Perceived interprofessional education outcomes across four health professions programs in Indonesia: a cross-sectional study

Abstract

Purpose: To describe health professions students' perceived contributions of a compulsory interprofessional education (IPE) course to collaborative competence, interprofessional attitudes, and practice readiness, and to examine whether these perceptions differed by demographic and academic characteristics.

Methods: This cross-sectional survey invited all 470 eligible Year 2 and Year 3 students in the nursing, midwifery, nutrition, and medical laboratory technology diploma programs of a health polytechnic in Eastern Indonesia, all of whom had taken or were taking the same 28-hour compulsory IPE course. Of 324 respondents, 307 were analyzed. Students completed a 110-item researcher-developed questionnaire comprising 3 scales. Group differences were examined using analysis of variance, Welch t tests, multivariate analysis of variance (MANOVA), and linear models with HC3 robust standard errors and Holm-adjusted pairwise comparisons.

Results: Mean scores (possible range, 1–4) were 2.49 (standard deviation [SD], 0.71) for collaborative competence, 2.50 (SD, 0.74) for interprofessional attitudes, and 2.51 (SD, 0.73) for practice readiness. In the MANOVA, professional program was the only significant factor (Pillai trace=0.179; F[9,894]=6.31; P<0.001). Nursing students reported higher adjusted scores than students in each of the other programs (vs medical laboratory technology, B=0.57 to 0.64; Holm-adjusted P<0.001). The 3 scales were highly correlated (r=0.894 to 0.923; heterotrait-monotrait ratio, 0.909 to 0.938).

Conclusion: Students' perceptions of a shared IPE course differed by professional program despite an identical curriculum, for reasons not captured in this study, and the 3 scales could not be empirically distinguished. These cross-sectional self-report findings do not establish IPE effectiveness or the superiority of any program.

Keywords: Interprofessional Education; Health Occupations Students; Surveys and Questionnaires; Cross-Sectional Studies; Health Personnel Attitudes; Interprofessional Relations

Introduction

Interprofessional education (IPE) occurs when learners from 2 or more health professions learn with, from, and about one another to support collaboration and improve health outcomes [1]. Contemporary competency frameworks emphasize values and ethics, roles and responsibilities, interprofessional communication, and teamwork as core elements of collaborative practice [2]. Recent evidence indicates that IPE commonly improves learners' perceptions, attitudes, knowledge, and collaborative skills, although higher-level behavioral and practice outcomes are evaluated less often [3,4]. Effective IPE also depends on purposeful curricular integration, appropriate teaching strategies, facilitator preparation, and opportunities for authentic interprofessional interaction [5-7]. In Indonesia, program evaluation has shown generally favorable student perceptions of IPE while also identifying areas for continued implementation improvement [8].

A recent scoping review identified a measurement gap in longitudinal IPE research, with evaluations relying heavily on self-assessed competencies and readiness while higher-level behavioral outcomes remain less frequently examined [9]. Evidence is also limited on whether students from different health professions within the same institution perceive comparable educational contributions from IPE. Program-level differences may reflect curriculum sequencing, clinical placements, professional socialization, or unequal opportunities for interprofessional interaction. Social Learning Theory provides an interpretive lens because observation, modeling, interaction, reinforcement, and participation may shape students' perceptions of collaborative capabilities and readiness [10]. This study therefore aimed to describe the perceived contribution of a compulsory IPE course to collaborative competence, interprofessional attitudes, and practice readiness among students from 4 health professions programs and to examine whether these scores differed according to age, gender, professional program, and academic level. The study focused on perceived educational contribution rather than objective competence or causal effectiveness.

Competence, attitudes, and readiness are related but conceptually distinct constructs. Competency frameworks describe the capabilities that collaborative practice requires, attitude measures capture learners' evaluations of interprofessional work, and readiness measures capture their perceived preparedness to learn or work with other professions [2,9,11]. Published reviews have also noted substantial variation in instruments and outcome definitions across IPE evaluations, which complicates comparison across programs and institutions [3,6,9,11,12]. For these reasons, the present study specified

the 3 constructs a priori as separate outcomes, analyzed them jointly to account for their expected correlation, and examined empirically whether the researcher-developed scales distinguished them.

Methods

Study design and setting

This cross-sectional survey was conducted at the Health Polytechnic of the Ministry of Health (Poltekkes Kemenkes) Kendari, Southeast Sulawesi, Indonesia. Data were collected online on October 2–4, 2025. The study examined students' perceptions of a compulsory IPE course and compared scores across demographic and academic characteristics at a single time point. Reporting follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement [13].

Educational context

At the study institution, IPE is delivered as a compulsory course in the third semester (Year 2) of the 3-year Diploma (D3) programs in nursing, midwifery, nutrition, and medical laboratory technology. The course comprises 14 sessions of 2 hours each (28 contact hours) and combines lectures, simulation, and case-based discussion in mixed-profession groups of students from the 4 programs, facilitated by an interprofessional team of lecturers. The course structure, content, and contact hours were identical across the 4 programs. Exposure therefore differed by academic level at the time of data collection: Year 3 students had completed the full course in the previous academic year, whereas Year 2 students were enrolled in the course and had attended 5 of the 14 sessions (approximately 10 contact hours). Year 3 students had also generally completed more clinical placements than Year 2 students; clinical placement exposure was not recorded at the individual level.

Participants and recruitment

The source population comprised all 490 Year 2 and Year 3 students in the 4 programs. Because the IPE course is compulsory, all students in these cohorts were eligible. After exclusion of the 20 students who had participated in the pilot test, the remaining 470 students were invited to participate (total population sampling). An online questionnaire (Google Forms) was distributed by the institution's administrative staff through class WhatsApp groups; the researchers were not involved in distribution, participation was voluntary, and providing a name was optional. Of 324 submitted responses (response rate, 68.9%), 17 were excluded because they were blank, duplicate submissions, or incomplete. The final analytic sample comprised 307 students (65.3% of invited students). No item responses were missing in the analytic dataset.

Sample size

No a priori sample-size calculation was performed because all eligible students were invited. A sensitivity power analysis indicated that the analytic sample (n=307) provided 80% power at $\alpha=0.05$ to detect a between-program effect of $f=0.19$ ($\eta^2 \approx 0.035$) in a one-way analysis of variance across 4 groups.

Questionnaire development and content review

Data were collected using a 110-item questionnaire in Bahasa Indonesia developed by the researchers on the basis of the IPEC core competencies [2], the WHO framework for action on IPE [1], and the Readiness for Interprofessional Learning Scale (RIPLS) [14], supplemented by researcher-written items reflecting the local curriculum. The questionnaire comprised 3 scales: the Interprofessional Collaborative Competence Scale (40 items, 8 domains), the Interprofessional Attitude Scale (40 items, 8 domains), and the Practice Readiness Scale (30 items, 6 domains). Each item described a collaborative capability (e.g., "I actively listen to the perspectives of interprofessional team members"), and students rated the contribution of IPE to that capability on a 4-point scale (1=no impact, 2=low impact, 3=moderate impact, 4=high impact). The 3 scales were specified a priori as separate outcomes because they operationalize conceptually distinct targets of IPE evaluation [2,11]; because they were expected to correlate, they were analyzed jointly, a single composite score was analyzed as a sensitivity analysis, and their empirical distinctiveness was examined.

Content review was conducted by 3 independent experts: 2 IPE/IPC lecturers and 1 methodologist from a faculty of teacher training and education. Each expert assessed the instrument using a structured form with 5 dichotomous (yes/no) indicators covering alignment with the study variables, clarity of wording, objectivity, practical utility, and consistency of measurement, followed by an overall recommendation. All 3 experts endorsed all 5 indicators; 2 rated the instrument as "highly recommended" and 1 as "recommended with minor revisions," which concerned the layout of the questionnaire and were incorporated before piloting. Because the review was conducted at the instrument level rather than the item level, item-level content validity indices could not be calculated. The instrument was then piloted before the main data collection in 20 Year 2 and Year 3 students from the participating programs who were not included in the main sample (Cronbach's $\alpha=0.997$).

Domain and scale scores were calculated as the mean of their constituent items (possible range, 1–4), with higher scores indicating greater perceived contribution. Interpretive bands defined before data collection (1.00–1.49, no impact; 1.50–2.49, low; 2.50–3.49, moderate; 3.50–4.00, high) are noted for completeness,

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but because the observed means lay close to the 2.50 cut-point, inferences were based on continuous scores rather than categories.

Statistical analysis

Internal consistency was assessed using Cronbach's α. Age was analyzed as a categorical variable (18, 19, 20, and 21 years; reference, 18 years) because of its narrow range, and a sensitivity analysis treated age as continuous. Unadjusted comparisons used one-way analysis of variance (ANOVA) with Tukey HSD and Games-Howell post hoc tests and Welch t tests with Hedges g and 95% confidence intervals (CIs); homogeneity of variance was examined with Levene tests. The multivariable analysis was a multivariate analysis of variance (MANOVA) including age, gender (reference, female), professional program (reference, medical laboratory technology), and academic level (reference, Year 2) simultaneously. Because Box's M test indicated heterogeneity of covariance matrices (P<0.001), Pillai's trace was used as the most robust multivariate statistic. Follow-up linear models with the same predictors used HC3 heteroskedasticity-consistent standard errors [15] because Breusch-Pagan tests indicated heteroskedasticity. Model diagnostics included residual distributions, variance inflation factors (maximum, 3.23), Cook's distance (maximum, 0.06), and Mahalanobis distances of the residuals (Supplementary Table S5). All 6 pairwise program contrasts for the 3 outcomes (18 tests) were adjusted using the Holm method [16].

Additional sensitivity analyses, conducted in response to peer review, excluded respondents who gave the same response to all 110 items (n=4) and multivariate outliers (n=8) and analyzed a single composite score of all items. Exploratory psychometric analyses, conducted post hoc, comprised the Kaiser-Meyer-Olkin index, Bartlett's test of sphericity, parallel analysis, inter-scale correlations, and the heterotrait-monotrait ratio [17]. Analyses used Python 3.12.3 with statsmodels 0.15.0, pingouin 0.7.0, and SciPy 1.17.1.

Ethics statement

Ethical approval was granted by the institutional review board of Poltekkes Kemenkes Kendari (reference No. DP.04.03/F.XXVIII.15/099/2025). All participants provided informed consent before data collection. Names provided optionally by respondents were removed before analysis and data sharing.

Results

Participant characteristics

The analytic sample comprised 307 students (Table 1). Most were aged 19 or 20 years (230/307, 74.9%), 278 (90.6%) were female, and all 4 professional programs were represented. Year 2 and Year 3 students were nearly equally distributed. Gender was patterned by program: all 76 midwifery respondents were female, and 15 of the 29 male respondents were enrolled in nursing. Age and academic level overlapped substantially: 119 of the 141 students aged 20 or 21 years were in Year 3.

Table 1. Participant characteristics (N=307)

Characteristic	Category	n (%)
Age (y)	18	51 (16.6)
	19	115 (37.5)
	20	115 (37.5)
	21	26 (8.5)
Gender	Female	278 (90.6)
	Male	29 (9.4)
Professional program	Nursing	67 (21.8)
	Midwifery	76 (24.8)
	Nutrition	73 (23.8)
	Medical laboratory technology	91 (29.6)
Academic level	Year 2	155 (50.5)
	Year 3	152 (49.5)

Perceived contribution scores

Overall mean scores were 2.49 (SD, 0.71) for collaborative competence, 2.50 (SD, 0.74) for interprofessional attitudes, and 2.51 (SD, 0.73) for practice readiness (Table 2). Domain means varied within narrow ranges (collaborative competence, 2.44 to 2.51; interprofessional attitudes, 2.45 to 2.53; practice readiness, 2.49 to 2.53). Because all scale and domain means lay close to the 2.50 cut-point between the prespecified low and moderate categories, results are reported as continuous scores rather than categorical labels.

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Table 2. Internal consistency and perceived contribution scores (N=307)

Scale/domain	Items	Cronbach α	Mean (SD)
Collaborative competence	**40**	**0.983**	**2.49 (0.71)**
Interprofessional communication	5	0.858	2.48 (0.72)
Roles and responsibilities	5	0.861	2.51 (0.73)
Teamwork	5	0.892	2.51 (0.78)
Collaborative decision-making	5	0.889	2.51 (0.76)
Collaborative values and ethics	5	0.892	2.51 (0.80)
Contextual awareness	5	0.884	2.44 (0.74)
Reflection and continuous improvement	5	0.879	2.47 (0.73)
Information and knowledge management	5	0.892	2.47 (0.76)
Interprofessional attitudes	**40**	**0.986**	**2.50 (0.74)**
Interpersonal communication skills	5	0.911	2.49 (0.79)
Empathy and social sensitivity	5	0.899	2.45 (0.77)
Openness and flexibility	5	0.893	2.52 (0.76)
Teamwork	5	0.908	2.52 (0.78)
Professionalism	5	0.912	2.53 (0.80)
Conflict resolution	5	0.908	2.49 (0.80)
Trust and reliability	5	0.883	2.51 (0.76)
Self-awareness	5	0.904	2.51 (0.77)
Practice readiness	**30**	**0.982**	**2.51 (0.73)**
Practical knowledge and skills	5	0.908	2.53 (0.75)
Interprofessional communication skills	5	0.912	2.50 (0.78)
Clinical decision-making skills	5	0.907	2.53 (0.76)
Professionalism and ethics	5	0.904	2.51 (0.78)
Readiness to work in a team	5	0.903	2.49 (0.76)
Management and organization	5	0.911	2.52 (0.78)

Items were rated 1 (no impact) to 4 (high impact); scores are item means (possible range, 1–4). SD, standard deviation.

Unadjusted comparisons

Professional program showed the largest unadjusted differences (η^2, 0.138 to 0.148; Table 3). Nursing students reported higher scores than students in each of the other 3 programs on all 3 outcomes (Tukey and Games-Howell P<0.001 for all 9 comparisons; Hedges g, 0.64 to 1.17). No other pairwise program difference was significant, except midwifery versus nutrition for interprofessional attitudes, which was significant with the Tukey test (P=0.034) but not with the Games-Howell test (P=0.056) (Supplementary Table S1). Male students reported higher scores than female students (g, 0.41 to 0.61), and Year 3 students reported higher scores than Year 2 students (g, 0.30 to 0.40). Age was associated with interprofessional attitudes (P=0.035) and practice readiness (P=0.045) but not with collaborative competence (P=0.095); these effects were small (η^2, 0.021 to 0.028).

Table 3. Unadjusted perceived contribution scores by participant characteristics (N=307)

Variable	n	Collaborative competence, mean (SD)	Interprofessional attitudes, mean (SD)	Practice readiness, mean (SD)
Age (y)				
18	51	2.35 (0.68)	2.36 (0.72)	2.37 (0.73)
19	115	2.44 (0.77)	2.41 (0.79)	2.44 (0.78)
20	115	2.54 (0.66)	2.60 (0.68)	2.59 (0.69)

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Variable	n	Collaborative competence, mean (SD)	Interprofessional attitudes, mean (SD)	Practice readiness, mean (SD)
21	26	2.74 (0.65)	2.76 (0.67)	2.79 (0.61)
ANOVA		F(3,303)=2.14; P=0.095; η^2=0.021	F(3,303)=2.90; P=0.035; η^2=0.028	F(3,303)=2.71; P=0.045; η^2=0.026
Gender				
Female	278	2.45 (0.70)	2.47 (0.74)	2.48 (0.73)
Male	29	2.87 (0.65)	2.81 (0.67)	2.78 (0.66)
Welch t test		t(35.2)=3.34; P=0.002; g=0.61 (0.22 to 0.99)	t(35.4)=2.58; P=0.014; g=0.47 (0.08 to 0.85)	t(35.6)=2.31; P=0.027; g=0.41 (0.03 to 0.80)
Professional program				
Nursing	67	2.98 (0.66)[a]	2.99 (0.67)[a]	3.00 (0.67)[a]
Midwifery	76	2.42 (0.73)	2.52 (0.78)	2.49 (0.77)
Nutrition	73	2.21 (0.64)	2.22 (0.68)	2.25 (0.65)
Medical laboratory technology	91	2.40 (0.59)	2.35 (0.60)	2.38 (0.63)
ANOVA		F(3,303)=17.60; P<0.001; η^2=0.148	F(3,303)=17.23; P<0.001; η^2=0.146	F(3,303)=16.19; P<0.001; η^2=0.138
Academic level				
Year 2	155	2.38 (0.76)	2.36 (0.79)	2.38 (0.79)
Year 3	152	2.59 (0.64)	2.65 (0.65)	2.65 (0.65)
Welch t test		t(298.1)=2.63; P=0.009; g=0.30 (0.07 to 0.52)	t(297.0)=3.53; P<0.001; g=0.40 (0.18 to 0.63)	t(296.1)=3.26; P=0.001; g=0.37 (0.14 to 0.60)

Hedges g (95% CI) compares male vs female and Year 3 vs Year 2 students; positive values indicate higher scores in male and Year 3 students. η^2, eta squared (proportion of variance explained by the grouping variable); SD, standard deviation. [a]Higher than each other program (Tukey HSD and Games-Howell, P<0.001). All pairwise program comparisons are shown in Supplementary Table S1.

Multivariable analysis

In the MANOVA including age, gender, professional program, and academic level, professional program was the only significant multivariate predictor (Pillai trace=0.179; F[9,894]=6.31; P<0.001; partial η^2=0.060). Age (P=0.924), gender (P=0.104), and academic level (P=0.152) were not significant (Table 4). In HC3-adjusted linear models, nursing students had higher adjusted scores than medical laboratory technology students for collaborative competence (B=0.57; 95% CI, 0.37 to 0.77), interprofessional attitudes (B=0.64; 95% CI, 0.44 to 0.85), and practice readiness (B=0.63; 95% CI, 0.43 to 0.84). After Holm adjustment for 18 pairwise comparisons, all differences between nursing and each other program remained significant (adjusted P≤0.009), as did the difference between midwifery and nutrition for interprofessional attitudes (adjusted P=0.028). Differences between nutrition and medical laboratory technology and between midwifery and medical laboratory technology were not significant after adjustment (adjusted P≥0.278). Full model coefficients are reported in Supplementary Table S2.

Table 4. Multivariable analysis of perceived contribution scores (N=307)

A. Multivariate tests (MANOVA)

Predictor	Pillai trace	F (df)	P	Partial η^2
Age (reference, 18 y)	0.013	0.42 (9, 894)	0.924	0.004
Gender (reference, female)	0.021	2.07 (3, 296)	0.104	0.021
Professional program (reference, MLT)	0.179	6.31 (9, 894)	<0.001	0.060
Academic level (reference, Year 2)	0.018	1.77 (3, 296)	0.152	0.018

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B. Adjusted program comparisons (HC3 linear models)

Comparison	Collaborative competence, B (95% CI); Holm P	Interprofessional attitudes, B (95% CI); Holm P	Practice readiness, B (95% CI); Holm P
Adjusted means: NUR / MID / NUT / MLT	2.96 / 2.46 / 2.20 / 2.39	2.99 / 2.56 / 2.20 / 2.34	3.00 / 2.52 / 2.23 / 2.37
Nursing vs MLT	0.57 (0.37 to 0.77); <0.001	0.64 (0.44 to 0.85); <0.001	0.63 (0.43 to 0.84); <0.001
Nursing vs midwifery	0.49 (0.25 to 0.73); <0.001	0.43 (0.18 to 0.69); 0.009	0.48 (0.23 to 0.73); 0.002
Nursing vs nutrition	0.76 (0.53 to 0.99); <0.001	0.79 (0.55 to 1.03); <0.001	0.77 (0.53 to 1.00); <0.001
Midwifery vs MLT	0.08 (−0.13 to 0.28); 0.605	0.21 (0.00 to 0.42); 0.278	0.15 (−0.06 to 0.37); 0.605
Midwifery vs nutrition	0.26 (0.04 to 0.49); 0.137	0.36 (0.12 to 0.59); 0.028	0.29 (0.05 to 0.52); 0.127
Nutrition vs MLT	−0.19 (−0.38 to 0.00); 0.278	−0.14 (−0.34 to 0.05); 0.605	−0.13 (−0.33 to 0.06); 0.605

All models included age (categorical), gender, professional program, and academic level simultaneously. Adjusted means are marginal means averaged over the observed covariate distribution. B, adjusted mean difference; HC3, heteroskedasticity-consistent standard errors; Holm P, P value adjusted for 18 comparisons (6 program pairs × 3 outcomes) using the Holm method; MID, midwifery; MLT, medical laboratory technology; NUR, nursing; NUT, nutrition; partial η^2, multivariate effect size (Pillai trace/s). Full coefficients are reported in Supplementary Table S2.

Sensitivity analyses

In additional sensitivity analyses conducted in response to peer review, the program effect remained significant and of similar magnitude when age was modeled as continuous (Pillai trace=0.179; P<0.001), after excluding 4 respondents who gave the same response to all 110 items (Pillai trace=0.173; P<0.001), and after excluding 8 multivariate outliers (Pillai trace=0.190; P<0.001). The nursing–medical laboratory technology differences ranged from 0.54 to 0.64 across these analyses. A model using a single composite score of all 110 items yielded the same pattern (nursing vs medical laboratory technology, B=0.61; 95% CI, 0.42 to 0.81) (Supplementary Table S3).

Exploratory psychometric findings

The 3 composite scores were highly correlated (r=0.894 to 0.923). Heterotrait-monotrait ratios were 0.909 to 0.938, and mean inter-item correlations within scales were 0.592 to 0.652. Parallel analysis of all 110 items suggested 2 dimensions, with the first eigenvalue accounting for 59.7% of total variance (Supplementary Table S4). These post hoc findings indicate limited empirical distinction among the 3 scales.

Discussion

Key findings

In this cross-sectional survey of 307 students from 4 health professions programs, mean perceived contribution scores for collaborative competence, interprofessional attitudes, and practice readiness were nearly identical and lay close to the midpoint of the response scale. Professional program was the only factor that remained significant in the multivariable analysis. Nursing students reported higher adjusted scores than students in each of the other 3 programs, whereas most differences among midwifery, nutrition, and medical laboratory technology students were small and did not survive adjustment for multiple comparisons. These findings describe students' perceptions of the contribution of a compulsory IPE course; they do not estimate the effectiveness of IPE, and they do not indicate that one program's IPE was superior to another's.

Interpreting the similarity of the 3 outcomes

The similarity of the 3 composite scores should be interpreted in light of the psychometric findings rather than as evidence that IPE contributed equally to 3 distinct outcomes. The composite scores were correlated at 0.894 to 0.923, the heterotrait-monotrait ratios (0.909 to 0.938) exceeded commonly used thresholds for discriminant validity [17], and scale α coefficients above 0.98 with mean inter-item correlations of 0.592 to 0.652 suggest substantial item redundancy rather than simply high reliability [18,19]. Parallel analysis likewise suggested only 2 broad dimensions across all 110 items. Taken together, these results indicate

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that the 3 scales largely captured a common general perception of the course, possibly amplified by common-method variance because all items were self-reported on the same response format at a single time point [20]. Consequently, the study cannot determine whether students perceived different contributions to competence, attitudes, and readiness, and comparisons among the 3 constructs, including the small differences among domain means, should not be interpreted. This caution is consistent with reviews that highlight heterogeneous outcome definitions and instruments in IPE evaluation and the frequent reliance on self-assessment [3,9,11,21]. The sensitivity analysis using a single composite score yielded the same program pattern, which supports treating the program finding as robust to how the scales are combined but does not resolve their distinctiveness.

Differences among professional programs

Because the IPE course had the same structure, content, and contact hours for all 4 programs, the higher scores among nursing students cannot be explained by differences in the formal dose of IPE. The difference may instead reflect factors that were not measured, including how the shared course was experienced by students from different programs, the timing and settings of clinical placements, professional socialization, the perceived relevance of interprofessional work to each profession's anticipated role, and program-specific response styles in interpreting the questionnaire. Students may also have attributed collaborative learning from clinical placements to the IPE course when rating its contribution. Reviews of IPE implementation identify learner background, authenticity of learning activities, facilitation, and institutional context as factors that shape how students experience IPE [5-7,22], and Indonesian and other Asian studies similarly report that students' readiness and perceptions vary with program and instructional context [8,23,24]. Because these studies used different instruments and IPE designs, their scores cannot be compared numerically with the present results. The program difference is therefore best regarded as a signal for further inquiry rather than as a ranking of programs or professions.

Demographic characteristics and IPE exposure

The unadjusted differences by gender, academic level, and age were attenuated after multivariable adjustment. All midwifery respondents were female, and half of the male respondents were nursing students, so the unadjusted gender difference largely reflected program composition. Age and academic level overlapped strongly, which limits the ability to separate them. Notably, Year 2 students had attended only 5 of the 14 course sessions at the time of data collection, and Year 3 students had generally completed more clinical placements. The absence of a significant adjusted difference by academic level despite this marked difference in exposure is consistent with the interpretation that scores were not closely tied to the amount of IPE received. However, the study was not designed to estimate exposure–response relationships, and differences in IPE completion and clinical experience between the 2 levels cannot be disentangled.

Theoretical perspective

Social Learning Theory provides a plausible lens because observation, modeling, interaction, and reinforcement may shape students' perceptions of collaborative practice [10]. The present survey did not measure these mechanisms, so the theory remains an interpretive framework for future research rather than an explanation supported by these data.

Implications for educational evaluation

For the study institution, the program difference supports a structured review of how the shared IPE course and subsequent clinical placements are experienced by students in each program, including learning activities, group composition, facilitation, reflection, and assessment [1,2,6,7,22]. More broadly, IPE evaluations would be strengthened by recording exposure prospectively, using instruments with established structural and discriminant validity, distinguishing students' immediate perceptions from observed collaborative behavior, and including pre-post or comparison-group designs [22,25,26].

Strengths and limitations

Strengths include a multiprofessional sample drawn from a defined population with a uniform compulsory IPE course, multivariable adjustment with robust standard errors, correction for multiple comparisons, and several sensitivity analyses. Several limitations should be considered. First, the cross-sectional design, absence of a non-IPE comparison group, and lack of pre-post measurement preclude causal inference. Second, all outcomes were self-reported perceptions of contribution rather than objective measures, and students may have been unable to separate the contribution of IPE from that of clinical placements, which were not recorded at the individual level. Third, Year 2 students had completed only part of the course, so their scores reflect partial exposure. Fourth, the study was conducted at a single institution, participation was voluntary through an online questionnaire with a response rate of 68.9%, and the gender distribution was highly imbalanced, which limit generalizability and may introduce selection bias. Fifth, the researcher-developed questionnaire has not been validated: content review was conducted at the instrument level rather than the item level, the psychometric analyses were exploratory and post hoc, ordinal items were analyzed as continuous scores, and the 3 scales showed insufficient discriminant validity. Established

instruments such as the RIPLS have their own validation histories that cannot be transferred to a new questionnaire [14,27-29]. Future work should refine and shorten the item pool, assess item-level content validity, and test the proposed structure using factor-analytic methods suitable for ordinal data in an independent sample, together with convergent validity against established instruments and measurement invariance across programs.

Conclusion

Students from 4 health professions programs reported similar perceived contributions of a compulsory IPE course to collaborative competence, interprofessional attitudes, and practice readiness, but the high correlations among the researcher-developed scales indicate that these outcomes could not be empirically distinguished. Professional program was the only factor independently associated with perceived contribution scores, with nursing students reporting higher scores than students in the other programs despite an identical IPE curriculum. These findings do not establish IPE effectiveness or the superiority of any program; rather, they indicate that students' perceptions of a shared IPE course may differ by program for reasons not captured in this study. Future longitudinal studies should measure IPE and clinical exposure prospectively, use validated instruments, and include objective or performance-based outcomes.

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