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Beyond Academic Meritocracy: Mentees' Multi-Disciplinary Evaluation of aPeer Mentoring Program and the Relational-Scaffolding Mentorship Model (RSMM)

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Beyond Academic Meritocracy: Mentees' Multi-Disciplinary Evaluation of a Peer Mentoring Program and the Relational-Scaffolding Mentorship Model (RSMM)

Abstract

Background: Peer mentoring serves as a pivotal educational scaffolding architecture across undergraduate health and basic science education. However, the precise empirical mechanisms through which mentor attributes and relational dynamics shape mentee appraisal across heterogeneous disciplines remain under-theorized. This study evaluated first-year undergraduate mentees' multi-dimensional appraisal of a formal peer mentoring program and examined relational predictors of mentoring efficacy.

Methods: A descriptive-analytical cross-sectional study was conducted during the 2025–2026 academic year at Islamic Azad University, Yazd, Iran (N=90). Mentees across medicine (n=27), nursing (n=26), psychology (n=18), anesthesiology (n=13), and biology (n=6) completed a validated multi-domain instrument evaluating three functional dimensions: communicative/relational, academic support, and psychosocial support, alongside global satisfaction and open-ended feedback. Data were analyzed using independent-samples t-tests, one-way ANOVA with post-hoc LSD tests, and Pearson correlation coefficients in SPSS v27.0.

Results: The overall mentor evaluation score was 52.96±12.40 (out of 65). The communicative domain received the highest proportional appraisal (8.91±1.77), followed by academic (16.62±3.74) and psychosocial support (27.42±7.65). Global mentee satisfaction was favorable (4.44±0.90 out of 5). Encounter duration significantly and positively correlated with all mentoring

dimensions ($r=0.337$ to 0.397 0, $p \leq 0.001$), whereas meeting frequency showed no significant correlation. Mentor Grade Point Average (GPA) was not associated with overall evaluation ($r=0.082$, $p=0.443$), but exhibited a counterintuitive inverse correlation with communicative competence in the medical cohort ($r=-0.551$, $p=0.003$). Disciplinary disparities were prominent, with basic biology students reporting significantly lower scores across domains compared to clinical peers ($p<0.05$). Qualitative thematic synthesis identified mentor communication inertia (17.8%) as the primary operational vulnerability.

Conclusion: Mentoring efficacy is governed by the substantive depth of relational dialogue rather than superficial meeting frequency or mentor academic standing. Synthesizing these empirical findings with Vygotskian scaffolding and safe-failure paradigms, we propose the Relational-Scaffolding Mentorship Model (RSMM) as an actionable framework advocating for non-cognitive mentor selection, temporal engagement, and relational safety containers in higher education.

Keywords:

Mentoring; Peer Group; Education, Medical, Undergraduate; Program Evaluation; Interpersonal Relations; Psychological Safety; Educational Scaffolding; Higher Education

Introduction

The transition into higher health professions and biological sciences education represents a critical, high-stakes developmental crossroad characterized by rigorous cognitive demands, intense clinical or laboratory acculturation, and acute psychological vulnerability(1, 2). First-year undergraduate learners frequently confront unyielding curricular densities, the enigmatic "hidden curriculum," and profound evaluative anxieties-often precipitating the impostor phenomenon, emotional exhaustion, and premature attrition (3, 4). To mitigate these transitional stressors, academic institutions globally have increasingly operationalized peer mentoring programs as essential psychosocial and educational scaffolding architectures(5, 6). Unlike traditional vertical faculty-student hierarchies, near-peer mentoring leverages shared cognitive and social congruence, establishing an accessible conduit for socialization, professional identity formation (PIF), and academic resilience(7, 8).

From a theoretical vantage point, near-peer mentoring is deeply anchored in classic developmental and sociocultural paradigms. Kram's seminal mentoring framework delineates two foundational pillars: career/academic facilitation (e.g., coaching, challenging assignments) and psychosocial support (e.g., role modeling, counseling, acceptance)(9). Within modern educational psychology, these functional dimensions find profound synergy in Vygotsky's sociocultural theory and the concept of the Zone of Proximal Development (ZPD)(10) . Near-peer mentors, possessing proximal experiential distance, are uniquely positioned to gauge the mentee's emergent developmental edge, providing tailored cognitive scaffolding that enables novices to deconstruct complex conceptual schemas that they could not master autonomously(11, 12). Crucially, when grounded in relational trust and non-evaluative psychological safety(13), this peer scaffolding

creates a vital secure container. In such an environment, academic missteps and novice struggle are destigmatized, operationalizing the Safe Failure framework wherein developmental errors are transformed into productive, metacognitive learning opportunities rather than traumatizing setbacks(14, 15).

Despite the widespread implementation of peer mentoring across higher education, conventional institutional practices remain predominantly anchored in unexamined, empirical assumptions. Historically, mentor selection protocols have exhibited a ubiquitous reliance on static academic metrics-most notably, cumulative Grade Point Average (GPA) and seniority-under the tacit premise that superior cognitive mastery intrinsically translates into empathic, effective mentorship(16, 17). However, emerging evidence in cognitive psychology suggests that high academic expertise may paradoxically hinder novice-attuned communication through cognitive blind spots such as the "Curse of Knowledge" and relational perfectionism(18, 19).

Furthermore, while peer mentoring has flourished in monolithic clinical cohorts, comparative inquiries exploring how mentoring dynamics operate across heterogeneous disciplines (e.g., clinical medicine versus basic biological sciences) within the same institutional ecosystem remain scarce(15, 20). The differential socialization pathways, presence or absence of early clinical communities of practice, and bespoke micro-cultures across disciplines suggest that a standardized, "one-size-fits-all" mentoring paradigm may inadvertently alienate specific student cohorts(21, 22). Moreover, existing literature has predominantly evaluated mentoring programs through unidimensional satisfaction scores, leaving critical operational parameters-such as the substantive depth of encounter duration versus raw meeting frequency-empirically opaque(6, 23).

Local Context and Program Description

To address these transitional challenges within a multi-disciplinary health and basic science setting, the Student Peer Mentoring Program at Islamic Azad University, Yazd Branch, was launched in the 2023–2024 academic year. Participation is voluntary; incoming first-year mentees (in clusters of one to four students) are paired with senior peer mentors (second-year students and above) for at least one full semester. Dyadic matching prioritizes demographic and contextual homophily: full concordance is enforced for academic discipline and gender, while campus residency (dormitory vs. commuter status) and individual expectations stated on registration forms are aligned as closely as possible.

Mentors are recruited and selected through structured individual interviews evaluating interpersonal aptitude, emotional intelligence, and altruistic motivation. Prior to program initiation, mentors undergo standardized training workshops addressing active listening, constructive feedback, non-evaluative empathy, and professional boundaries, complemented by ongoing inter-mentor peer debriefing sessions. Structurally, dyadic contact is scheduled weekly during the initial critical transition weeks, tapering into flexible, need-based interactions thereafter. In-person engagement is formally encouraged, though dyads retain autonomy to connect via telephone or institutional digital platforms based on mutual agreement. Programmatic adherence and dyadic health are monitored through mandatory bi-weekly progress reports submitted by mentors to the institutional program coordinators.

Study Rationale and Objectives

Evaluating this multi-disciplinary initiative provides a unique empirical lens to decode the underlying relational determinants of mentoring efficacy. Specifically, by interrogating mentee feedback across communicative, academic, and psychosocial domains, analyzing disciplinary

disparities, and examining functional relational predictors (such as interaction duration versus frequency, and mentor academic standing), this study aims to evaluate first-year undergraduate mentees' experiences and appraisal of the program. Ultimately, these empirical insights are intended to inform a theoretically grounded, relational conceptual framework to guide the design, mentor selection, and operationalization of humanistic peer mentoring programs in higher education.

Materials and Methods

Study Design and Setting

This descriptive, cross-sectional study was conducted to evaluate the student peer mentoring program at the Islamic Azad University, Yazd Branch, during the first semester of the 2025–2026 academic year. The study was designed to appraise mentor performance and overall program effectiveness from the perspective of first-year mentees within an observational framework without active experimental intervention by the investigators. This study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline for cross-sectional studies (see Additional File 1).

Ethical Considerations

The study protocol was conducted in strict accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical clearance was formally reviewed and granted by the Institutional Ethics Committee of Islamic Azad University, Yazd Branch (Ethics Code: IR.IAU.YAZD.REC.1404.089). Prior to data collection, all participants were informed about the study objectives, the voluntary nature of participation, and their right to withdraw at any stage

without academic consequences. Written or digital informed consent was obtained from all participants. To safeguard participant privacy and ensure data integrity, all responses were collected anonymously, and unique alphanumeric identifiers were utilized to manage dataset confidentiality.

Participants and Sampling

The target population comprised all first-year undergraduate students (mentees) enrolled in five distinct health and biological science disciplines (Medicine, Nursing, Anesthesiology, Psychology, and Biology) who had participated in the institutional peer mentoring program for at least one full semester.

Participants were selected using a simple random sampling technique based on the official institutional registry of enrolled mentees. Following data screening for completeness and consistency, a total of 90 mentees provided complete responses and were included in the final analytical cohort.

Instrument Development and Psychometric Properties

Data were gathered using a structured, researcher-developed instrument titled the *Mentor Evaluation Questionnaire*. The questionnaire was constructed by synthesizing and adapting relevant items from two established international instruments: the Mentoring Evaluation Tool (MET) and the Munich Evaluation of Mentoring Questionnaire (MEMeQ), modified to contextualize the unique structural and cultural dynamics of the mentoring program at Islamic Azad University, Yazd (see Additional File 2).

The primary evaluation section comprised 13 items rated on a 5-point Likert scale ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree"). These items evaluated three core functional dimensions of mentorship:

- **Communicative/Relational Domain:** 2 items (theoretical score range: 2–10).
- **Academic Support Domain:** 4 items (theoretical score range: 4–20).
- **Psychosocial Support Domain:** 7 items (theoretical score range: 7–35).

Summing the 13 items yielded the *Total Mentor Evaluation Score* (theoretical range: 13–65), where higher aggregate scores denoted superior mentor performance. Additionally, a single independent global item assessed *Overall Mentee Satisfaction* on a 5-point scale; this variable was analyzed separately as an external criterion rather than incorporated into the composite score. An open-ended qualitative question was included at the conclusion of the survey to capture mentees' perceived barriers and constructive recommendations. Qualitative textual data were analyzed through inductive thematic analysis; codes were grouped into recurring themes, and frequencies and percentages were tabulated.

Content Validity and Reliability:

Content validity was established through expert evaluation by a multidisciplinary panel of seven medical education specialists who assessed each item for necessity, clarity, and domain relevance. The Content Validity Ratio (CVR) was 1.0 for all 13 items, and the item-level Content Validity Index (CVI) ranged from 0.85 to 1.0, satisfying established psychometric criteria. Internal consistency was confirmed within the study sample via Cronbach's alpha coefficient, yielding

values of 0.846 for the communicative domain, 0.895 for the academic domain, and 0.943 for the psychosocial domain, demonstrating excellent scale reliability.

Variables and Data Collection Procedure

Beyond the core evaluation domains, the questionnaire captured dyadic interactional characteristics: total encounter frequency across the semester and the average encounter duration (measured in minutes). To strictly preserve mentor privacy, encourage honest disclosure, and avoid evaluative anxiety, mentors' cumulative Grade Point Average (GPA) was collected via self-report under explicit guarantees of data confidentiality.

Statistical Analysis

Data management and statistical analyses were performed using SPSS software (Version 27.0, SPSS Inc., Chicago, IL, USA). Descriptive statistics were summarized as frequencies and percentages for categorical variables, and as means, standard deviations (SD), and minimum/maximum ranges for continuous variables.

To compare mean performance domain scores across categorical subgroups (mentee academic discipline, mentee gender, residential status [dormitory vs. commuter], mentor seniority/academic year, and meeting frequency categories), independent samples t-tests and one-way Analysis of Variance (ANOVA) were employed. In cases where ANOVA revealed statistically significant omnibus differences, post-hoc pairwise comparisons were performed using Fisher's Least Significant Difference (LSD) test. Pearson correlation coefficients (r) were computed to evaluate bivariate linear relationships between continuous predictors (encounter duration, mentor GPA, and

global satisfaction) and the evaluation domain scores. All statistical tests were two-tailed, with the threshold for statistical significance maintained at $p<0.05$.

Results

Participant Demographics and Interactional Dynamics

A total of 90 first-year undergraduate mentees successfully completed the evaluation across five academic disciplines: Medicine (n=27, 30.0%), Nursing (n=26, 28.9%), Psychology (n=18, 20.0%), Anesthesiology (n=13, 14.4%), and Biology (n=6, 6.7%). Over half of the mentees were native residents of Yazd (n=48, 53.3%), while 40.0% (n=36) resided in university dormitories, and 6.7% (n=6) were non-native commuters. Peer mentors were distributed across seniority levels, with 41.1% (n=37) in their third year, 40.0% (n=36) in their second year, and 18.9% (n=17) in their fourth year or beyond.

The self-reported cumulative Grade Point Average (GPA) of mentors averaged 17.29±1.15 (range: 13.50–19.60 out of 20). Dyads engaged in an average of 12.02±10.41 meetings throughout the semester (range: 1–50 encounters), with an average encounter duration of 17.30±10.51 minutes (range: 2–60 minutes) (**Table 1**).

Table 1. Baseline Characteristics of Study Participants and Interactional Parameters (N=90).

Variable	Category / Metric	Frequency (n) / Mean ±\pm± SD	Percentage (%) / Range
Mentee Academic Discipline	Medicine	27	30.0%
	Nursing	26	28.9%
	Psychology	18	20.0%
	Anesthesiology	13	14.4%
	Biology	6	6.7%
	Native resident (Yazd)	48	53.3%

Mentee Residency Status	Non-native (Dormitory)	36	40.0%
	Non-native (Off-campus housing)	6	6.7%
Mentor Seniority Level	Second year	36	40.0%
	Third year	37	41.1%
	Fourth year and above	17	18.9%
Mentor Cumulative GPA (Scale: 0–20)	Continuous	17.29±1.15	13.50 – 19.60
Meeting Frequency (Number of contacts)	Continuous	12.02±10.41	1.0 – 50.0
Meeting Duration (Minutes per contact)	Continuous	17.30±10.51	2.0 – 60.0

SD: Standard Deviation; GPA: Grade Point Average.

Multidimensional Mentor Evaluation and Disciplinary Differences

The mean total mentor performance score was 52.96±12.40 (out of 65), corresponding to 76.8% of the maximum theoretical score. When transformed into standardized percentages to facilitate cross-domain comparisons, the **Communicative/Relational domain** received the highest evaluation (8.91±1.77 out of 10; 86.3%), followed by the **Academic Support domain** (16.62±3.74 out of 20; 78.9%), and the **Psychosocial Support domain** (27.42±7.65 out of 35; 72.9%). Global mentee satisfaction averaged 4.44±0.90 (out of 5; 88.8%) (**Table 2**).

One-way ANOVA revealed statistically significant disciplinary variations in the Communicative domain ($F=9.87$, $p<0.001$), the Academic Support domain ($F=2.76$, $p=0.034$), and the Total Evaluation score ($F=3.16$, $p=0.018$). No significant difference was detected across disciplines in the Psychosocial Support domain ($F=2.33$, $p=0.064$). Post-hoc pairwise comparisons via Fisher's LSD indicated that medical students evaluated mentor communication significantly higher than nursing students ($p=0.044$). Furthermore, biology students reported significantly lower scores in the communicative and academic domains, as well as total evaluation, compared to all health

sciences disciplines ($p<0.05$ for all pairwise contrasts). Anesthesiology mentees reported higher total evaluation scores than nursing mentees, approaching borderline statistical significance ($p=0.050$) (**Table 2**).

Table 2. Domain-Specific and Total Mentor Performance Scores Across Academic Disciplines

Evaluation Domain (Theoretical Range)	**Overall Cohort (n=90) Mean ± SD (% Max)**	**Medicine (n=27) Mean ± SD**	**Nursing (n=26) Mean ± SD**	**Anesthesiology (n=13) Mean ± SD**	**Psychology (n=18) Mean ± SD**	**Biology (n=6) Mean ± SD**	**ANOVA (p-value)**	**Post-hoc Contrasts (LSD Significant Pairs, p<0.05)**
Communicative (2–10)	8.91±1.77 (86.3%)	9.48±1.09	8.62±1.72	9.62±0.77	9.00±1.61	5.83±3.06	<0.001	Med > Nurs; Med, Nurs, Anesth, Psych > Bio
Academic Support (4–20)	16.62±3.74 (78.9%)	17.48±2.90	15.96±4.13	17.77±2.77	16.78±3.95 16.78 \pm 3.9516.78±3.95	12.67±4.50	0.034	Med, Nurs, Anesth, Psych > Bio
Psychosocial Support (7–35)	27.42±7.65 (72.9%)	29.33±5.70	24.96±8.86	30.15±4.62	27.83±8.79	22.33±7.92	0.064	-
Total Evaluation (13–65)	52.96±12.40 (76.8%)	56.30±8.71	49.54±13.88	57.54±7.68	53.61±13.91	40.83±15.00	0.018	Med > Nurs ($p=0.041$); Anesth ≈\approx≈ Nurs ($p=0.050$); Med, Anesth, Psych > Bio

Global Satisfaction (1–5)	4.44±0.90 (88.8%)	4.70±0.54	4.23±1.07	4.69±0.63	4.39±1.04	3.83±1.17	0.108	-

Values presented as Mean ± Standard Deviation. Bold values denote statistical significance at $p<0.05$.

Sociodemographic, Seniority, and Relational Predictors

Independent samples t-tests revealed no significant differences in evaluation scores based on mentee gender across any domain or total score ($p>0.05$). Mentee residency status significantly influenced the Communicative domain ($F=3.65, p=0.030$), with post-hoc analysis demonstrating higher relational scores among native local students compared to non-native dormitory residents ($p=0.030$). Residency was not associated with academic support, psychosocial support, or total scores ($p>0.05$). Mentor seniority (second vs. third vs. fourth+ year) demonstrated no significant impact on any evaluation dimension ($p>0.05$).

Categorizing dyads into equal frequency tiers (low: 1–8 contacts vs. high: 9–50 contacts) demonstrated that higher interaction frequency was significantly associated with superior Communicative scores ($t=2.19$, $p=0.031$). However, meeting frequency did not significantly alter academic support, psychosocial support, or overall evaluation scores.

Correlation Matrix: Interaction Dynamics, Mentor GPA, and Global Satisfaction

Bivariate Pearson correlation analyses revealed that the average duration of each mentoring contact was positively and significantly correlated with all evaluation dimensions: Communicative ($r=0.397, p<0.001$), Academic Support ($r=0.353, p=0.001$), Psychosocial Support ($r=0.337, p=0.001$), and Total Evaluation score ($r=0.371, p<0.001$) (**Table 3**).

Mentor cumulative GPA exhibited no significant correlation with the overall mentor evaluation score ($r=0.082, p=0.443$). In discipline-specific sub-analyses, mentor GPA demonstrated a moderate positive correlation with academic support in Nursing ($r=0.420$, $p=0.033$), but paradoxically showed a significant negative correlation with communicative performance in Medicine ($r=-0.551, p=0.003$).

Global mentee satisfaction exhibited robust positive correlations with the Communicative domain ($r=0.795$, $p<0.001$), Academic domain ($r=0.760, p<0.001$), Psychosocial domain ($r=0.746, p<0.001$), and the Total Evaluation score ($r=0.803, p<0.001$) (**Table 3**).

Table 3. Bivariate Pearson Correlation Matrix Between Mentoring Metrics, GPA, and Domain Scores (N=90).

Variable	1	2	3	4	5	6
1. Meeting Duration (min)	1.000					
2. Mentor GPA	0.041	1.000				
3. Communicative Domain	0.397**	-0.114	1.000			
4. Academic Support Domain	0.353**	0.178	0.693**	1.000		
5. Psychosocial Domain	0.337**	0.091	0.722**	0.814**	1.000	
6. Total Evaluation Score	0.371**	0.082	0.818**	0.912**	0.974**	1.000
7. Global Mentee Satisfaction	0.362**	0.065	0.795**	0.760**	0.746**	0.803**

***p<0.01 (two-tailed).*

Qualitative Findings: Challenges and Recommendations

Qualitative narrative data were derived from the final open-ended item of the evaluation questionnaire (see Additional File 2), which prompted mentees to describe perceived challenges and constructive recommendations. Of the 90 participants, 35 mentees (38.9%) explicitly stated complete satisfaction with the program and identified no operational challenges. Twenty-six

mentees (28.9%) articulated specific constructive challenges or recommendations, while 29 mentees (32.2%) left the open-ended item blank.

Thematic analysis of the qualitative responses revealed four primary operational themes:

1. **Insufficient Mentor Follow-up and Communication Proactivity:** Reported by 16 mentees (17.8%), representing the most prevalent operational barrier. Mentees highlighted irregular contact initiation and delayed responses.
2. **Deficits in Mentor Domain Knowledge:** Reported by 5 mentees (5.6%), citing instances where senior mentors lacked updated regulatory or course-specific curricular information.
3. **Desire for Structured Interactive Platforms:** Reported by 4 mentees (4.4%), requesting institutionally organized face-to-face panels, interactive skill workshops, and collaborative group mentoring sessions.
4. **Ambiguity in Mentoring Framework and Role Boundaries:** Reported by 3 mentees (3.3%), emphasizing the need for formal role orientation and clear operational guidelines.

Individual innovative recommendations included implementing a multi-mentor model (assigning multiple senior mentors to a single mentee cohort for broader experiential perspectives; n=1, 1.1%) and institutionalizing anonymous mentee feedback systems regarding teaching faculty (n=1, 1.1%).

Discussion

Peer mentoring in health and biological sciences education represents an indispensable institutional scaffolding strategy designed to buffer transitional stress, foster socialization, and accelerate professional identity formation (PIF)(24, 25). In this cross-sectional study evaluating a

peer mentoring initiative at Islamic Azad University, Yazd, mentees reported robust overall satisfaction and favorable multidimensional appraisal of mentor performance. Intriguingly, empirical interrogation of the relational metrics revealed that the *depth and duration* of dyadic dialogue-rather than static mentor attributes such as seniority or academic standing-served as the vital catalyst of perceived mentorship efficacy. Moreover, striking interdisciplinary disparities and a paradoxical inverse association between mentor academic performance (GPA) and communicative competence among medical students emerged, challenging traditional merit-based mentor selection and offering fertile ground for theoretical advancement.

The Primacy of Relational Depth: Durational Dialogue vs. Quantitative Contact

A quintessential finding of this investigation is that average encounter duration demonstrated consistent, statistically significant positive correlations across all functional dimensions: communicative ($r=0.397$), academic ($r=0.353$), psychosocial ($r=0.337$), and global mentoring scores ($r=0.371$). Conversely, meeting frequency showed a much narrower effect, isolated solely to communicative familiarity ($p=0.031$). Within adult learning paradigms, superficial or rushed interactions fail to transition past bureaucratic check-ins. According to Vygotsky's Zone of Proximal Development (ZPD) and modern scaffolding frameworks (6, 26), genuine cognitive and emotional scaffolding necessitates sustained temporal immersion. Sustained dialogues allow the senior peer to diagnose the mentee's emergent struggle, deconstruct tacit curricular expectations, and collaboratively construct metacognitive coping strategies.

Furthermore, prolonged interaction is a prerequisite for cultivating relational trust and psychological safety(8, 12). As articulated in the Safe Failure pedagogical framework, novice learners frequently harbor profound evaluative anxiety and impostor phenomena during early

clinical and academic transitions(9). Transformative struggle only becomes "productive" rather than traumatic when the educational environment guarantees a non-punitive container(9, 10). Extended peer encounters provide the spatial-temporal latitude needed for mentees to expose vulnerability, recount academic missteps, and engage in reflective debriefing without fear of negative appraisal.

The Mentor Academic Paradox: Disentangling Competence from Empathic Attunement

Conventional academic mentorship programs universally prioritize high academic achievers (elevated GPA) during peer mentor recruitment, presuming that cognitive mastery intrinsically translates into mentoring prowess. Our findings fundamentally disrupt this conventional paradigm: overall mentor GPA exhibited no significant correlation with total evaluation performance ($r=0.082$, $p=0.443$). More provocatively, discipline-stratified sub-analyses uncovered a strong, statistically significant *negative* correlation between mentor GPA and communicative scores among medical students ($r=-0.551$, $p=0.003$), contrasting with a moderate positive correlation with academic support among nursing students ($r=0.420$, $p=0.033$).

This striking medical discrepancy can be elucidated through the lens of cognitive psychology and the "Curse of Knowledge" cognitive bias(13, 14). Senior medical peers with exceptional academic metrics often automate complex medical knowledge and cognitive scripts; consequently, they encounter difficulty reconstructing the cognitive struggles of novices traversing initial biomedical hurdles. Furthermore, hyper-academic achievers in high-stakes medical curricula are frequently constrained by perfectionistic standards and intense personal academic pressures, which can manifest as relational rigidity, reduced tolerance for novice pacing, or diminished empathic attunement(1, 27). Conversely, in nursing education-where cooperative group scaffolding, peer

debriefing, and collaborative clinical competencies are deeply integrated into experiential learning-mentors with higher academic achievement appear more adept at transmitting pragmatic study habits, clinical prioritization, and structural curricular knowledge(11, 28). These divergent trajectories suggest that selection criteria must reject universal GPA cut-offs in favor of non-cognitive, relational, and emotional intelligence evaluations (19).

Disciplinary Stratification and Professional Socialization: The Biology Vulnerability

Marked disciplinary variance was documented: mentees in medicine, anesthesiology, psychology, and nursing consistently evaluated their mentors favorably, whereas biology mentees reported significantly lower scores in communicative (5.83±3.06), academic (12.67±4.50), and total (40.83±15.00) evaluation domains ($p<0.05$ across contrasts). Lave and Wenger's theory of Situated Learning and Communities of Practice (CoP) provides profound explanatory power for this divergence(15). Health sciences students (medical, nursing, anesthesiology) enter a clinical environment characterized by acute collective responsibility, overt shared identities, structured hospital rotations, and continuous professional socialization(29). In such tightly bounded clinical communities, the utility of a senior peer who serves as a near-peer guide across the hidden curriculum is immediately recognizable and structurally validated (3).

In stark contrast, basic life sciences and biology curricula frequently lack early experiential clinical placements, physical community hubs, and collective cohorts. Biology mentees often experience what educational sociologists describe as "disciplinary atomization"-isolated classroom environments devoid of structured professional rites of passage(16). When peer mentoring models are superimposed onto basic science programs without tailoring to their distinct pedagogical architecture and community milestones, dyadic alienation ensues. As underscored in recent

inclusivity literature, institutional support systems must eschew deficit-based assumptions and actively adapt to the bespoke micro-cultures and contextual demands of heterogeneous student bodies(18).

Residential Dynamics and Relational Isolation

Residency comparisons revealed that local native students evaluated mentor communication significantly higher than non-native dormitory residents ($p=0.030$). While intuition might suggest that dormitory students-facing greater acculturative stress and geographic dislocation-would seek closer peer relationships, our data suggest potential relational friction or structural mismatch. Native local students share regional socio-linguistic and cultural capital with mentors originating from the same urban milieu, facilitating frictionless rapport. Dormitory students, navigating concurrent accommodation struggles, home sickness, and domestic independence, likely require specialized psychosocial onboarding that conventional peer mentors are neither trained nor equipped to deliver (2, 17).

A Novel Conceptual Framework: The Relational-Scaffolding Mentorship Model (RSMM)

Synthesizing our quantitative dynamics, qualitative thematic gaps (e.g., mentors' communication inertia [17.8%] and knowledge voids [5.6%]), and modern educational theory, we propose a new institutional architecture: The Relational-Scaffolding Mentorship Model (RSMM) (Figure 1).

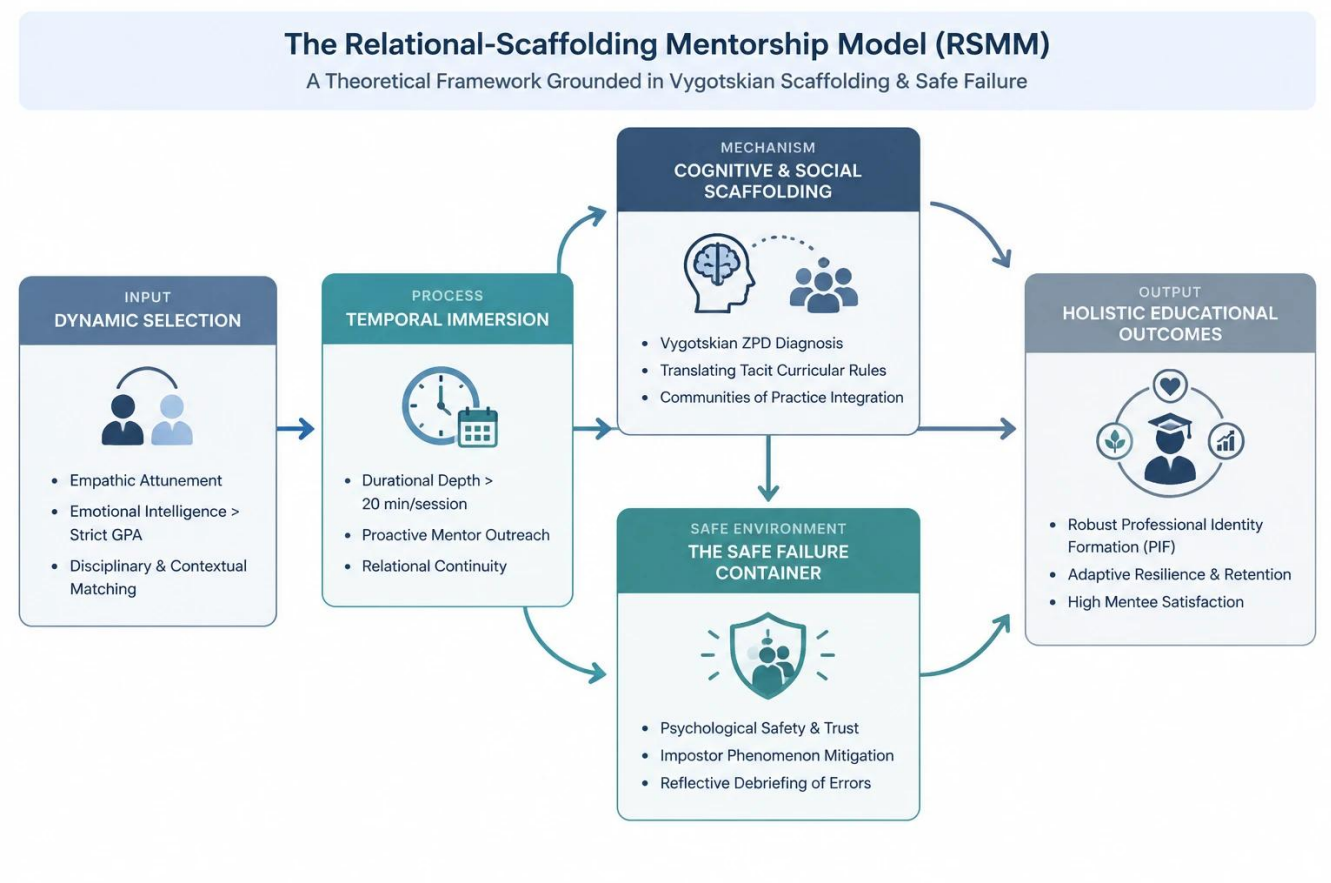


Figure 1. Schematic representation of the Relational-Scaffolding Mentorship Model (RSMM).

The RSMM reconceptualizes academic peer mentoring through three integrated tiers:

1. **Dynamic Selection & Culturally-Attuned Dyad Formation:** Dismantling reliance on academic metric gatekeeping. Recruitment emphasizes active listening, perspective-taking, and coaching attitudes. Non-native and commuter students receive deliberate pairing with culturally competent mentors.
2. **Temporal Immersion as the Currency of Growth:** Replacing open-ended, ad-hoc text messages with institutional expectations of substantive, durational encounters. Program

administrators must scaffold senior mentors with micro-skills in proactive outreach to mitigate communication inertia.

3. **The "Safe Failure" Reflective Space:** Anchored in psychological safety, the mentoring encounter functions as a protected haven where first-year novices can experience productive struggle, deconstruct errors, normalize self-doubt, and construct adaptive coping mechanisms without evaluative consequence.

Strengths and Limitations

This study possesses notable methodological strengths, including the multi-disciplinary sampling across clinical, paramedical, and basic science disciplines within a single higher education ecosystem, rigorous psychometric instrument validation (CVR/CVI), and the unearthing of non-intuitive empirical phenomena such as the GPA-communication paradox.

Nonetheless, several limitations warrant measured interpretation. First, the cross-sectional, single-center design at Islamic Azad University, Yazd, constrains causal inferences and institutional generalizability. Second, the small sample size within the biology discipline (n=6), while reflective of actual institutional matriculation cohorts, reduces statistical power for advanced subgroup modeling. Third, mentor GPAs were collected via voluntary self-report to maintain confidentiality, introducing potential social desirability or recall bias. Fourth, long-term educational outcomes-such as subsequent academic achievement, retention rates, and validated burnout metrics-were beyond the temporal scope of this semester-long investigation.

Implications for Educational Practice and Future Research

Medical and health sciences faculties must re-engineer peer mentoring frameworks. Institutional guidelines should:

- Shift mentor screening away from pure academic merit toward structured behavioral interviews assessing emotional empathy and constructive feedback delivery.
- Institute discipline-tailored micro-curricula: basic science mentors require tools to forge artificial communities of practice, whereas medical and nursing mentors need training on boundary management and cognitive desensitization.
- Embed formalized tracking of meeting duration, actively monitoring dyadic encounter depth rather than perfunctory attendance logs.

Future multi-center studies employing longitudinal mixed-methods designs and structural equation modeling (SEM) are strongly encouraged to empirically validate the predictive pathways hypothesized within the RSMM.

Conclusion

Effective peer mentoring in higher health and biological education is fundamentally underpinned by relational temporal depth rather than superficial meeting frequency or mentor academic elitism. The discovery of an inverse relationship between mentor GPA and communication efficacy in medicine emphasizes the urgent imperative to prioritize relational competencies over cognitive accolades during mentor selection. By grounding peer mentoring initiatives in structured scaffolding, psychological safety, and disciplinary attunement-as synthesized in the Relational-

Scaffolding Mentorship Model-academic institutions can foster inclusive, resilient, and humanistic learning environments.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. The study protocol was reviewed and approved by the Research Ethics Committee of Islamic Azad University, Yazd Branch (Ethics Code: IR.IAU.YAZD.REC.1404.089). Written informed consent was obtained from all participating undergraduate students prior to their inclusion in the study. The voluntary nature of participation, confidentiality, and anonymity of all collected data were strictly maintained throughout data collection and analysis.

Consent for publication

Not applicable, as this manuscript does not contain any individual person's identifiable personal data, clinical details, or identifiable images.

Availability of data and materials

The quantitative datasets (raw data in SPSS format) generated and analyzed during the current study are not publicly available due to institutional ethical restrictions, but are available from the corresponding author upon reasonable academic request.

Competing interests

The authors declare that they have no competing interests (financial or non-financial).

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Authors' contributions

- SH: Conceptualization, study design, methodology, formulation of the Relational-Scaffolding Mentorship Model (RSMM), statistical data analysis, drafting the initial manuscript, and critical revision of the manuscript.
- MHMA: Data collection, survey administration, data curation and entry, initial literature review, and final manuscript approval.

Both authors reviewed, critically revised, and approved the final manuscript.

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Supplementary Information

- **Additional File 1:** STROBE Checklist for Cross-Sectional Studies.
- **Additional File 2:** Peer Mentoring Evaluation Questionnaire.

Declaration of Generative AI and AI-Assisted Technologies in the Scientific Process

During the preparation of this manuscript, the authors utilized OpenAI's GPT-4o / GPT-5-series conversational architecture to assist in linguistic refinement, structural reorganization of drafts, and synthesis of educational conceptual frameworks. Additionally, the conceptual framework diagram (Figure 1: The Relational-Scaffolding Mentorship Model [RSMM]) was generated and visualized using OpenAI's DALL·E 3 / GPT-IMAGE generative engine via GapGPT API, based on author-designed theoretical parameters and empirical study findings.

Following generation, the authors critically reviewed, verified, edited, and approved all textual and visual contents to ensure factual accuracy, methodological rigor, and academic integrity. The authors assume ultimate and full responsibility for the entirety of the published work.

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Supplementary Files

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- Additionalfile1STROBEStatementChecklistforCrossSectionalStudies.pdf
- AdditionalFile2Questionnaire.pdf