rated by every panellist on relevance and clarity (1–4), yielding item-level I-CVIs of 1.00 on both dimensions (S-CVI/Ave = 1.00), and 52 structured suggestions—checklist-style task options, phased use of the competency framework, SMART-format action plans, and a reduced entry frequency—were used to inform subsequent refinements of the log.

Tri-mentor mechanism. Clinical preceptors provided daily in-situ guidance and brief journal comments; career mentors held individual or small-group consultations one to two times per month, using the journal as the anchor for discussion; industry role models delivered sharing sessions and shadowing opportunities (two to three occasions per semester). Monthly tri-party meetings and an online platform with shared journal annotation were intended to reduce "information silos" among the three mentor types.

Modular career micro-courses. Four short modules (16 contact hours in total: self-exploration; the occupational world; decision-making skills; planning and management) were delivered through online videos plus biweekly on-site workshops to provide shared conceptual vocabulary for the reflections and consultations.

Iterative implementation. Implementation ran for 16 weeks (March–June 2026) in four 4-week action research cycles; problems identified, adjustments made, and resulting process indicators are reported in the Results (Section "Implementation process").

Data collection

Survey. In weeks 13–16 (June 2026), an online questionnaire was distributed via class-based WeChat groups to approximately 4,500 final-year students, and 1,000 completed responses were collected. It contained: (a) demographic items (gender, age, rural/urban origin, parental education, parental occupation); (b) 12 self-developed five-point Likert items (1 = strongly disagree, 5 = strongly agree) covering three dimensions of four items each—*career decision-making readiness* (self-awareness, goal clarity, occupational knowledge, plan formulation), *professional identity* (pride, perceived social value, willingness to invest effort, sense of belonging), and *self-perceived competence* (practical skills, communication, teamwork, professional ethics); item wordings are given in Table 2. The items were drafted by the research team from the project's theoretical framework and refined iteratively during the action-research cycles; the survey instrument itself did not undergo a separate formal content-

validity study, which we acknowledge as a limitation; (c) employment intention items (intended employer types, multi-select plus first choice; preferred work region; expected monthly salary); (d) a ranking item on the most-needed career guidance services; and (e) two open-ended questions: "Compared with before the clerkship, do you now have clearer and more definite ideas about your career plan? Please describe" (Q1), and "Among the career development log, the career mentor, and the industry role models, which influenced you most, and why?" (Q2). The full questionnaire is provided in Additional file 1 (English translation of the Mandarin original). The overall response rate was approximately 22%.

Interviews. Thirty-seven students were recruited through open invitation across majors and bases; participation was voluntary. Semi-structured interviews explored experiences with the CDL, perceptions of the three mentor types, self-perceived changes in career thinking, and suggestions for improvement. Representatives of each mentor role also participated in debriefing meetings. Interviews lasted 20–50 minutes each, were audio-recorded with participants' consent, and were transcribed verbatim in Mandarin; verbatim quotes were anonymised and translated into English for publication.

Process records. Platform logs (submission and comment rates, feedback timeliness), workshop attendance, and meeting minutes were compiled by the project team for each cycle.

Quantitative analysis

Analyses used Python 3.13 (pandas, scipy). Dimension scores were computed as the mean of the four constituent items (range 1–5); the overall score was the mean of all 12 items. The agreement rate for each item was defined as the percentage of respondents choosing 4 or 5. Because Shapiro–Wilk tests indicated substantial non-normality for all scale variables ($p < 0.001$), group comparisons were conducted primarily with non-parametric tests: Mann–Whitney U for rural/urban origin and gender; Kruskal–Wallis H for major (six groups: five largest majors plus combined "other", n = 281) and parental education (five categories), with Dunn post-hoc tests and Bonferroni adjustment. Effect sizes were reported as rank-biserial r for U tests, epsilon-squared (ε^2) for H tests, and Cramér's V for chi-square tests; parametric results (Cohen's d, η^2) are reported as sensitivity supplements. Chi-square tests (with continuity correction where applicable) examined the association of origin with primary-care employment intention and of major with intended employer types; because nine major-level tests were run without multiplicity adjustment, near-threshold p-values are interpreted cautiously. Cronbach's α was used for internal consistency. Significance was set at two-sided $p < 0.05$. One implausible

age entry (80 years) was retained in the dataset but flagged and excluded from the interpretation of age statistics.

Qualitative analysis

Both open-ended questions were classified item-by-item using LLM-assisted semantic coding—i.e., judgment of meaning rather than keyword matching—against predefined frames [32–34]: Q1 into *clearer with a specific direction*, *somewhat clearer but still vague*, *no obvious change*, and *invalid or unclassifiable*; Q2 into *career mentor*, *industry role model*, *career development log*, *combined (two or three named as equally influential)*, and *other* (including "none" and unclassifiable answers). To assess coding reliability, a stratified random subsample of approximately 10% of coded responses (n = 210) was drawn; after excluding 47 non-substantive responses (single characters or punctuation), the remaining 163 substantive responses (Q1: n = 95; Q2: n = 68) were independently reviewed by the first author. Agreement between LLM-assisted initial coding and human review was 100% (Cohen's $\kappa = 1.00$). Interview transcripts and journal excerpts were analysed thematically [35–37], with an additional classification of reflection depth into descriptive, analytical, and transformative levels consistent with Moon's model of reflective learning [38]. Findings from the survey, open-ended responses, interviews, and process records were triangulated. Quotations below are translated from Chinese and anonymised.

Ethical approval

This study was conducted as part of a routine educational quality improvement programme at the participating college. Questionnaire data were collected anonymously and participation was voluntary; returning the completed questionnaire was taken as consent to use the data for research purposes. Interview participants received an explanation of the study purpose and provided verbal informed consent before audio recording. No personally identifying information was collected, and all data were de-identified before analysis. The need for formal ethics committee approval was reviewed by the Life Science Ethics Review Committee of Zhengzhou Health College, which determined that the study did not constitute high-risk human-participant biomedical research and granted a formal waiver of ethical review in accordance with institutional policy for educational quality improvement projects (waiver no. 2023-SQLL-EC-20230915-1007-0000136, issued 27 September 2026; the scanned waiver document is provided in Additional file 2).

Results

Sample characteristics

Sample characteristics are shown in Table 1. The cohort was predominantly female (64.7%) and of rural origin (67.9%); 70.1% of students reported parental education at senior-secondary level or below. The median age was 21 years (mean 21.8, SD 3.2; excluding one flagged implausible entry, mean 21.8, SD 1.2). Nursing was the largest major (24.7%).

Table 1. Sample characteristics (n = 1,000)

Characteristic	Category	n	%
Major	Nursing	247	24.7
	Clinical medicine	166	16.6
	Dental medicine	156	15.6
	Rehabilitation technology	98	9.8
	Medical laboratory technology	52	5.2
	Traditional Chinese medicine rehabilitation	47	4.7
	Other	234	23.4
Gender	Female	647	64.7
	Male	353	35.3
Age group	≤ 20 years	222	22.2
	21 years	406	40.6
	22 years	214	21.4
	≥ 23 years	157	15.7
	Missing	1	0.1
Origin	Rural	679	67.9
	Urban	321	32.1
Parental education (highest)	Junior secondary or below	353	35.3
	Senior secondary/technical secondary	348	34.8
	Associate degree	195	19.5
	Bachelor's degree	96	9.6
	Master's degree or above	8	0.8

Scale performance and overall scores

Internal consistency was excellent: $\alpha = 0.950$ for the 12-item scale, and 0.914 (career

decision-making readiness), 0.922 (professional identity), and 0.930 (self-perceived competence) for the subscales. Item-level and dimension-level statistics are shown in Table 2. The three dimensions formed a consistent hierarchy: self-perceived competence (3.92 ± 0.62) ≥ professional identity (3.83 ± 0.65) > career decision-making readiness (3.58 ± 0.68); the overall 12-item mean was 3.78 ± 0.58 (sum 45.33 ± 6.98, range 12–60). At item level, professional ethics received the highest agreement (81.2%) and teamwork the second highest (77.4%), whereas plan formulation (46.6%) and goal clarity (51.6%) were lowest, and roughly half of respondents chose the neutral midpoint on these two items. Selected subgroup patterns included: dental medicine students showed the highest agreement on professional ethics (87.2%); medical laboratory technology students reported high agreement on communication (86.5%) but the lowest agreement on plan formulation (32.7%).

Table 2. Item-level descriptive statistics and dimension scores (n = 1,000)

Dimension	Item (abridged)	M ± SD	Agreement % (4–5)	Neutral % (3)	Disagreement % (1–2)
Career decision-making readiness	I can clearly recognise my career interests and strengths	3.66 ± 0.78	60.8	35.5	3.7
	I have clear goals for my future career direction	3.55 ± 0.77	51.6	43.6	4.8
	I understand the job content and prospects of different roles in my field	3.62 ± 0.76	57.0	39.2	3.8
	I have made detailed plans to achieve my career goals	3.50 ± 0.75	46.6	48.7	4.7
Professional identity	I feel proud of the career I will enter in this field	3.72 ± 0.75	62.4	35.1	2.5
	Professions in my field are of great value to society	3.88 ± 0.71	73.4	25.3	1.3
	I am willing to make extra efforts to become an excellent professional	3.87 ± 0.71	73.5	25.1	1.4
	In my study/practicum environment I feel professional belonging and identity	3.85 ± 0.71	73.1	24.9	2.0
Self-perceived competence	I have the basic practical skills required by my profession	3.86 ± 0.70	72.7	26.0	1.3
	I can communicate effectively with the people I serve	3.90 ± 0.69	75.6	23.2	1.2

Dimension	Item (abridged)	M ± SD	Agreement % (4–5)	Neutral % (3)	Disagreement % (1–2)
	I know how to collaborate within a work team	3.91 ± 0.67	77.4	21.4	1.2
	I understand and can abide by the professional ethics of my field	4.00 ± 0.69	81.2	17.8	1.0
Dimension score	Career decision-making readiness (items 1–4)	3.58 ± 0.68			
	Professional identity (items 5–8)	3.83 ± 0.65			
	Self-perceived competence (items 9–12)	3.92 ± 0.62			
	Overall 12-item mean	3.78 ± 0.58			

Note: Scoring 1–5 (strongly disagree to strongly agree). Cronbach's α: 0.914 (readiness), 0.922 (identity), 0.930 (competency), 0.950 (overall). 12-item sum: 45.33 ± 6.98 (range 12–60).

Between-group differences

Group comparisons are summarised in Table 3. For career decision-making readiness, students of rural origin scored lower than urban students (3.54 ± 0.67 vs 3.67 ± 0.69; U = 98,598, p = 0.013, rank-biserial r = −0.095), and women scored lower than men (3.55 ± 0.62 vs 3.65 ± 0.78; U = 102,648, p = 0.007, r = −0.101). Scores also rose with parental education (H(4) = 17.878, p = 0.001, ε^2 = 0.014); a sensitivity analysis merging the top categories ("bachelor's and above", n = 104) yielded the same direction, with the two lowest parental-education groups scoring significantly below the highest group in post-hoc tests, while the master's-and-above group (n = 8) was too small for stable estimation. By major, dental medicine students scored highest on career decision-making readiness (3.76 ± 0.66; H(5) = 20.032, p = 0.001, ε^2 = 0.015), significantly above nursing, rehabilitation technology, medical laboratory technology, and the combined "other" group in Dunn tests (all adjusted $p < 0.05$). Professional identity showed the same major pattern (dental medicine highest, 3.97 ± 0.59; H(5) = 19.284, p = 0.002, ε^2 = 0.014). In contrast, self-perceived competence did not differ significantly by origin, gender, or major (all $p \geq 0.05$), and showed only a negligible, borderline association with parental education (H(4) = 9.702, p = 0.046, ε^2 = 0.006). For professional identity by origin and by parental education, the non-parametric and parametric results were inconsistent (identity by origin: U-test p = 0.046 but t-test p = 0.125; identity by parental education: H-test p = 0.077 but ANOVA p = 0.048); these findings are therefore regarded as unstable. All statistically significant differences were small in magnitude ($|d| \leq 0.18$; $\varepsilon^2 \leq 0.015$), and we emphasise their descriptive rather than practical significance.

Table 3. Between-group comparisons of dimension scores and overall score (primary non-parametric tests)

Grouping	Outcome	Group 1 M ± SD	Group 2 M ± SD	Statistic	p	Effect size
Origin (rural n=679 / urban n=321)	Career decision-making readiness	3.54 ± 0.67	3.67 ± 0.69	U = 98,598	0.013	r = −0.095 (d = −0.181)
	Professional identity	3.81 ± 0.63	3.88 ± 0.68	U = 100,826	0.046	r = −0.075
	Self-perceived competence	3.90 ± 0.61	3.96 ± 0.65	U = 101,700	0.070	r = −0.067
	Overall 12-item mean	3.75 ± 0.57	3.83 ± 0.61	U = 100,372	0.042	r = −0.079
Gender (female n=647 / male n=353)	Career decision-making readiness	3.55 ± 0.62	3.65 ± 0.78	U = 102,648	0.007	r = −0.101 (d = −0.149)
	Professional identity	3.82 ± 0.60	3.85 ± 0.73	U = 107,456	0.108	r = −0.059
	Self-perceived competence	3.91 ± 0.59	3.94 ± 0.69	U = 111,140	0.457	r = −0.027
	Overall 12-item mean	3.76 ± 0.53	3.81 ± 0.66	U = 105,394	0.042	r = −0.077
Major (6 groups)	Career decision-making readiness	dental highest: 3.76 ± 0.66		H(5) = 20.032	0.001	$\varepsilon^2 = 0.015$
	Professional identity	dental highest: 3.97 ± 0.59		H(5) = 19.284	0.002	$\varepsilon^2 = 0.014$
	Self-perceived competence			H(5) = 4.460	0.485	$\varepsilon^2 \approx 0.000$
	Overall 12-item mean	dental highest: 3.91 ± 0.56		H(5) = 14.782	0.011	$\varepsilon^2 = 0.010$
Parental education (5 groups)	Career decision-making readiness	rises with parental education		H(4) = 17.878	0.001	$\varepsilon^2 = 0.014$
	Professional identity			H(4) = 8.445	0.077	$\varepsilon^2 = 0.004$
	Self-perceived competence			H(4) = 9.702	0.046	$\varepsilon^2 = 0.006$
	Overall 12-item mean			H(4) = 12.595	0.013	$\varepsilon^2 = 0.009$

Notes: U = Mann–Whitney U; H = Kruskal–Wallis H. Effect sizes: rank-biserial r (negative = first-listed group lower); ε^2 for H tests. Parametric results (t/ANOVA with d and η^2) are retained as sensitivity supplements; where non-parametric and parametric conclusions diverged (professional identity by origin and parental education), findings are treated as unstable. In major-group analyses the five largest majors were compared with a combined "other" group (n = 281). Dunn post-hoc (Bonferroni): dental > nursing, rehabilitation, laboratory technology, and "other" on career decision-making readiness; dental > nursing and rehabilitation on professional identity; dental >

nursing on overall mean (all adjusted $p < 0.05$).

Employment intentions and guidance needs

Employment intentions are shown in Table 4. Tertiary hospitals were the most frequently selected intended employer type (61.8% selected; 42.3% ranked first), while primary-care institutions (community or township health centres) were selected by 54.1% but ranked first by only 15.8%. County-level cities/counties (25.1%), first-tier cities (22.4%), and "no clear intention yet" (21.9%) led the preferred-region distribution; 50.2% preferred prefecture-level cities or above, and 63.7% expected a monthly salary of 4,000 CNY or more. The most-needed guidance services were résumé revision and interview coaching (29.3% ranked first; 44.1% in the top three) and specialty-choice and career planning (50.2% in the top three).

Students of rural origin were significantly more likely than urban students to include primary-care institutions among their intended employers (57.3% vs 47.4%; $\chi^2(1) = 8.669$, $p = 0.003$, Cramér's $V = 0.093$; continuity-corrected $\chi^2 = 8.273$, $p = 0.004$), although the effect size was small and the gap nearly disappeared when primary care had to be ranked first (16.5% vs 14.3%). By major, primary-care selection was highest among clinical medicine students (63.3%) and lowest among nursing students (46.2%; $\chi^2(5) = 12.231$, $p = 0.032$, $V = 0.111$), while tertiary-hospital selection was highest among medical laboratory technology students (71.2%; $\chi^2(5) = 18.648$, $p = 0.002$, $V = 0.137$); these nine major-level tests were not adjusted for multiplicity and are interpreted cautiously.

Table 4. Employment intentions and most-needed guidance services (n = 1,000)

Domain	Category	Selected %	Ranked first %
Intended employer type (multi-select)	Tertiary hospitals	61.8	42.3
	Primary care (community/township health centres)	54.1	15.8
	Secondary hospitals	46.2	9.4
	CDC/public health agencies	38.7	4.4
	Further education (degree upgrading/graduate study/abroad)	33.6	10.0
	Health-service or elder-care institutions	31.8	3.0
	Medical device/pharmaceutical companies	29.6	2.5
	Other related employers	25.5	12.0
	Kindergartens/early-childhood institutions	18.3	0.6

Domain	Category	Selected %	Ranked first %
Preferred work region (single choice)	County-level city/county	25.1	—
	First-tier cities	22.4	—
	No clear intention yet	21.9	—
	New first-tier/provincial capital cities	17.4	—
	Prefecture-level cities	10.4	—
	Townships/rural areas	2.8	—
Most-needed guidance service (ranking)	Résumé revision and interview coaching	29.3 (first) / 44.1 (top 3)	—
	Specialty-choice and career planning	18.2 (first) / 50.2 (top 3)	—
	Policy and entry-process interpretation (residency training, establishment exams, recruitment)	15.2 (first) / 48.2 (top 3)	—
	Job postings and referrals	14.2 (first) / 35.6 (top 3)	—
	Other personalised guidance	6.7 (first) / 8.2 (top 3)	—
	Licensing-exam guidance	6.6 (first) / 18.9 (top 3)	—
	Primary-care/public-health job guidance	5.0 (first) / 13.7 (top 3)	—
	Job-search mindset and stress management	2.7 (first) / 10.4 (top 3)	—
	Salary negotiation and career counselling	2.1 (first) / 8.9 (top 3)	—

Open-ended responses

Q1: Career-plan clarity compared with before the clerkship. Of 1,000 responses, 91 (9.1%) were invalid or unclassifiable; analyses below use the 909 valid responses. Only 18.0% (n = 164) described a clearer plan with a specific direction; 22.3% (n = 203) reported partial clarification; and the majority, 59.6% (n = 542), reported no obvious change. Representative statements illustrate each category. A clinical medicine student in the first category wrote: "Rotating through different departments let me experience the real value of frontline work in community health institutions, and clarified my positioning—starting as an assistant physician and building my career in primary care." A student in the second category wrote: "Compared with before, I have some new understanding of job roles and workplaces, but the longer-term pathway is still unclear." Typical "no obvious change" responses were candid about limited role exposure: "Nothing has changed, because interns mostly do very basic chores like running

errands and transporting specimens—I didn't learn much real competence," and "I still don't have a clear idea; I feel quite lost, because being an intern and having a formal job are quite different things."

Q2: Most influential support element. Among the 1,000 responses, 558 named exactly one of the three support elements as most influential: career mentors were chosen by 57.5%, industry role models by 28.1%, and the career development log by 14.3%; 62 responses (6.2%) named two or three elements as equally influential, and 380 (38.0%) were coded as "other" (mostly "none" or unclassifiable). Students who valued the mentor emphasised direction-finding and reassurance: "When I felt confused during the internship, my mentor's career-planning advice and emotional support helped me sort out my direction and corrected my one-sided views of the profession." Role models were valued for making the future concrete: "For the first time I saw the real working state of this profession—its opportunities and challenges—which broke my idealised image of it." Log supporters highlighted habit change: "Writing the log changed my one-sided view that laboratory work is just operating machines; it helped me build a habit of reviewing my experience instead of focusing only on the procedure itself." One student summarised the complementarity: "All three matter—the log is for planning, the mentor for direction, the role model as a benchmark."

Interviews: developmental processes and perceptions (n = 37)

Three shifts in professional understanding. Thematic analysis of the interviews identified three recurrent transformations. First, from *idealised* to *realistic* views of medicine: "I used to imagine doctors as legendary healers; in the wards I found they are ordinary people who get tired but keep going." Second, from *technique-first* to *whole-person care*: "I used to think medicine was just seeing patients, prescribing, and operating; now I understand it is more about responsibility, patience, and accumulated expertise—and humanistic care matters." Third, from *passive conformity* to *active planning*: "I no longer blindly chase popular specialties; I choose what actually suits me." Students anchored these shifts in emotionally salient events—receiving a patient's thankful banner ("what was seen was not my technique but my dedication"), feeling the weight of clinical responsibility ("one small mistake affects a patient's whole life"), and witnessing preceptors' endurance (a preceptor operating from morning to afternoon without lunch).

Depth of reflection. Classification of journal and interview material into three levels indicated that roughly 35% of students' reflections remained at the descriptive level, about 45%

reached the analytical level, and about 20% attained the transformative level (i.e., linking reflection to identity and career direction)—a distribution broadly consistent with established models of reflective learning [38]. A nursing student's progression was typical: from "today I met an uncooperative patient" (descriptive) to "I realise communication is not just technique but the capacity to understand others" (analytical) to "this changed how I see nursing—I may suit a high-intensity emergency setting" (transformative).

Attitudes toward the log and the unexpected role of competency evidence. Students' attitudes toward the CDL followed a U-shaped trajectory: initial resistance in roughly 40% of interviewees ("it felt like an extra burden on top of busy clinical work"), growing appreciation in about 45% after one or two rotations ("I began using it to summarise my strengths and weaknesses"), and deep identification in a minority ("I feel lucky to have had this experience"). The deep-reflection module was repeatedly described as "the hardest to write, but the most valuable." Notably, the competency-evidence module—designed as a secondary component—generated a consistent and unanticipated response: students reported discovering previously unrecognised strengths. "I never realised my patience and communication skills were core strengths until I filled in the competency-evidence section," one clinical medicine student reflected; a dental medicine student similarly "became aware of how careful I am, which I had never noticed amid the daily rush."

Perceptions of the tri-mentor mechanism. The three mentor types were perceived as functionally differentiated: clinical preceptors were ranked "most influential" by 76% of interviewees, valued for hands-on demonstration and daily professional modelling; career mentors were valued for "helping me sort out direction and make plans"; and role models for "letting me see what I could become." Two structural tensions were repeatedly described: information silos ("there is almost no information shared among my mentors") and occasional divergence of advice ("my preceptor suggested seizing a job offer, while my career mentor suggested further study"). Some students converted such divergence into decision practice—weighing common ground between advisors—but others experienced it as added confusion. Regarding specialty direction, 48% of interviewees reported having determined a concrete direction (e.g., cardiology, emergency care), 32% described themselves as still exploring with clearer criteria, and 20% reported wavering because the clerkship had exposed real difficulties of the profession; these figures are interview-derived impressions and are not survey statistics.

Implementation process across four action research cycles

Process indicators evolved across the four cycles as follows. **Cycle 1 (weeks 1–4)** revealed a low submission rate (52% against an 80% expectation), shallow records ("intravenous infusion × 5" style entries), and an almost untouched observation prompt. Adjustments—model entries, a reworded one-line observation prompt ("a staff member I noticed today whose conduct was worth learning"), and reduced frequency of extended entries—raised submission to 71% by week 4. **Cycle 2 (weeks 5–8)** targeted the mentor layer: preceptor comment participation was only 21% (6 of 28 preceptors), attributed to role-boundary perceptions and uncertainty about what to write; simplifying the comment to "signature plus one sentence," linking comments to teaching-assessment records, and setting a weekly minimum raised participation to 46% by week 8. **Cycle 3 (weeks 9–12)** addressed reflection depth by adding scaffolded prompts and replacing ineffective peer review with curated anonymous exemplars; 65% of students subsequently evaluated deep reflection as "the most difficult but most valuable" part, and mentor feedback timeliness rose from roughly 40% to above 75% after time-limit rules and tracking were introduced. **Cycle 4 (weeks 13–16)** consolidated the system; feedback timeliness remained above 85%, and platform records indicated that over 90% of students maintained regular completion in the final cycle. Participation followed a U-shaped curve across the semester, dipping when clinical workload peaked and recovering as mentor linkage and exemplar displays increased perceived value. Students' post-implementation suggestions focused on an electronic version, more worked examples, and more frequent mentor interaction.

Discussion

This project embedded a structured career development support system—three-module reflective log, tri-mentor mechanism, and micro-courses—into vocational medical clerkships, refined it through four action research cycles, and evaluated student career development status at the end of the clerkship using a cross-sectional mixed-methods design. Three findings merit discussion: a "readiness gap" between competency and decision-making; the prominence of human guidance over the reflective tool; and the unexpected value of competency-evidence writing. Given the design, all interpretations are associative and hypothesis-generating.

A readiness gap at the end of the clerkship. Self-perceived competence (3.92) and professional identity (3.83) were substantially higher than career decision-making readiness (3.58), and the two lowest-agreement items were plan formulation (46.6%) and goal clarity

(51.6%). In career construction terms, students had accumulated confidence resources—supported by daily participatory practice in the ward community—more readily than the concern, control, and curiosity needed to organise a coherent occupational story [3,39]. This pattern is consistent with international observations that medical students' career-development needs are poorly served by information-giving alone and require structured self-assessment and planning activities [25,40,41]. The subgroup contrasts, although small, point to the same conclusion from a different angle: readiness—rather than competency—was where rural-origin students ($r = -0.095$), women ($r = -0.101$), and students from lower parental-education backgrounds ($\varepsilon^2 = 0.014$) lagged, echoing broader evidence that family cultural and social capital shapes career decision-making resources [42–44]. The slightly greater openness of rural-origin students to primary-care employment (57.3% vs 47.4%, $V = 0.093$)—while their first-choice rankings barely differed (16.5% vs 14.3%)—suggests that willingness and actual preference may diverge, an issue of direct policy relevance for grassroots workforce planning [17,45]. The uniform absence of competency differences across subgroups may reflect the standardised, procedure-level nature of vocational clerkship training; by contrast, dental medicine students' higher readiness and identity plausibly reflect a well-bounded occupational scope and relatively autonomous career paths. We stress that all effects were small ($|d| \leq 0.18$; $\varepsilon^2 \leq 0.015$) and that near-threshold, inconsistently supported findings (professional identity by origin and parental education) should not be over-interpreted.

Human guidance outweighed the reflective tool. The starkest result was the hierarchy of perceived influence: career mentors (57.5%) far ahead of role models (28.1%) and the log itself (14.3%) among students naming a single most influential element. At first sight this seems to undercut the reflective-writing premise. A more plausible reading is that the log's effects were realised *through* interpersonal channels: consultations were explicitly anchored in journal content, and students who named the log typically described habit change ("reviewing my experience rather than focusing only on procedures")—a benefit that could be verbalised and reinforced by mentors. This is consistent with evidence that portfolio and reflective tools in medical education succeed only under enabling conditions—clear purpose, teacher engagement, and timely feedback [23,24,46,47]—and with mentoring research showing that developmental outcomes depend on relationship quality and responsiveness [48,49]. Moon's model would predict exactly this: reflection deepens when cognitive processing is coupled to feedback and social interaction [38]. The practical implication is that institutions should not deploy reflective career tools as standalone homework; they should engineer the interpersonal

loop around them—response-time standards, comment templates that lower preceptors' entry costs, and scheduled mentor–log consultations. The 76% of interviewees ranking preceptors most influential further suggests that embedding career prompts inside existing preceptor–student interactions may reach more students than parallel career-specific channels, while role models served a distinct, inspiration-oriented function consistent with social-cognitive accounts of role modelling [50–52].

Competency evidence as a self-efficacy trigger. The most unexpected finding was the affective power of the competency-evidence module. Although designed as a recording aid, it repeatedly produced "discovery" experiences—students articulated strengths they had not previously recognised ("I never realised my patience was a core strength"). In Bandura's terms, the module operationalised mastery and vicarious experience into documented personal evidence, a plausible trigger for self-efficacy beliefs [50,53,54]. This suggests a design principle for career-embedded tools: balanced attention to positive evidence, not only to gaps and problems. It also connects to professional identity formation, which is driven by enacted practice and its interpretation rather than by instruction alone [55–58]; documenting "what I did well" appears to help students author the vocational narrative that career construction theory places at the centre of adaptation [3,39].

Implementation lessons. The four cycles showed that feasibility is achieved, not assumed: submission (52%→71%), preceptor participation (21%→46%), feedback timeliness (~40%→≥85%), and reflection depth all improved through scaffolding, exemplars, threshold-lowering, and modest institutional embedding. These adjustments mirror the conditions identified for successful reflective portfolios [24] and the recognised difficulty of engaging busy clinical teachers [59–61]. The U-shaped participation curve and students' persistent requests for more mentor interaction indicate that sustaining engagement remains the binding constraint. Equally sobering, 59.6% of survey respondents reported no obvious change in career-plan clarity after 16 weeks, and only 18.0% articulated a specific direction; the interview-derived impression that 48% had determined a specialty direction is more optimistic but comes from a small, self-selected sample. A 16-week embedded system appears sufficient to shift frames of reference—students described idealised-to-realistic, technique-to-whole-person, and conformity-to-planning shifts—but insufficient, for many, to produce articulated plans, particularly where mentor contact was thin. Differentiated support for students with low baseline readiness (rural-origin, first-generation, and plan-avoidant students) seems warranted [19,62–64].

Limitations. First, the study was conducted at a single college with one cohort; transferability to other institutions and programme types is unknown. Second, the evaluation is cross-sectional: without a comparison group or within-cohort baseline, reported levels reflect end-of-clerkship status that may partly reflect clerkship experiences in general, not the embedded system; no causal inference is warranted. Third, the 12-item scale was self-developed: internal consistency was excellent, but construct and criterion validity have not been externally established, and single-source self-report is subject to common-method and social-desirability bias; retrospective framings ("compared with before the clerkship") add recall bias. Fourth, self-selection and volunteer bias are likely: participation was voluntary and the response rate of approximately 22% means participants may be more career-engaged than non-participants, potentially biasing estimates upward; this limits generalisability. The 37 interviewees were volunteers, probably with above-average involvement, so qualitative impressions (e.g., 76% preceptor influence; the 48/32/20 direction-clarity distribution) should be read as accounts of engaged students rather than cohort estimates. Fifth, open-ended responses were coded with LLM assistance; although coding followed predefined frames and human double-checking was performed (see Methods), residual misclassification is possible, and 9.1% of Q1 and 38.0% of Q2 responses could not be meaningfully classified. Sixth, multiple statistical comparisons were run without multiplicity adjustment, effect sizes were small, and one implausible age entry and the very small master's-education group (n = 8) limit demographic precision. Finally, process indicators (submission and participation rates) were self-reported by the project team rather than independently audited.

Conclusions. Embedding structured career development support into vocational medical clerkships is feasible and acceptable, and iterative, cycle-based refinement was essential to make it work. End-of-clerkship data depict students who feel competent and identify with their profession but remain under-prepared for concrete career decisions, with small but consistent readiness gaps for rural-origin students, women, and students from lower parental-education backgrounds. Students valued human guidance—especially career mentors—over the reflective log itself, and an unplanned benefit emerged from strength-documenting: competency-evidence writing appeared to trigger self-efficacy. For practice, career-embedded tools should be implemented as interfaces within responsive interpersonal feedback loops rather than as standalone assignments. For research, longitudinal and controlled designs, externally validated measures, and multi-site replication are needed to test whether career-embedded clerkships improve decision quality and, ultimately, the alignment of graduates with

workforce needs.

List of abbreviations

CDL: Career Development Log; U: Mann–Whitney U statistic; H: Kruskal–Wallis statistic; ε^2: epsilon-squared; CI: not applicable; LLM: large language model; COREQ: Consolidated Criteria for Reporting Qualitative Research.

Declarations

Ethics approval and consent to participate: This study was conducted as part of a routine educational quality improvement programme at the participating college. Questionnaire data were collected anonymously and participation was voluntary; returning the completed questionnaire was taken as consent to use the data for research purposes. Interview participants received an explanation of the study purpose and provided verbal informed consent before audio recording. No identifying information was collected. The need for formal ethics committee approval was reviewed by the Life Science Ethics Review Committee of Zhengzhou Health College, which determined that the study did not constitute high-risk human-participant biomedical research and granted a formal waiver of ethical review in accordance with institutional policy for educational quality improvement projects (waiver no. 2023-SQLL-EC-20230915-1007-0000136, issued 27 September 2026; the scanned waiver document is provided in Additional file 2).

Consent for publication: Not applicable. No identifiable individual data are presented.

Data availability statement: The datasets generated and analysed during the current study are not publicly available because they contain information that could compromise participant privacy, but are available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests.

Funding: This work was supported by the Zhengzhou Municipal Education Bureau under the 2025 Zhengzhou Local Colleges Career Education Teaching Reform Research and Practice Programme (project title: Construction of a "Career-Embedded" Medical Practical Teaching System).

Authors' contributions:S.Y. conceived and designed the study, developed the career-embedded clerkship model and the Career Development Log, implemented the four action research cycles, collected and analysed the data, drafted the manuscript, and approved the final

version for submission.

Acknowledgements: The authors thank the students, clinical preceptors, career mentors, and industry role models who participated in this project, and the teaching hospitals and community health service centres that supported implementation.

Additional files

Additional file 1: Survey questionnaire, English translation of the Mandarin original (DOCX).

Additional file 2: Ethics review waiver document issued by the Life Science Ethics Review Committee of Zhengzhou Health College, waiver no. 2023-SQLL-EC-20230915-1007-0000136, 27 September 2026 (JPG).

References

1. Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge University Press.
2. Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge University Press.
3. Savickas, M. L. (2005). The theory and practice of career construction. In S. D. Brown & R. W. Lent (Eds.), *Career development and counseling: Putting theory and research to work* (pp. 423–436). John Wiley & Sons.
4. Super, D. E., & Knasel, E. G. (1981). Career development in adulthood: Some theoretical problems and a possible solution. *British Journal of Guidance & Counselling, 9*(2), 194–201. https://doi.org/10.1080/03069888108258214
5. Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. Basic Books.
6. Sandars, J. (2009). The use of reflection in medical education: AMEE Guide No. 44. *Medical Teacher, 31*(8), 685–695. https://doi.org/10.1080/01421590903050374
7. Mann, K., Gordon, J., & MacLeod, A. (2009). Reflection and reflective practice in health professions education: A systematic review. *Advances in Health Sciences Education, 14*(4), 595–621. https://doi.org/10.1007/s10459-007-9090-2
8. Wald, H. S., Borkan, J. M., Taylor, J. S., Anthony, D., & Reis, S. P. (2012). Fostering and evaluating reflective capacity in medical education: Developing the REFLECT

rubric for assessing reflective writing. *Academic Medicine, 87*(1), 41–50. https://doi.org/10.1097/ACM.0b013e31823b55fa

9. 中共中央, 国务院. (2016). “健康中国 2030”规划纲要 [“Healthy China 2030” planning outline]. https://www.gov.cn/zhengce/2016-10/25/content_5124174.htm
10. Hou, J., Liang, Y., Tong, L., Kolars, J. C., & Wang, M. (2019). Targeted enrollment of medical students for rural China: Prospects and challenges. *Advances in Medical Education and Practice, 10*, 1021–1030. https://doi.org/10.2147/AMEP.S227028
11. Li, X., Lu, J., Hu, S., Cheng, K. K., De Maeseneer, J., Meng, Q., Mossialos, E., Xu, D. R., Yip, W., Zhang, H., Krumholz, H. M., Jiang, L., & Hu, S. (2017). The primary health-care system in China. *The Lancet, 390*(10112), 2584–2594. https://doi.org/10.1016/S0140-6736(17)33109-4
12. 苏益民, 薛宇, 熊潇. (2021). “三全育人”视域下提升医学生职业规划教育满意度路径探析——以南京医科大学为例 [Enhancing medical students' satisfaction with career planning education: A case study of Nanjing Medical University]. *南京医科大学学报（社会科学版）, 21*(6), 601–605. https://doi.org/10.7655/NYDXBSS20210615 (in Chinese)
13. Li, X., Krumholz, H. M., Yip, W., Cheng, K. K., De Maeseneer, J., Meng, Q., Mossialos, E., Li, C., Lu, J., Su, M., Zhang, Q., Xu, D. R., Li, L., Normand, S.-L. T., Peto, R., Li, J., Wang, Z., Yan, H., Gao, R., … Hu, S. (2020). Quality of primary health care in China: Challenges and recommendations. *The Lancet, 395*(10239), 1802–1812. https://doi.org/10.1016/S0140-6736(20)30122-7
14. Wen, T., Zhang, Y., Wang, X., & Tang, G. (2018). Factors influencing turnover intention among primary care doctors: A cross-sectional study in Chongqing, China. *Human Resources for Health, 16*(1), Article 10. https://doi.org/10.1186/s12960-018-0274-z
15. Zhang, L., Bossert, T., Mahal, A., Hu, G., Guo, Q., & Liu, Y. (2016). Attitudes towards primary care career in community health centers among medical students in China. *BMC Family Practice, 17*(1), Article 75. https://doi.org/10.1186/s12875-016-0472-5
16. Qing, Y., Hu, G., Chen, Q., Peng, H., Li, K., Wei, J., & Yi, Y. (2015). Factors that influence the choice to work in rural township health centers among 4,669 clinical medical students from five medical universities in Guangxi, China. *Journal of*

Educational Evaluation for Health Professions, 12, Article 40. https://doi.org/10.3352/jeehp.2015.12.40

17. Bao, M., & Huang, C. (2021). Job preferences of medical and nursing students seeking employment in rural China: A discrete choice experiment. *BMC Medical Education, 21*(1), Article 146. https://doi.org/10.1186/s12909-021-02573-3
18. Zhang, J., Talib, M. A., & Wang, J. (2025). Enhancing career adaptability and career decision-making self-efficacy through career planning education: A quasi-experimental study. *Frontiers in Psychology, 16*, Article 1612768. https://doi.org/10.3389/fpsyg.2025.1612768
19. 赵小云. (2011). *大学生生涯适应力研究——结构、特点及其与相关因素的关系* [Career adaptability of Chinese college students: Structure, characteristics, and correlates] [Doctoral dissertation, Nanjing Normal University]. (in Chinese)
20. 赵小云, 谭顶良, 郭成. (2015). 大学生生涯适应力问卷的编制 [Development of a career adaptability questionnaire for Chinese college students]. *中国心理卫生杂志, 29*(6), 463–469. (in Chinese)
21. Epp, S. (2008). The value of reflective journaling in undergraduate nursing education: A literature review. *International Journal of Nursing Studies, 45*(9), 1379–1388. https://doi.org/10.1016/j.ijnurstu.2008.01.006
22. Bjerkvik, L. K., & Hilli, Y. (2019). Reflective writing in undergraduate clinical nursing education: A literature review. *Nurse Education in Practice, 35*, 32–41. https://doi.org/10.1016/j.nepr.2018.11.013
23. Buckley, S., Coleman, J., Davison, I., Khan, K. S., Zamora, J., Malick, S., Morley, D., Pollard, D., Ashcroft, T., Popovic, C., & Sayers, J. (2009). The educational effects of portfolios on undergraduate student learning: A Best Evidence Medical Education (BEME) systematic review. BEME Guide No. 11. *Medical Teacher, 31*(4), 282–298. https://doi.org/10.1080/01421590902889897
24. Driessen, E. W., van Tartwijk, J., Overeem, K., Vermunt, J. D., & van der Vleuten, C. (2005). Conditions for successful reflective use of portfolios in undergraduate medical education. *Medical Education, 39*(12), 1230–1235. https://doi.org/10.1111/j.1365-2929.2005.02337.x

25. Navarro, A. M., Taylor, A. D., & Pokorny, A. P. (2011). Three innovative curricula for addressing medical students' career development. *Academic Medicine, 86*(1), 72–76. https://doi.org/10.1097/ACM.0b013e3181ff7dfc

26. Kemmis, S., & McTaggart, R. (1988). *The action research planner* (3rd ed.). Deakin University Press.

27. Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). SAGE Publications.

28. Fetters, M. D., Curry, L. A., & Creswell, J. W. (2013). Achieving integration in mixed methods designs—Principles and practices. *Health Services Research, 48*(6pt2), 2134–2156. https://doi.org/10.1111/1475-6773.12117

29. Tong, A., Sainsbury, P., & Craig, J. (2007). Consolidated criteria for reporting qualitative research (COREQ): A 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care, 19*(6), 349–357. https://doi.org/10.1093/intqhc/mzm042

30. Gibbs, G. (1988). *Learning by doing: A guide to teaching and learning methods*. Further Education Unit, Oxford Polytechnic.

31. Frank, J. R., Snell, L. S., ten Cate, O., Holmboe, E. S., Carraccio, C., Swing, S. R., Harris, P., Glasgow, N. J., Campbell, C., Dath, D., Harden, R. M., Iobst, W., Long, D. M., Mungroo, R., Richardson, D. L., Sherbino, J., Silver, I., Taber, S., Talbot, M., & Harris, K. A. (2010). Competency-based medical education: Theory to practice. *Medical Teacher, 32*(8), 638–645. https://doi.org/10.3109/0142159X.2010.501190

32. Gilardi, F., Alizadeh, M., & Kubli, M. (2023). ChatGPT outperforms crowd workers for text-annotation tasks. *Proceedings of the National Academy of Sciences, 120*(30), e2305016120. https://doi.org/10.1073/pnas.2305016120

33. Xiao, Z., Yuan, X., Liao, Q. V., Abdelghani, R., & Oudeyer, P.-Y. (2023). Supporting qualitative analysis with large language models: Combining codebook with GPT-3 for deductive coding. In *Companion Proceedings of the 28th International Conference on Intelligent User Interfaces* (pp. 75–78). Association for Computing Machinery. https://doi.org/10.1145/3581754.3584136

34. De Paoli, S. (2024). Performing an inductive thematic analysis of semi-structured interviews with a large language model: An exploration and provocation on the limits of

the approach. *Social Science Computer Review, 42*(4), 997–1019. https://doi.org/10.1177/08944393231220483

35. Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa
36. Braun, V., & Clarke, V. (2021). One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qualitative Research in Psychology, 18*(3), 328–352. https://doi.org/10.1080/14780887.2020.1769238
37. Byrne, D. (2022). A worked example of Braun and Clarke's approach to reflexive thematic analysis. *Quality & Quantity, 56*(3), 1391–1412. https://doi.org/10.1007/s11135-021-01182-y
38. Moon, J. A. (1999). *Reflection in learning and professional development: Theory and practice*. Kogan Page.
39. Savickas, M. L. (2013). Career construction theory and practice. In S. D. Brown & R. W. Lent (Eds.), *Career development and counseling: Putting theory and research to work* (2nd ed., pp. 147–183). Wiley.
40. Gati, I., Krausz, M., & Osipow, S. H. (1996). A taxonomy of difficulties in career decision making. *Journal of Counseling Psychology, 43*(4), 510–526. https://doi.org/10.1037/0022-0167.43.4.510
41. Zhang, J., Talib, M. A., Wang, J., & Pei, X. (2025). Career adaptability and career planning among medical students: Mediating role of career decision-making self-efficacy. *Social Behavior and Personality: An International Journal, 53*(11), 1–9. https://doi.org/10.2224/sbp.14832
42. Whiston, S. C., & Keller, B. K. (2004). The influences of the family of origin on career development. *The Counseling Psychologist, 32*(4), 493–568. https://doi.org/10.1177/0011000004265660
43. Blustein, D. L., Chaves, A. P., Diemer, M. A., Gallagher, L. A., Marshall, K. G., Sirin, S., & Bhati, K. S. (2002). Voices of the forgotten half: The role of social class in the school-to-work transition. *Journal of Counseling Psychology, 49*(3), 311–323. https://doi.org/10.1037/0022-0167.49.3.311
44. Griffin, B., & Hu, W. (2019). Parental career expectations: Effect on medical students' career attitudes over time. *Medical Education, 53*(6), 584–592. https://doi.org/10.1111/medu.13812

45. Chen, J., Wong, E. L. Y., Yu, S., Wang, Y., Cheung, A. W. L., Xu, R. H., Yeoh, E. K., & Wang, D. (2026). Perspectives on primary healthcare careers across career stages among medical students and primary healthcare providers in China's Greater Bay Area: A qualitative interview study. *BMJ Open, 16*(2), e111081. https://doi.org/10.1136/bmjopen-2025-111081

46. Telio, S., Ajjawi, R., & Regehr, G. (2015). The "educational alliance" as a framework for reconceptualizing feedback in medical education. *Academic Medicine, 90*(5), 609–614. https://doi.org/10.1097/ACM.0000000000000560

47. Van de Ridder, J. M. M., Stokking, K. M., McGaghie, W. C., & ten Cate, O. T. J. (2008). What is feedback in clinical education? *Medical Education, 42*(2), 189–197. https://doi.org/10.1111/j.1365-2923.2007.02973.x

48. Sambunjak, D., Straus, S. E., & Marušić, A. (2006). Mentoring in academic medicine. *JAMA, 296*(9), 1103–1115. https://doi.org/10.1001/jama.296.9.1103

49. Frei, E., Stamm, M., & Buddeberg-Fischer, B. (2010). Mentoring programs for medical students—A review of the PubMed literature 2000–2008. *BMC Medical Education, 10*(1), Article 32. https://doi.org/10.1186/1472-6920-10-32

50. Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice-Hall.

51. Cruess, S. R., Cruess, R. L., & Steinert, Y. (2008). Role modelling—making the most of a powerful teaching strategy. *BMJ, 336*(7646), 718–721. https://doi.org/10.1136/bmj.39503.757847.BE

52. Kenny, N. P., Mann, K. V., & MacLeod, H. (2003). Role modeling in physicians' professional formation: Reconsidering an essential but untapped educational strategy. *Academic Medicine, 78*(12), 1203–1210. https://doi.org/10.1097/00001888-200312000-00002

53. Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191–215. https://doi.org/10.1037/0033-295X.84.2.191

54. Klassen, R. M., & Klassen, J. R. L. (2018). Self-efficacy beliefs of medical students: A critical review. *Perspectives on Medical Education, 7*(2), 76–82. https://doi.org/10.1007/s40037-018-0411-3

55. Cruess, R. L., Cruess, S. R., Boudreau, J. D., Snell, L., & Steinert, Y. (2014). Reframing medical education to support professional identity formation. *Academic Medicine, 89*(11), 1446–1451. https://doi.org/10.1097/ACM.0000000000000427

56. Cruess, R. L., Cruess, S. R., & Steinert, Y. (2016). Amending Miller's pyramid to include professional identity formation. *Academic Medicine, 91*(2), 180–185. https://doi.org/10.1097/ACM.0000000000000913

57. Monrouxe, L. V. (2010). Identity, identification and medical education: Why should we care? *Medical Education, 44*(1), 40–49. https://doi.org/10.1111/j.1365-2923.2009.03440.x

58. Orsmond, P., McMillan, H., & Zvauya, R. (2022). It's how we practice that matters: Professional identity formation and legitimate peripheral participation in medical students: A qualitative study. *BMC Medical Education, 22*(1), Article 91. https://doi.org/10.1186/s12909-022-03107-1

59. Van Tartwijk, J., & Driessen, E. W. (2009). Portfolios for assessment and learning: AMEE Guide no. 45. *Medical Teacher, 31*(9), 790–801. https://doi.org/10.1080/01421590903139201

60. Driessen, E., van Tartwijk, J., & Dornan, T. (2008). The self critical doctor: Helping students become more reflective. *BMJ, 336*(7648), 827–830. https://doi.org/10.1136/bmj.39503.608032.AD

61. Steinert, Y., Mann, K., Centeno, A., Dolmans, D., Spencer, J., Gelula, M., & Prideaux, D. (2006). A systematic review of faculty development initiatives designed to improve teaching effectiveness in medical education: BEME Guide No. 8. *Medical Teacher, 28*(6), 497–526. https://doi.org/10.1080/01421590600902976

62. Koen, J., Klehe, U.-C., & Van Vianen, A. E. M. (2012). Training career adaptability to facilitate a successful school-to-work transition. *Journal of Vocational Behavior, 81*(3), 395–408. https://doi.org/10.1016/j.jvb.2012.10.003

63. van der Horst, A. C., Klehe, U.-C., Brenninkmeijer, V., & Coolen, A. C. M. (2021). Facilitating a successful school-to-work transition: Comparing compact career-adaptation interventions. *Journal of Vocational Behavior, 128*, Article 103581. https://doi.org/10.1016/j.jvb.2021.103581

64. Rudolph, C. W., Lavigne, K. N., Katz, I. M., & Zacher, H. (2017). Linking dimensions of career adaptability to adaptation results: A meta-analysis. *Journal of Vocational Behavior, 102*, 151–173. https://doi.org/10.1016/j.jvb.2017.06.003

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Additionalfile1Surveyquestionnaire.docx
- Additionalfile2Ethicswaiverdocument.pdf