Regular Article

Teachers' perceptions of interprofessional collaboration in higher education: Contributions to a framework

Atle Ødegård [a], Jon Strype [f], Susanne Lindqvist [d], Frøydis Vasset [a,*], Elisabeth Willumsen [c], Hans Petter Iversen [a], Petter Laake [a,e], Synnøve Hofseth Almås [b]

[a] *Department of Health and Social Care, University College in Molde, Briteveien 2, 6410, MOLDE, Norway*
[b] *Department of Health Science Aalesund, Faculty of Medicine and Health Sciences, Norwegian University of Science and Technology, Larsgårdsvegen 2, 6009, ÅLESUND, Norway*
[c] *Faculty of Health Sciences, University of Stavanger, Post Box 8600, 4036, STAVANGER, Norway*
[d] *Faculty of Social Sciences, University of East Anglia, Norwich Research Park, NORFOLK, NR4 7TJ, UK*
[e] *Oslo Centre for Biostatistics and Epidemiology, Department of Biostatistics, University of Oslo, OSLO, Norway*
[f] *Oslo New University College ONH, Lovisenberggata 13, 0456, OSLO, Norway*

1. Introduction

Interprofessional Education (IPE) is advocated by many as an approach to equip our health and social care workforce for working together so that they can meet peoples' increasingly complex and changing care needs (Frenk et al., 2010 Reeves, 2016; Reeves et al., 2016; Dow & Thibault, 2017; Illingworth & Chelvanayagam, 2017; Thistlethwaite et al., 2019). The agenda driving IPE is supported and emphasized at global level (World Health Organisation, WHO, 2010 & 2022). A commonly used definition of IPE is *when students from two or more professions learn about, from, and with each other* (WHO, 2013). In Norway, for example, the government has since the 1980's requested that educational programmes should place more emphasis on IPE by offering students across programmes opportunities to engage in interprofessional learning (IPE) both on campus and on placements in the clinical setting (White Paper 47, 2008–2009). In 2017, the Ministry of Education and Research in Norway further emphasized this message by expecting all health and social care professionals to collaborate interprofessionally by 2020. Similar developments have taken place in the United Kingdom (UK), where the Department of Health and Social Care has actively promoted IPE (Department of Health, 2001). Governmental directives have been strengthened by professional, statutory and regulatory bodies stating that students should learn together with peers from other courses during their education (General Medical Council, GMC General Medical Council, 2016; Health and Care Professions Council, HCPC, 2017; Nursing and Midwifery Council, NMC, 2018). In the practice setting, a number of integrated care systems (ICSs) have been set up across the UK with the aim of strengthening partnerships and working across health and social care in response to local needs (for more information about the ICSs, see the UK independent think tank Kings Fund, 2018).

Progress has been made, and opportunities for IPL are now evident in many medical and health care curricula across the globe (Khalili et al., 2019 & 2023). However, IPE remains inconsistently present in the course curricula (Khalili et al., 2023) and is still considered by many teachers and students as an 'add-on' rather than a fully integrated and valued constituent of the curricula that is necessary to prepare our future workforce (Lindqvist et al., 2018). In the study by Lindqvist and colleagues (2018), exploring university teachers' views of IPL and their role in achieving outcomes, findings revealed that although participating university teachers were generally positive about IPL and its intended purpose, they did not always agree with the approach to IPE taken by their institutions. There was also an underlying skepticism amongst some, whether IPL would survive the graduates' transition into 'the real world' of clinical practice. Hence, some teachers questioning whether their efforts would be worth it (Lindqvist et al., 2018). Results were based on data collated across three universities, two in Norway and one in England, which increased the study's validity and generalizability, indicating that these views may resonate with other university teachers across the world. Should this be the case, then this calls for immediate and concerted action to promote meaningful and sustainable IPE into curricula. In an attempt to take this forward, members of the same group

embarked on a journey to create a framework with teachers and leaders at their respective institutions and beyond that can support and ensure successful integration of IPE into the curricula.

To develop a framework that can be adopted more widely, further empirical research is needed to more fully understand teachers' perceptions of IPL and the concerns that were reported by Lindqvist and colleagues (2018). To our knowledge, no prior research has been conducted that investigates university teachers' perceptions of IPL using a quantitative methodological approach. However, there is a growing body of research on Interprofessional Education (IPE) that is highly relevant for developing a new IPE framework. Empirical evidence underscores the positive impact of IPE on patient care, linking IPE interventions to improved quality measures such as reduced medical errors and increased patient satisfaction. A scoping review of 94 studies (2015–2020) highlights the pressing need for further development and evaluation of IPE to enhance health outcomes (Cadet et al., 2023). Patient safety, recognized as a global health priority, is jeopardized by ineffective nurse-physician collaboration. A systematic review analyzing 15 studies with 1185 participants found that IPE significantly improves attitudes, skills, knowledge, behaviors, and patient outcomes. Strategies such as high-fidelity simulations and standardized communication tools have demonstrated effectiveness in fostering collaboration, enhancing care quality, and promoting patient safety on a global scale (Tan Shuyi et al., 2024). Further, a thematic synthesis of 14 qualitative studies explored the potential and limitations of IPE in undergraduate health-related programs. The findings underscore IPE's benefits, including enhanced interprofessional learning, collaboration, and patient-centered care, while identifying challenges such as methodological and implementation barriers. Addressing these barriers is crucial to maximizing IPE's impact on student education and population health outcomes (Rodrigues da Silva Noll Gonçalves, Noll Gonçalves, da Rosa et al., 2023).

Together, these studies underline the urgent need to better understand and integrate IPE within higher education. By addressing both its potential and its limitations, higher education institutions can develop more effective curricula that equip future health professionals with the collaborative skills necessary to meet the evolving demands of healthcare systems and improve patient outcomes. This research establishes a foundation for refining IPE frameworks to better align with global health priorities and institutional needs.

The framework will be constructed around three different datasets collated from educators involved in IPE and derived from: 1) a quantitative questionnaire completed by teachers who were mainly working in Norway and the UK; 2) focus groups with study participants from the first phase of this study (Vasset et al., 2023); and 3) interviews with educational leaders working at the three universities involved in the first phase of the study (Lindqvist et al. submitted for publication Oct 2023).

1.1. Aims

This article concentrates on the first data set investigating university teachers' perceptions of IPL that is collected from a quantitative questionnaire. It aims to: a) describe the development of the questionnaire; b) test, describe and discuss the psychometric qualities of the questionnaire; c) present the results from the questionnaire, including a full structural model, which will be discussed in relation to existing and future work. Findings will be useful to readers in their own right, and as part of the abovementioned framework, which will be presented separately.

2. Theoretical underpinning of questionnaire development

Over a decade ago, we learned from Hean et al. (2012) that there are many theories that give meaning to the understanding of IPE. They suggested that there is a need to gain a better understanding of how theoretical perspectives on IPE help students achieve the intended

outcomes. Indeed, Hean et al. (2018) have underscored the importance of engaging with theory to comprehensively comprehend and address the intricate nature of interprofessional education (IPE) and its integration into curricula. The focal point of our study revolves around establishing stronger connections between the teaching and learning opportunities associated with the theoretical framework and those that occur within the practice placement environment. It is crucial for multiple stakeholders to actively participate in forging such links, thus emphasizing the pivotal role played by university teachers and practice educators. Their close relationship with students throughout their educational journey, as highlighted by Higgins (2014), solidifies their significance in this process.

In designing the present research project, certain decisions were made on which theoretical perspectives would guide the development of the questionnaire for this study. We recognize that measuring teachers' perceptions of interprofessional education (IPE) is a complex undertaking that requires a clear conceptual understanding of its fundamental essence. To develop statements that accurately reflect the content and meaning of this phenomenon, a conceptual model is preferred, thereby offering validity to the scores. We drew from two primary sources to develop a tentative conceptual model: the qualitative study completed to date by Lindqvist et al. (2018) and an adapted version of the multidimensional "Perception of Interprofessional Collaboration Model Questionnaire" (PINCOM-Q) developed by Ødegård (2006).

2.1. Developing a conceptual model for the questionnaire

The overall study design, within which the present research is framed, adopted a mixed method approach (Creswell & Plano Clark, 2011). The overarching project, which aims to develop the main framework, has used a sequential mixed method to collect data (Teddlie & Tashakkori, 2009) where cumulative validity - i.e., one data set informs the next - is of central importance (Ødegård & Bjørkly, 2013). Indeed, Messick (1994) stated that "validity is an evolving property and validation a continuing process" (p. 741). Hence, in the development of the questionnaire, several meetings among the researchers were held to decide what aspects to consider in a conceptual model that captures key influences of 'teachers' perceptions of IPL'. Fig. 1 illustrates the tentative conceptual model developed and used in the present study to help understand teachers' perceptions of IPL in more depth.

Generally, and according to Nunnally (1978), in any questionnaire development, researchers should specify the domains of statements representing the 'construct', which in this case is 'teachers' perceptions of IPL'. Without such domain specifications, it is difficult to ascertain to what extent the questionnaire includes irrelevant information, or under-represents the construct. Statements, or items, chosen should reflect different aspects of 'teachers' perceptions of IPL'. If not, the statements in the questionnaire are not of significance, or do not sufficiently capture, or under-represent, the construct. According to Messick (1994), failure to develop solid domain specifications poses a threat to construct validity.

As shown in Fig. 1, the three domains of statements that represent our 'construct' relate to: individual, group and organizational aspects. Since our aim was to understand 'teachers' perceptions of IPL' as a phenomenon, we developed and collated items paying close attention to each of these three domains. Furthermore, and as alluded to earlier, our ultimate goal is for this work to reveal the cornerstones of a framework that can guide successful and sustainable integration of IPE into curricula.

3. Methodology

3.1. Study design

The design of this research was a non-experimental fixed design, as the phenomenon under study 'teachers' perceptions of IPL' was not
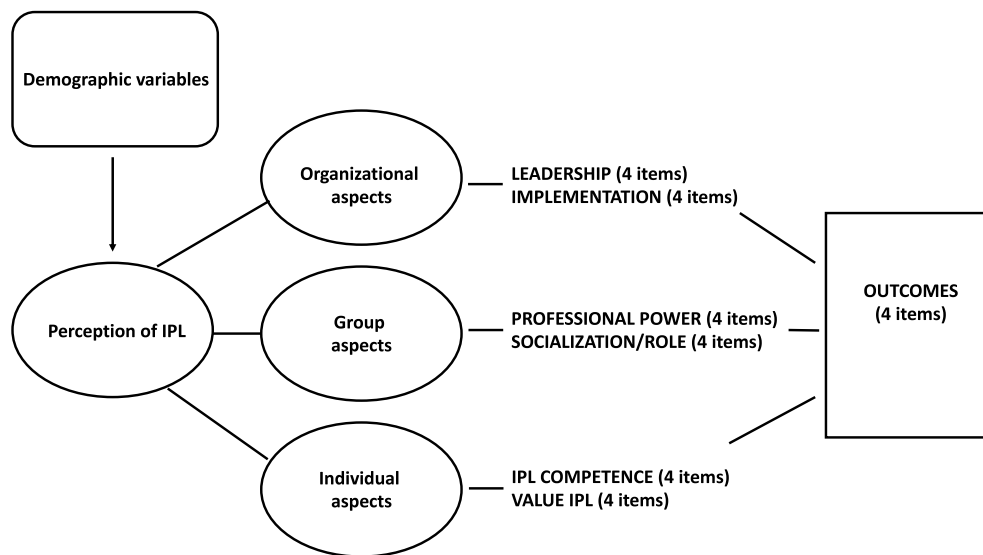
Fig. 1. Tentative conceptual model that captures key influences of teachers' perceptions of IPL that will guide the development of a questionnaire.

manipulated or changed in any way (Robinson, 2002). Data from the questionnaire, representing teachers' perceptions of IPE in a higher education context, were exposed to exploratory and confirmative factor analysis, which are statistical methods used to extract the common factors that help explain our construct and conceptual model. Data collection and analyses were conducted between 2020 and 2023 in Norway and the United Kingdom.

3.2. Development of the questionnaire

A questionnaire was developed based on the tentatitive conceptual model illustrated in Fig. 1 based on findings presented by Lindqvist et al. (2018), and adapted statements in the existing measure PINCOM-Q (Strype et al., 2014; Ødegård, 2006). In brief, the PINCOM-Q measures subjective perceptions of interprofessional collaboration. Cronbach's alpha = 0.91 (48 items); split half alpha = 0.84 for Part 1 and 0.87 for Part 2 (Ødegård, 2006). Construct validity has been considered high in several studies due to factor solutions (Ødegård, 2006) and generalizability coefficients (Ødegård et al., 2008) proving meaningful.

In total, the questionnaire used in the present study contained 33 items, including demographic questions: gender, age, educational background, profession, work experience, and experience with IPE; 24 items specifically related to IPE; and 4 items linked to IPE outcomes (see Fig. 1). The questionnaire can be found as a supplement (see Appendix I).

3.3. Sample

In line with exploratory principles, the sample should be considered a 'convenience sample' based on the relatively easy availability of respondents (Sedgwick, 2013). Therefore, the questionnaire was mainly sent to educators working at universities and university colleges in Norway and the UK using authors' networks. A total of 183 educators working in universities and university colleges in Norway and the UK completed the questionnaire. One hundred forty-one identified as women and 42 as men, with ages ranging from 25 to 65. The largest group of professionals was nurses (49.2%); followed by other professions distributed as shown in Table 1.

3.4. Statistical analysis

To ensure a rigorous psychometric evaluation of the questionnaire, based on data collected in Norway and the United Kingdom, all analyses

Table 1
Professional background.

Profession	Freq.	%	Cum. %
Nurse	90	49,2	49,2
BLS[a]	5	2,7	51,9
Medical doctor	11	6,0	57,9
Social worker	12	6,6	64,5
Social educator	5	2,7	67,2
Physical therapist	12	6,6	73,8
Occupational therapist	5	2,7	76,5
Childcare worker	2	1,1	77,6
Other	41	22,4	100,0
Total	181	100,0	

[a] Biomedical laboratory scientist.

were conducted using IBM SPSS v26 and Stata/SE 15.1. Prior to performing factor analysis, the dataset underwent comprehensive screening for missing values and assessment of score distributions. Descriptive statistics were computed, and graphical representations of each variable were analyzed to support a thorough interpretation of the data and its suitability for subsequent analyses.

To test the appropriateness of using factor analysis, we used the Kaiser–Meyer–Olkin (KMO). The KMO index was >0.759 (p < .01), which is above the desired 0.7 and well above the cut-off value of 0.50. Thus, based on several statistical procedures and considerations, our data met the basic criteria to fit a factor analytic design. An Exploratory Factor Analysis (EFA) was initially performed on the 24 items specifically relating to IPL to estimate the common shared variance across items. This analytical approach "assumes that some of the variance in the variables is caused by some other sources, which ideally should be removed from the analysis" (Mehmetoglu & Jacobsen, 2017, p. 272). Next, we performed a Confirmatory Factor Analysis (CFA) using Structure Equation Modelling (SEM) to investigate how well the factor solution emerging from EFA applied to this dataset, if any of the factors related to the outcome variables and whether any new factors emerged. In addition to the 24 items linked to IPL, the four outcome variables in the questionnaire (Items 30–33) were explored using the Principal Axis Factor (PAF) approach, giving a one-factor solution.

Based on the findings the full structural model was tested (all the five factors; 'Commitment to IPE' (F1), 'Value of professions' (F2), 'IPE in curricula' (F3) and 'Professional identity and competence' (F4) and the outcome factor (F5)). Both the measurement model and the structural model were tested simultaneously. This allowed us to explore the

potential relationship between the four factors that emerged through EFA ('Commitment to IPE' (F1), 'Value of professions' (F2), 'IPE in curricula' (F3) and 'Professional identity and competence' (F4)) and tested by CFA and the outcome factor. In addition, descriptive analyses were performed, as well as reliability tests of the four main factors following the PAF analysis.

3.5. Ethics

Ethical approval was sought and granted at each university/country. Approvals were obtained from the Norwegian Centre for Research Data (NSD; Project Number 920871). In the UK, approval was given by the Faculty of Medicine and Health Ethics Committee (Ref 2019/20–045). The informants were given clear information about the study and consented to it.

4. Results

4.1. Exploratory factor analysis (EFA)

First, an exploratory factor analysis (EFA) was performed to identify the main structure in the dataset relating to the 24 items that specifically related to IPL. Four factors emerged that had eigenvalues above 1.0. As outlined in Table 2, Factor 1('Commitment to IPE') had an eigenvalue of 3.31 and accounted for 35% of the variance. Factor 2 ('Value of professions') had an eigenvalue of 3.01, accounting for 32% of the variance. Factors 3 ('IPE in curricula') and 4 ('Professional identity and competence') had eigenvalues of 1.7 and 1.08, respectively, accounting for 18 and 11% of the variance, respectively.

4.2. Factor loadings

Rotated factor loadings (pattern matrix) and unique variances for each item are presented in Table 3 below. Eight items loaded on Factor 1 ('Commitment to IPE'), five on Factor 2('Value of professions'), five on Factor 3 ('IPE in curricula') and seven on Factor 4 ('Professional identity

Table 2
Eigenvalues.

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor 1	3.31630	0.30172	0.3514	0.3514
Factor 2	3.01458	1.34852	0.3194	0.6708
Factor 3	1.66606	0.58399	0.1765	0.8473
Factor 4	1.08207	0.40776	0.1146	0.9620
Factor 5	0.67430	0.27434	0.0714	1.0334
Factor 6	0.39996	0.04608	0.0424	1.0758
Factor 7	0.35388	0.08779	0.0375	1.1133
Factor 8	0.26609	0.08663	0.0282	1.1415
Factor 9	0.17946	0.01143	0.0190	1.1605
Factor10	0.16803	0.08149	0.0178	1.1783
Factor11	0.08654	0.01912	0.0092	1.1875
Factor12	0.06742	0.02324	0.0071	1.1946
Factor13	0.04419	0.04585	0.0047	1.1993
Factor14	−0.00166	0.03095	−0.0002	1.1991
Factor15	−0.03262	0.04568	−0.0035	1.1957
Factor16	−0.07830	0.03197	−0.0083	1.1874
Factor17	−0.11027	0.01910	−0.0117	1.1757
Factor 18	−0.12937	0.05849	−0.0137	1.1620
Factor 19	−0.18786	0.05444	−0.0199	1.1421
Factor20	−0.24230	0.01536	−0.0257	1.1164
Factor 21	−0.25765	0.00575	−0.0273	1.0891
Factor 22	−0.26341	0.01624	−0.0279	1.0612
Factor23	−0.27965	0.01815	−0.0296	1.0316
Factor 24	−0.29780		−0.0316	1.0000

LR test: independent vs. saturated: chi2(276) = 1257.09.
Prob > chi2 = 0.0000, Factor analysis/correlation, Number of observations = 180.
Method: principal factors, retained factors = 13.
Rotation: (unrotated), Number of params = 234.

Table 3
Rotated factor loadings (pattern matrix) and unique variances.

Variable	Factor1	Factor2	Factor3	Factor4	Uniqueness
item6	0.5337				0.7163
item7	0.5550				0.6738
item8	0.5317				0.7091
item9			0.4248		0.6365
item10			0.7096		0.4964
item11			0.6623		0.5259
item12			0.6844		0.4331
item13			0.3254	−0.4752	0.6066
item14		0.7530			0.4146
item15		0.7638			0.3968
item16		0.5979			0.5161
item17		0.3225			0.6748
item18	0.6330				0.4474
item19		0.4116		0.4312	0.6015
item20					0.8508
item21				0.3969	0.7125
item22	0.3164			0.4715	0.6234
item23				0.6044	0.6083
item24				0.4282	0.7984
item25				0.3110	0.8763
item26	0.6171				0.5937
item27	0.5593				0.6286
item28					0.7279
item29	0.5784				0.6520

blanks represent abs(loading) < 0.3.

and competence'). Item 13 loaded on both Factors 3 and 4; Item 19 loaded on Factors 2 and 4; and Item 22 loaded on Factors 1 and 4.

In Table 4 below, the items and factor loadings are shown as well as Cronbach's alpha for each of the four factors from the EFA analysis.

Factor 1 was labelled Commitment to IPE with a Cronbach's alpha α = .76. Factor 2: Value of professions α = .74. Factor 3: IPE in the curricula α = .67, and Factor 4: Professional identity α = .63.

4.3. CFA and SEM analysis

The EPA above suggested a four-factor model representing teachers' perceptions of IPL, as measured by 24 items. Next, we subjected the model to a confirmatory factor analysis (CFA) and tested how well the full proposed structural model, including the outcome factor (F5) (see Tables 5 and 6), fit the data (see Table 7).

In Fig. 2, the full model, including both the measurement and structural models, is presented. This illustrates the relationships between factor loadings, items and factors so that we can interpret the conceptual model of teachers' perceptions of IPL.

Regression analyses showed that F1 (commitment to IPE) and F4 (professional identity and competence) were significantly related to outcomes (F5); see Table 8 below. In contrast, the analyses showed no relationship between F2 (Value of profession) and F3 (IPE in the curricula) and the outcome Factor F5.

5. Discussion

5.1. Key findings and theoretical contributions

Factor analysis conducted on questionnaire data shows that teachers' perceptions of IPE can largely be grouped into four categories (factors): i) commitment to IPE, ii) value of profession, iii) IPE in the curricula, and iv) professional identity. These four categories serve as cornerstones for a framework cocreated by participants of this study to support the integration of IPE into the curricula more widely, which was concluded from a previous study (Lindqvist et al., 2018). The framework will be constructed around three datasets collected from a survey, focus groups and interviews. This study focused on the quantitative component that relates to a survey. In its own right, this paper presents a full structural model (SEM) of teachers perception of IPE in a higher education context.

Table 4
Items with factor loadings in brackets for each of the four factors and reliability scores.

Item (Factor loading and Chronbach's alpha)	Factor
6. For IPE to be successful, leaders must help create suitable learning opportunities. (0.53)	**1: Commitment to IPE** $\alpha = .76$
7. It is important that senior leaders request the development of a joint approach to IPE across the different professions' curricula. (0.55)	
8. Senior leaders are not important for IPE delivery in our organization. (0.53)	
18. I think it is important for me as teacher that students develop a positive mindset towards IPL. (0.63)	
22. I think it is important that teachers from different professions complement one another as they deliver IPE. (0.31)	
26. I think it is worthwhile to teach about interprofessional work. (0.62)	
27. Learning about collaboration is positive for everyone who works within health and social care. (0.56)	
29. IPL is actually an unnecessary part of health and social care professionals' education. (0.58)	
14. In my experience, teachers across the different professional courses have preconceptions about one another. (0.75)	**2: Value of professions** $\alpha = .74$
15. Teachers from different professions are not always valued the same. (0.76)	
16. All teachers respect one another's professional background. (0.59)	
17. It is easy to communicate with teachers from different professions. (0.32)	
19. During IPL, I think students should be facilitated by teachers from their own profession. (0.41)	
9. My experience is that senior leaders where I work value IPE as a part of the curricula. (0.42)	**3: IPE in the curricula** $\alpha = .67$
10. IPE is well described in the curricula. (0.71)	
11. In our organization we follow national and professional recommendations for how IPE should feature in our students' education. (0.66)	
12. In my experience, IPE is firmly embedded in our teaching practice. (0.68)	
13. I think we should create opportunities for IPL during students' practice placements. (0.33)	
13. I think we should create opportunities for IPL during students' practice placements. (−0.48)	**4: Professional identity** $\alpha = .63$
19. During IPL, I think students should be facilitated by teachers from their own profession. (0.43)	
21. It is important that students can express their professional identity within their IPL groups. (0.40)	
22. I think it is important that teachers from different professions complement one another as they deliver IPE. (0.47)	
23. As teacher, it is important that I have knowledge about other professions' competencies when delivering IPE. (0.60)	
24. I believe that I am familiar with the competencies linked to my own profession. (0.43)	
25. I think that I need to know more about IPE. (0.31)	

Table 5
Eigenvalues (outcome variables, Items 30–31).

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor 1	1.55483	1.59224	1.3013	1.3013
Factor 2	−0.03741	0.08601	−0.0313	1.2700
Factor 3	−0.12342	0.07575	−0.1033	1.1667
Factor 4	−0.19917		−0.1667	1.0000

LR test: independent vs. saturated: chi2(6) = 147.61 Prob > chi2 = 0.0000.
Factor analysis/correlation, Number of observations = 176, Method: principal factors.
Retained factors = 1, Rotation: (unrotated), Number of params = 4.

The model is underpinned by empirical data collected and collated from educators who completed a survey that we adapted and validated, and appended here for use.

Table 6
Factor loadings (pattern matrix).

Variable	Factor1	Uniqueness
item30	0.5899	0.6521
item31	0.5564	0.6904
item32	0.6208	0.6146
item33	0.7155	0.4881

Table 7
Fit Indices for the full proposed structural model.

Fit statistic	Value	Description
Likelihood ratio		
chi2_ms(286)	470.991	model vs. saturated
p > chi2	0.000	
chi2_bs(325)	baseline vs. saturated	
539.900		
p > chi2	0.000	
Population error		
RMSEA	0.061	Root mean squared error of approximation
90% CI, lower bound	0.051	
upper bound	0.071	
pclose	0.036	Probability RMSEA≤0.05
Information criteria		
AIC	10463.210	Akaike's information criterion
BIC	10750.684	Bayesian information criterion
Baseline comparison		
CFI	0.848	Comparative fit index
TLI	0.827	Tucker-Lewis index
Size of residuals		
SRMR	0.082	Standardized root mean squared residual
CD	0.998	Coefficient of determination

The conceptual model presented in Fig. 1 served as the foundation for the development of the questionnaire used in this study. Central to the original conceptual model is the notion that perceptions of IPE can be understood at several levels: individual, group and organizational. It was suggested that each of these levels contains aspects of IPE — which could be operationalized as 'items'. The main body of the questionnaire constituted a total of 24 items specifically related to perceptions of IPE. The explorative and confirmatory factor analyses provide an empirical representation of how participants perceive IPE in the present study. As mentioned above, four factors emerged, each named based on the items within each of the factors: 'Commitment to IPE' (F1), 'Value of professions' (F2), 'IPE in curricula' (F3) and 'Professional identity and competence' (F4). The SEM analysis, which sought to investigate the relationship between each of the four factors and outcomes (F5), produced some meaningful and somewhat surprising results. Factor 5 included the following items: *Learning together with students from different professions will benefit the quality of our workforce; Lack of preparation for IPL can lead to bad collaboration between multiprofessional groups; IPL is important to improve patient safety;* and *IPL is important for resources to be correctly used.* Commitment to IPE (F1) and professional identity and competence (F4) both significantly relate to outcomes (F5). In contrast, Value of professions (F2) and IPE in curricula (F3) showed no relationship with the outcomes (F5). These findings confirm that IPE is a multifaceted phenomenon in accordance with the theoretical developments in the IPE field (Reeves, Xyrichis, & Zwarenstein, 2018; Hean et al. (2018)) and empirical studies (Lindqvist et al., 2018; Strype et al., 2014; Ødegård, 2006; Ødegård & Strype, 2009).

Curiously, although (F2) and (F3) are identified as central in how teachers perceive IPE (Tables 3–5), the same factors do not seem to be regarded as important for outcomes according to the findings presented here (Fig. 2 and Table 8). A closer inspection of the items in (F1) and (F4) clearly gives associations to personal and relational aspects of IPE, whereas (F2) and (F3) can be understood as something to do with a more abstract level of understanding (Table 4). If this is true, then teachers may find it easier to move forwards and help students achieve outcomes
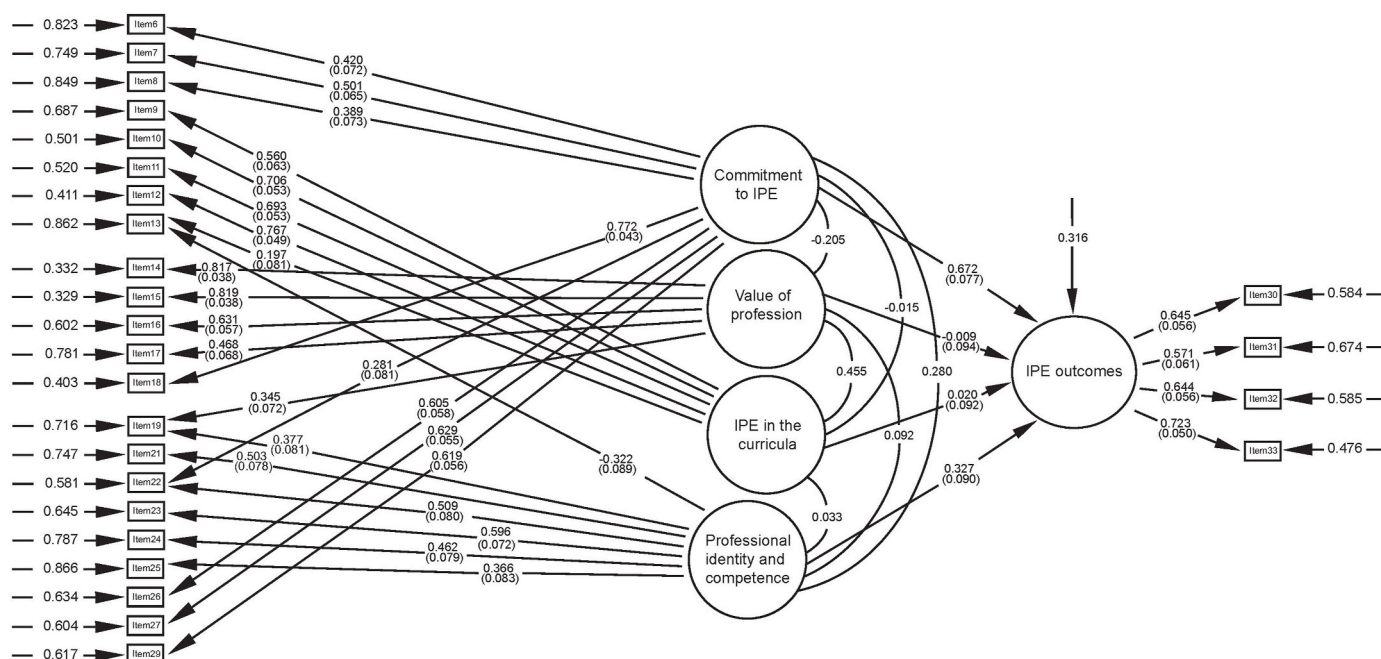
Fig. 2. The four factors elicited from the explorative factor analysis (measurement model) and the one factor elicited from the confirmatory factor analysis (structural model) related to outcomes.

Table 8
Regression analysis showing that Factors 1 and 4 relate to outcomes (Factor 5).

Standardized	OIM					
	Coef.Std.	Err.	z	P > z	[95% Conf. Interval]	
Structural						
Factor 5						
Factor1	0.6720298	0.0772938	8.69	0.000	0.5205367	0.8235229
Factor2	−0.0094859	0.0941546	−0.10	0.920	−0.1940255	0.1750538
Factor3	0.0206096	0.0917387	0.22	0.822	−0.159195	0.2004142
Factor4	0.3272032	0.0901349	3.63	0.000	0.1505421	0.5038643

because it is something they can more easily comprehend and do something about. In contrast, differences in values are much more challenging to address, as they need cultural change at a systemic and societal level (Olenick & Allen, 2013). Additionally, students are graduating as 'competent' despite the somewhat sporadic IPE content in curricula. Hence, there may be limited justification as to why they would invest, especially if they are not convinced that their efforts would be worth it, as discussed also in an earlier study (Lindqvist et al., 2018). The qualitative arm of this study presented in Vasset et al. (submitted 2022) reports findings from focus groups across two countries and three universities where teachers were invited again to expand on their views provided in a previous study (Lindqvist et al., 2018). Here, we learn that teachers are still conflicted as to what IPL is best to offer when and to whom and that the lack of organizational commitment together with complex logistics involved with IPE indeed threatens its existence in curricula. Some teachers still believe that interprofessional collaboration is best learned later on, once in practice (Vasset et al., submitted 2022). Perhaps this explains the lack of connection between F3 and F5.

Tentatively, a consideration from this study is the role of leadership in fostering effective interprofessional education (IPE). Leadership education styles and motives are crucial for equipping educators to engage students and promote interprofessional collaboration. Strong leadership aligns institutional priorities, supports educators, and ensures that curricula explicitly link learning to collaboration principles. Effective curricula must build skills in communication, teamwork, and shared understanding, providing a foundation for meaningful interprofessional

practice. Without leadership to drive these efforts, students' IPE learning may remain fragmented, limiting its impact on professional practice and patient care outcomes.

5.2. Implications for educational practice

The results presented here suggest that university teachers significantly impact on students' performance in practice. Considering how many teachers students meet during their time in education, it is plausible to assume that different outcomes will be achieved as a result of individual teaching approaches and styles underpinned by a variety of theoretical perspectives and evidence. As presented in a review by Denessen and colleagues (2022), there is evidence to support a relationship between teachers' attitudes and student outcomes. Interestingly, these authors also reported findings from the literature were teachers from a particular group can tend to be more positive to their own group, which we learned from Social Identity Theory (SIT)(Tajfel, 1981; Tajfel & Turner, 1986). Although this review focus more on younger students, these findings are likely to translate to the university setting too. Regardless of their professional background, teachers successfully help to enable most of their students to graduate as competent health and social care professionals. Whether professional competencies include for students to develop the necessary knowledge, skills, attitudes, values and behaviour that equip them to work interprofessionally is not always evident. Likewise, as discussed by Clark (2021) teachers may opt not to invest in creating interprofessional learning

opportunities, especially if this is not an explicit priority of the course, School or University.

Results indicate that it would not be enough if teachers offer IPL opportunities as part of the curricula, and have organizational support (Lindqvist et al., 2018), if the teachers themselves are not sufficiently engaged and/or believe its long-term benefits. Teachers, according to our results, need to be committed to IPE (F1), as well as having a professional identity and competence (F4) so that they can support IPE as an integral part of being educated as a professional. What curricula (F3) and what profession one belongs to (F2), or what professions that work together in an educational setting then, is shown to be of less importance for positive outcomes in the present study (F5). If we agree that well-developed, meaningful IPE, - delivered purposefully throughout students education, -is important in preparing students for practice, then this becomes an important mission for us all to put right. Hopefully, the findings of this study together with further research can help create a framework that can facilitate and guide this endeavour.

5.3. Implications for further research

The reliability of the index scores was satisfactory at this stage in the scale development, ranging from 0.63 to 0.76, for the subscales (F1-F4). The reliability for the 24 items focusing on aspects of IPE was 0.70. Clark and Watson (1995) hold that reliability is a necessary but insufficient condition for homogeneity or unidimensionality of subscales in a test or questionnaire.

Construct validity may be hampered if the items representing any of the constructs (in the conceptual model) become too narrow. Messick (1994) argues that there are two major threats to construct validity: a) "the assessment is too narrow and fails to include important dimensions or facets of the construct (construct underrepresentation)" (p.742) and/or b) "construct-irrelevant variance, the assessment is too broad, containing excess reliable variance associated with other distinct constructs as well as method variance, such as response sets or guessing propensities that affect responses in a manner irrelevant to the interpreted construct" (p.742). Research on social innovation IPE may lack construct validity if researchers have a too narrow operationalization of IPE or if irrelevant information is included, for example, items that belong to other theoretical constructs. Hence, the conceptual development and testing and evaluating psychometric properties is a crucial step in trying to measure perceptions of IPE.

The results indicate that the psychometric properties are sound, but there is a need for further development of the instrument by exploring other samples in the population of university teachers. The conceptual model presented ensured, to a certain degree, construct validity, as it was based partly on prior studies of IPE/IPL (Lindqvist et al., 2018; Ødegård, 2006). Additionally, the interpretation of the factors (F1-F4) gives substantial meaning, even in relation to central IPE outcomes (F5).

The main weakness of the study is the use of a convenience sample. Thus, there is a need to investigate the scale in broader samples, providing more diverse data regarding cultures, educational settings, and teachers' professional backgrounds. This would be in line with Lindqvist et al. (2018), who recognize that further investigation needs to be carried out to fully understand the teachers' positions, both in the local and wider context. Item development is also needed in future studies to enhance the reliability of the subscales.

5.4. Implication for the future practice in health service

These findings highlight the critical role of interprofessional education (IPE) in preparing a workforce capable of addressing the complexities of modern healthcare. Without IPE, the risk of fragmented care, poor communication, and compromised patient outcomes increases significantly. IPE equips health and social care professionals with the skills, attitudes, and trust needed for effective multidisciplinary teamwork, fostering collaboration that improves patient safety, resource use,

and care quality. Its purpose therefore extends beyond teaching teamwork to preparing professionals for dynamic, integrated care environments. To ensure the future of health services, IPE must be embedded in education and practice as a foundational component, making interprofessional collaboration the standard rather than the exception.

6. Conclusion

Importantly, there is a desire to help overcome the challenges identified to successfully integrate IPE into undergraduate curricula so that students can achieve the intended learning outcomes needed to prepare them appropriately for ICP. The authors propose that a framework created by educators for educators may be a sensible starting point. The rationale for this is that despite the findings appearing somewhat 'negative', since some teachers seemed less 'invested' in the current IPE initiatives taking place at their universities, all conveyed that they were willing to engage in the 'right type' of IPL and with the necessary support. Going forwards, the more sustainable solution is likely to be a more system-wide approach, as discussed by Olenick and Allen (2013), which is underpinned by social innovation (SI) (Murray, Calulier-Grice, & Mulgan, 2010). The concept of SI provides a perspective both as a means and end for change and improvement regarding IPE in the university context. For example, social innovation could make way for alternative ways of collaborating and mobilizing new actors, professionals and citizens for problem-solving and the production of health and welfare (Murray et al., 2010; Husebø et al., 2021). SI is value-based and connected to the common good and people's health and well-being. SI is associated with three dimensions – interactional, processual and relational (Crepaldi, De Rosa, & Pesce, 2012; Husebø et al., 2021) – and requires distinct professional competencies and managerial strategies as well as sensemaking, experimentation, commitment and critical dialogue in expansive learning environments (Fuller & Unwin, 2004; Fuller, Halford, Lyle, Taylor, & Teglborg, 2018). Consequently, it should be interesting to see how SI may intertwine with IPE and support learning and collaborative work.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Cadet, T., Cusimano, J., McKearney, S., Honaker, J., O'Neal, C., Taheri, R., … Cohn, J. S. (2023). Describing the evidence linking interprofessional education interventions to improving the delivery of safe and effective patient care: A scoping review. *Journal of Interprofessional Care, 38*(3), 476–485. https://doi.org/10.1080/13561820.2023.2283119

Clark, L. A., & Watson, D. (1995). Constructing validity: Basic issues in objective scale development. *Psychological Assessment, 7*(3), 309–319. https://doi.org/10.1037/1040-3590.7.3.309.

Clark, P. G. (2021). Looking below the surface of interprofessional education uncovering organizational factors and forces. *Journal Of Allied Health, 50*(19), 182–189.

Crepaldi, C., De Rosa, E., & Pesce, F. (2012). *Literature review on innovation in social services in Europe: Sectors of health, education and welfare services* (p. 1). INNOSERV Work Package.

Creswell, J., & Plano Clark, V. (2011). *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage.

Denessen, E., Hornstra, L., van den Bergh, L., & Bijlstra, G. (2022). Implicit measures of teachers' attitudes and stereotypes, and their effects on teacher practice and student outcomes: A review. *Learning and Instruction, 78*(April 2022). https://doi.org/10.1016/j.learninstruc.2020.101437

Department of Health. (2001). *Working together, learning together: A framework for lifelong learning for the NHS*. DH.

Dow, A., & Thibault, G. (2017). Interprofessional education — a foundation for a new approach to health care. *New England Journal of Medicine, 377*(9), 803–805.

Frenk, J., Chen, L., Zulfiqar, A. B., Cohen, J., Crisp, N., Evans, T., Fineberg, H., et al. (2010). Health professionals for a new century: Transforming education to strengthen health systems in an interdependent world. *The Lancet, 376*(9756), 923–1958. https://doi.org/10.1016/S0140-6736(10)61854-5

Fuller, A., Halford, S., Lyle, K., Taylor, R., & Teglborg, A.-C. (2018). Innovating for a cause: The work and learning required to create a new approach to healthcare for homeless people. *Journal of Education and Work, 31*(3), 219–233. https://doi.org/10.1080/13639080.2018.1447654.

Fuller, A., & Unwin, L. (2004). *Developing pedagogies for the contemporary workplace. Working to learn* (1 ed.). Taylor & Francis Group. eBook.

GMC, General Medical Council. (2016). *Promoting excellence: Standards for medical education and training*. London: General Medical Council.

HCPC. (2017). *Healthcare professions Council standards of education and training guidance*. London: Health and Care Professions Council, 27 Jun.

Hean, S., Craddock, D., & Hammick, M. (2012). Theoretical insights into interprofessional education: AMEE guide No. 62. *Medical Teacher, 34*(2), 78–101. https://doi.org/10.3109/0142159X.2012.643263

Hean, S., Green, C., Anderson, L., Morris, D., John, C., Pitt, R., & O'Halloran, C. (2018). The contribution of theory to the design, delivery, and evaluation of interprofessional curricula: BEME guide No. 49. *Medical Teacher, 40*(6), 542–558. https://doi.org/10.1080/0142159X.2018.1432851.

Higgins, M. (2014). Can practice educators be a 'bridge; between the academy and the practicum? *Journal of Practice Teaching and Learning, 12*(3), 62–78. https://doi.org/10.1921/jpts.v12i3.294

Husebø, A. M., Storm, M., Ødegård, A., Wegener, C., Aakjær, M., Pedersen, A. L., … Willumsen, E. (2021). Exploring social innovation (SI) within the research contexts of higher education, healthcare, and welfare services—A scoping review. *Nordic Journal of Social Research, 12*(1), 72–110. https://doi.org/10.7577/njsr.3455.

Illingworth, P., & Chelvanayagam, S. (2017). The benefits of interprofessional education 10 years on. *British Journal of Nursing, 26*(14), 813–818. https://doi.org/10.12968/bjon.2017.26.14.813

Khalili, H., Lackie, K., Langlois, S., Mendes da Silva Souza, C., & Wetzlmair, L.-C. (2023). The status of interprofessional education (IPE) at regional and global levels – update from 2022 global IPE situational analysis. *Journal of Interprofessional Care*. https://doi.org/10.1080/13561820.2023.2287023

Khalili, H., Thistlethwaite, J., El-Awaisi, A., Pfeifl e, A., Gilbert, J., Lising, D., MacMillan, K., Maxwell, B., Grymonpre, R., Rodrigues, F., Snyman, S., & Xyrichis, A. (2019). Guidance on global interprofessional education and collaborative practice research. *Discussion paper. A joint publication by interprofessional research*. Global, & Interprofessional.Global. Retrieved from www.research.interprofessional.global.

Kings Fund. (2018). *Integrated care systems explained*. The King's Fund (kingsfund.org.uk). [Accessed December 2023].

Lindqvist, S., Howard-Wilsher, S., Hofseth Almås, S., Vasset, F., Willumsen, E., Iversen, H.-P., & Ødegård, A. (2023). Integrating interprofessional education in health and social care curricula to equip our future workforce – qualitative findings from senior educational leaders. *Submitted to Peer Reviewed Journal*.

Lindqvist, S., Vasset, F., Iversen, H. P., Hofseth Almås, S., Willumsen, E., & Ødegård, A. (2018). University teachers' views of interprofessional learning and their role in achieving outcomes - a qualitative study. *Journal of Interprofessional Care, 33*(2), 190–199. https://doi.org/10.1080/13561820.2018.1534809

Mehmetoglu, M., & Jacobsen, T. G. (2017). *Applied statistics using Stata. A guide for the social sciences*. SAGE Publications LtD.

Messick, S. J. (1994). *Validity of psychological assessment: Validation of inferences from persons' responses and performances as scientific inquiry into score meaning.* Research Report RR-94-45 https://doi.org/10.1002/j.2333-8504.1994.tb01618.x.

Murray, R., Calulier-Grice, J., & Mulgan, G. (2010). *Open book of social innovation*. http://youngfoundation.org/wp-content/uploads/2012/10/The-Open-Book-of-Social-Innovationg.pdf.

NMC, Nursing and Midwifery Council. (2018). Realizing professionalism: Standards for education and training Part 1. *Standards framework for nursing and midwifery education*.

Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.

Ødegård, A. (2006). Exploring perceptions of interprofessional collaboration in child mental health care. *International Journal of Integrated Care, 18*(6), e25.

Ødegård, A., & Bjørkly, S. K. (2013). A mixed method approach to clarify the construct validity of interprofessional collaboration: An empirical research illustration. *Journal of Interprofessional Care, 26*, 283–288, 2012.

Ødegård, A., Hagtvet, K., & Bjørkly, S. (2008). Applying aspects of generalizabil-ity theory in preliminary validation of the multifacet interprofessional collabo-ration model (PINCOM). *International Journal of Integrated Care, 8*, 1–11.

Ødegård, A., & Strype, J. (May 2009). Perceptions of Interprofessional Collaboration in child mental health care in Norway. *Journal of Interprofessional Care, 23*(3), 286–296. https://doi.org/10.1080/13561820902739981.

Olenick, M, & Allen, L. R. (2013). Faculty intent to engage in interprofessional education. *Journal of Multidisciplinary Healthcare, 6*, 149–161. https://doi.org/10.2147/JMDH.S38499.

Reeves, S. (2016). Tverrprofesjonell utdanning – konsekvenser for samarbeid om brukere I helse- og velferdstjenestene. In E. Willumsen, & A. og Ødegård (Eds.), *Tverrprofesjonelt samarbeid – et samfunnsoppdrag* (2 ed.). Universitetsforlaget.

Reeves, S., Fletcher, S., Barr, H., Birch, I., Boet, S., Davies, N., … Kitto, S. (2016). A BEME systematic review of the effects of interprofessional education: BEME guide No. 39. *Medical Teacher, 38*(7), 656–666. https://doi.org/10.3109/0142159X.2016.1173663

Reeves, S., Xyrichis, A., & Zwarenstein, M. (2018). Teamwork, collaboration, coordination, and networking: Why we need to distinguish between different types of interprofessional practice. *Journal of Interprofessional Care, 32*(1), 1–3. https://doi.org/10.1080/13561820.2017.1400150

Robinson, C. (2002). *Real world research. A resource for social scientists and practitioner-researchers*. Chichester: Blackwell Publishing.

Rodrigues da Silva Noll Gonçalves, J., Noll Gonçalves, R., da Rosa, S. V., et al. (2023). Potentialities and limitations of interprofessional education during graduation: A systematic review and thematic synthesis of qualitative studies. *BMC Medical Education, 23*, 236. https://doi.org/10.1186/s12909-023-04211-6

Sedgwick, P. (2013). *Convenience sampling BMJ* (Vol. 347, p. f6304).

Strype, J., Gundhus, H. I., Egge, M., & Ødegård, A. (2014). Perceptions of interprofessional collaboration. *Professions and Professionalism, 4*(3), 806, 10.7577/.

Tajfel, H. (1981). *Human groups and social categories*. Cambridge: Cambridge University Press.

Tajfel, H., & Turner, J. C. (1986). The social identity theory of intergroup behaviour. In S. Worchel, & W. G. Austion (Eds.), *The psychology of intergroup relations* (pp. 7–24). Chicago, IL: Nelson-Hall.

Tan Shuyi, A., Lew Yi Ting, Z., Ang Mei Qi, A., & Koh Siew Lin, S. (2024). Effectiveness of interprofessional education for medical and nursing professionals and students on interprofessional educational outcomes: A systematic review. *Nurse Education in Practice, 74*, Article 103864. https://doi.org/10.1016/j.nepr.2023.103864

Teddlie, C., & Tashakkori, A. (2009). *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences*. Thousand Oaks, CA: Sage Publications Ltd.

Thistlethwaite, J. E., Dunston, R., & Yassine, T. (2019). The times are changing: Workforce planning, new health-care models and the need for interprofessional education in Australia. *Journal of Interprofessional Care, 33*(4), 361–368. https://doi-org.uea.idm.oclc.org/10.1080/13561820.2019.1612333.

Vasset, F., Ødegård, A., Iversen, H. P., Hofseth Almås, S., Willumsen, E., & Lindqvist, S. (2023). University teachers' experience of students interprofessional education: Qualitative contributions from teachers towards a framework. *Social Sciences & Humanities Open, 8*(1), 1–7. https://doi.org/10.1016/j.ssaho.2023.100515

White Paper no. 47. (2008-2009). *The cooperation reform. The right treatment- I the right place- at the right time*. Ministry of health and care. in Norway.

WHO. (2010). Framework for action on interprofessional education & collaborative practice. *World health organisation report*. WHO reference number: WHO/HRH/HPN/10.

WHO. (2013). Framework for action on interprofessional education and collaborative practice, 2010. [March 4, 2013] http://www.who.int/hrh/resources/framework_action/en/index.html.

World Health Organization. (2022). *Global competency and outcomes framework for universal health coverage*. Geneva: World Health Organization.