Component Analysis of the Readiness for Interprofessional Learning Scale (RIPLS) in a Graduate and Professional Educational Context

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Authors' contributions

This work was carried out in collaboration between all authors. Author WDR designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors DRT and MLA managed the analyses of the study and contributed heavily to the discussion. Author MLA managed the literature searches. All authors read and approved the final manuscript.

ABSTRACT

In the United States, collaborative practice models for delivering patient-centered care are central to health-care reform. In response, graduate and professional education in health-related disciplines are increasingly prioritizing interprofessional education (IPE). The Readiness for Interprofessional Learning Scale (RIPLS) is one of only a few instruments used to assess the processes of IPE. However, since the original publication [1], studies across the globe using RIPLS have found the instrument's factor structure to vary between 2, and 4 factors.

In this study, the first replication study of the psychometric properties of RIPLS conducted in the Unites States since 2006, the authors explored the latent structure in an administration of RIPLS to graduate and professional students at the outset of their programs in medicine, physician assistant practice, pharmacy, and public health (n=130). Using principal component analysis, the authors

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found RIPLS to have a three component structure: 1) shared learning, 2) teamwork and collaboration, and 3) role distinction/uncertainty. These three components accounted for a larger percentage of cumulative variance (65.91%) than any previously published results—even those reporting a four-factor solution. Future research should explore the predictive value of these dimensions on operational and student learning outcomes in IPE.

1. INTRODUCTION

Interprofessional education (IPE) has been consistently defined as the opportunity for students to learn with, from and about other healthcare professionals [2,3]. The impetus for IPE among health professional programs is driven in part by the focus on patient-centered care and collaborative practice models, often called the patient-centered medical home (PCMH) model. The PCMH model has demonstrated efficacy with reduced cost, enhanced community health, and positive patient outcomes as the result of the integration and coordination of health professionals in a sustained partnership [4,5]. Yet even with the promise of success demonstrated by collaborative practice models the attitudes, perceptions, and beliefs of health care professionals still present a challenge to the effective implementation of patient-centered models [6]. Likewise the requisite predisposition for effective interprofessional learning is often negatively impacted by the attitudes and perceptions of health professions students [7]. Therefore if IPE efforts are to succeed in preparing health professionals for collaborative practice it is imperative to understand the attitudes and perceptions of students before they encounter the interprofessional curriculum so that stage matched educational interventions can be developed and implemented.

The Readiness for Interprofessional Learning Scale (RIPLS) has been widely used to assess the attitudes of health professions students toward interprofessional learning [7,8]. The RIPLS has been used with undergraduate students [9], graduate students [10], and translated into several languages [11-14] as educators seek out valid and reliable tools to gauge the readiness of learners to engage the interprofessional curriculum. As the RIPLS tool has been implemented across these diverse cultural and academic contexts, findings have been inconsistent regarding the constructs measured by the tool. The original tool was first found to assess two distinct factors: *teamwork/collaboration* and *professional identity* [1] while the same authors later report three distinct factors: *team-work/collaboration, professional identity,* and *roles/responsibilities* [8]. A subsequent study with a large sample of undergraduate students (n = 308) suggested that a four factor model that differentiated between *positive professional identity* and *negative professional identity* was most appropriate [15]. The potential for a four factor model was further supported by a study conducted with a large sample of undergraduate students (n = 418) at a large Australian University [16] as well as in the Indonesian translation (n = 755) focusing on medical, nursing, pharmacy, and public health students [17]. Still, other studies with undergraduate, graduate, and post-graduate populations have found a three factor solution in the RIPLS [10,11,17] and even a single factor in the Swedish adaptation of the instrument [13]. While the RIPLS has been found to be both reliable and valid, additional studies are required to further investigate the factors measured by the tool [18]. This study aims to determine the factors measured by the RIPLS when applied to first year graduate and professional students through Component Analysis (PCA).

2. METHODS

2.1 Participants

Students were recruited from the first-year cohorts of the Doctor of Pharmacy, Doctor of Osteopathic Medicine, Master of Physician Assistant Practice, and Master of Science in Public Health programs at Campbell University in North Carolina, United States. Participation was voluntary and students received an informed consent document stating the purpose of the study, requirements of participation, and use of the findings.

2.2 Instrument

The RIPLS was first developed to assess readiness for interprofessional learning based on

attitudinal constructs related to *teamwork/collaboration*, *professional identity*, and *roles/responsibilities* [8]. The instrument contains 19 items measured on a 5-point Likert-type scale ranging from "Strongly Disagree = 1" to "Strongly Agree = 5". While some items are directionally negative, these items were not reverse coded [8,16].

2.3 Data Analysis

All analyses were carried out using the Statistical Package for the Social Sciences (SPSS) Version 22.0, SPSS, Inc., Chicago, IL, USA.

2.4 Procedure

Prior to arriving on campus to begin their graduate and professional training, first-year students in their respective programs received an email invitation to participate in the study along with an informed consent document stating the purpose, requirements of participation, and intended use of the data. Embedded within the email was a link to an electronic version of the RIPLS with additional demographic questions. The process of recruiting students and deploying the RIPLS was conducted by the primary author during August, 2013.

2.5 Ethics Approval

Potential participants who were invited to participate in the study were provided with an electronic informed consent statement before the start of the survey. The informed consent statement indicated that participation in this study was completely voluntary and involved minimal risk. To access the electronic survey students were required to read and click "agree" to the informed consent document. Students who clicked "disagree" were redirected to a brief message thanking them for their time. The study received approval by the university institutional review board (IRB).

3. RESULTS

3.1 Demographics

In all, 130 students participated in the study yielding a response rate of 59.6%. Most respondents were between the ages of 21 and 25 years old (61.5%) and female (65.4%). All students completed the RIPLS prior to arriving on campus for their first professional/graduate year.

Complete demographic information is available in Table 1, including the distribution of students among the professional and graduate health programs.

3.2 Factor Analysis

The resulting data demonstrated high loading marker variables (>0.80) therefore extremely large samples sizes are not necessary [19]. Additionally the *N:p* ratio was 6.8:1, exceeding the minimum recommended sample size to variable ratio of 5:1 [20]. The Kaiser – Meyer – Olkin measure of sampling adequacy (0.889) and Bartlett's test of sphericity (x^2 = 1733.96, *df* = 171, *p* < .0001) also indicate that the data are appropriate for factor analysis.

Results from the PCA with varimax rotation are shown in Table 2. A three-factor construct was obtained as indicated by eigenvalues > 1.0 and observed in the resulting scree plot. The three-factor solution accounted for 65.91% of the variance in the RIPLS where items loaded with > 0.57 onto factors obtained in the PCA. While some authors have suggested reverse coding directionally negative items [15,16], the original developers of the RIPLS have not indicated that this is necessary [8] therefore no items were reverse coded in this analysis.

Nine of the 19 items in this study corresponded with the original three-factor solution suggested by Parsell and Bligh in 1999 including factor 1: teamwork and collaboration (items 5, 2, 9, 4, 3 and 1) as well as factor 2: professional identity (items 12, 11, and 10). The Cronbach α obtained in this study for the 19 items indicate good overall reliability (α = 0.80). Likewise the Cronbach α for the resulting factors indicate excellent reliability for two of the factors (α ≥ 0.90) and good reliability for the third factor (α = 0.77). Internal reliability estimates for each of the obtained factors are available in Table 3. The cumulative variance accounted for in this analysis of the RIPLS was 65.91%.

Based on the original factors named by Parsell and Bligh [8] as well as findings from recent studies that suggested a distinction in positive and negative professional identity [15] the resulting factors in this study were renamed as 1) *shared learning,* 2) *teamwork and collaboration, and* 3) *role distinction / uncertainty.*

Table 1. Demographics

Variable	N	Percentage (%)
Graduate health program		
Doctor of pharmacy	38	29.2
Doctor of osteopathic medicine	61	46.9
Master of physician assistant practice	22	16.9
Master of public health	9	6.9
Total	130	100
Program year		
First	130	100
Total	130	100
Age		
< 21 years	8	6.2
21 – 25 years	80	61.5
26 – 30 years	29	22.3
31 – 35 years	7	5.4
36 – 40 years	5	3.8
41 – 45 years	1	0.8
>45 years	0	0
Total	130	100
Gender		
Female	85	65.4
Male	45	34.6
Total	130	100

Eight items loaded onto factor 1 (shared learning) with factor loadings ranging from 0.60 to 0.84 accounting for 46.78% of the total variance in the data. Many items using the stem "shared learning" clustered closely together with factor loadings between 0.74 and 0.77; however the largest factor loading (0.84) corresponded to item 14, "I would welcome the opportunity to work on small group projects with other health care students". The only item that did not load onto factor 1 using the stem "shared learning" was item 3, "Shared learning with other health care students will increase my ability to understand clinical problems" which loaded onto factor 2 (teamwork and collaboration).

Six items loaded onto factor 2 (teamwork and collaboration) with factor loadings ranging from 0.57 to 0.87. Item 5, "Team-working skills are vital for all health care students to learn" was the top loading item for factor 2 with a factor loading of 0.87. Other items loading onto factor 2 dealt with "respect and trust", "communication skills" and "clinical problem [solving]". Item 1, "Learning with other students/professionals will make me a more effective member of a health care team," cross-loaded onto Factor 2 (0.572) and Factor 1 (0.554). Factor 2 accounted for 11.98% of the variance in the data.

Five items loaded onto factor 3 (role distinction/uncertainty) with factor loadings ranging from 0.59 to 0.77, with three of the items clustering closely together from 0.75 to 0.77. Factor three dealt heavily with the distinction of professional identity and role as demonstrated by the top loading item "Clinical problem solving can only be learned effectively with students from my own school/organization". Other items were related to uncertainty about the value of undergraduate / postgraduate students learning together, uncertainty of professional role, uncertainty about the efficiency of role diffusion ("wasting time learning with other students"), and the distinctiveness of knowledge within one's own field. Factor 3 accounted for the smallest portion of the variance among the three factors with 7.15%.

4. DISCUSSION

The purpose of this study was to further examine the structure and constructs measured by the RIPLS in a graduate/professional student population prior to beginning their respective programs and interprofessional curriculum at a regional, private institution in the southeastern United States with multiple health care disciplines. PCA with varimax rotation revealed three distinct factors were measured by the

Table 2. Rotated component matrix – PCA (Varimax rotation; n = 130)

Rotated component matrix				
	Factor			
	1	2	3	h^2
	α 0.92	α 0.90	α 0.77	
I would welcome the opportunity to work on small group projects with other health care students / professionals (item14)	**0.839**			0.670
Shared learning with other health care professionals will help me to communicate better with patients and other professionals (item 13)	**0.774**			0.701
Shared learning will help me think positively about other health care professionals (item 8)	**0.755**			0.649
Shared learning before and after graduation will help me become a better team worker (item 17)	**0.752**			0.693
I would welcome the opportunity to share some generic lectures, tutorials or workshops with other health care students / professionals (item 15)	**0.736**			0.575
Shared learning and practice will help me clarify the nature of patients' or clients' problems (item 16)	**0.666**			0.644
Shared learning will help me to understand my own professional limitations (item 6)	**0.628**			0.644
Learning between health care students before graduation and for professionals after graduation would improve working relationships after graduation / collaborative practice (item 7)	**0.604**			0.552
Team-working skills are vital for all health care students / professionals to learn (item 5)		**0.867**		0.827
Patients would ultimately benefit if health care students / professionals worked together (item 2)		**0.799**		0.723
For small-group learning to work, students / professionals need to respect and trust each other (item 9)		**0.677**		0.626
Communications skills should be learned with other health care students / professionals (item 4)		**0.672**		0.656
Shared learning with other health care students will increase my ability to understand clinical problems (item 3)		**0.640**		0.626
Learning with other students / professionals will make me a more effective member of a health care team (item 1)		**0.572**		0.670
Clinical problem solving can only be learned effectively with students / professionals from my own school / organization (item 12)			**0.766**	0.626
It is not necessary for undergraduate / postgraduate health care students to learn together (item 11)			**0.756**	0.772
I don't want to waste time learning with other health care students / professionals (item 10)			**0.751**	0.795
I am not sure what my professional role will be / is (item 18)			**0.703**	0.602
I have to acquire much more knowledge and skill than other students / professionals in my own organization (item 19)			**0.588**	0.400
Eigenvalue	8.89	2.28	1.36	
% variance explained	46.78	11.98	7.15	65.91

Notes: α, Cronbach; h2, Communalities. Item loadings bolded

RIPLS: shared learning, teamwork and collaboration, and role distinctiveness / uncertainty. To some extent, the three-factor structure obtained in this study does align with the original three-factor structure reported by Parsell and Bligh [8]. The strongest factor observed in this study, shared learning, corresponds to the second strongest factor in the original factor structure of the RIPLS with six of the items aligning (items 5, 2, 9, 4, 3 and 1). Interestingly most of items from the original factor structure of the RIPLS that comprised the "roles and responsibility" factor loaded with items that originally comprised the "professional identity" factor to create a factor in this study that was renamed "role distinction/uncertainty". While previous studies have labeled this factor "negative professional identity" [8,15] the

Table 3. Sample size, internal reliability of observed factors, and percent variance explained

Study	Type	Factor 1 α	Factor 2 α	Factor 3 α	Factor 4 α	Cumulative variance explained (%)
Parsell & Bligh (1999)	PCA					
n = 120		0.88	0.63	0.32	---[b]	42
McFayden et al. (2005)	CFA					
n = 308		0.79	0.60	0.76	0.40	44
n = 247		0.88	0.76	0.81	0.43	
Reid, et al., (2006)	PCA					
n = 546		0.88	0.86	0.69	---[b]	44.3
El-Zubeir et al. (2006)	PCA					
n = 195		0.86	0.80	0.80	---[b]	44.1
Lauffs et al. (2008)	CFA					
n = 214		0.89	0.48	0.34	---[b]	---[c]
Willams, Brown, & Boyle (2012)	PCA					
n = 418		0.83	0.74	0.72	0.42	53.87
Tamura et al. (2012)	PCA					
n = 132		0.92	0.90	0.60	---[b]	---[c]
Tyastuti et al. (2014)	CFA					
n = 755		0.84	0.77	0.72	0.59	59.9
Cloutier et al. (2015)	PCA					
n = 141		0.89	0.67	r = 0.62[a]	---[b]	---[c]
Rich, et al. (2017)	PCA					
n = 130		0.92	0.90	0.77	---[b]	65.91

[a] *Pearson's r reported instead of Cronbach's alpha*
[b] *Factor did not load*
[c] *Not reported*

imprecision and value-laden term "negative" was abandoned in an effort to recognize that there is no requisite "negativity" in either the uncertainty about the efficiency and effectiveness of shared learning or the perception that the distinctiveness of roles necessitate uniprofessional learning. Indeed, one recent study reported that a possible third factor related to potential self-efficacy was ultimately deleted from their model resulting in a two-factor solution [21]. While the nature of these items perhaps reflects an inherently pessimistic perspective on IPE, the primary overlapping value of the items in Factor 3 is uncertainty about the educational relevance of role distinction and diffusion.

The factors obtained in this study yield stronger internal reliability than previous studies as shown in Table 3. Additionally findings accounted for a larger percentage of variance in the RIPLS than any previous study (65.91%). Since the two germinal studies by Parsell & Bligh [1,8], the factor structure for RIPLS has been unstable. Though published structures have found one to four factors, the most commonly reported structure is a three-factor solution. However, in previous studies reporting a three-factor solution, the highest cumulative variance explained was approximately 44% [10,12]. In PCA, the addition

of factors always results in the addition of cumulative variance explained by the model. Hence, it is even more interesting that this study's three-factor solution explains 10% greater variance than previously published four-factor solutions [17]. The structure presented in this analysis maintains explanatory power without the unparsimonious addition of a fourth factor.

While this three-factor solution maintains greater internal consistency and explains greater cumulative variance than previous replications, the items on the third factor continue to present problems related to both the psychometric properties and the educational utility of the items. Parsell & Bligh initially argued that their exploratory principal components analysis "appears to confirm a causal relationship" between the latent variables measured by RIPLS and "the attributes needed for team-work and collaboration, roles and responsibilities, professional practice, personal growth, relationships and benefits to patients." However, no path analysis was conducted to substantiate such a claim of "causal relationships".

Future research should explore the relationship between these latent variables regarding

"readiness" and outcome variables related to the experience of interprofessional education. That is, if RIPLS provides a valuable tool for assessing the readiness of students for interprofessional learning, then the latent variables should be predictive of the positive experiences with interprofessional learning experiences, affirmative evaluations on interprofessional collaborations, and improved outcomes for interprofessional clinical activities. Future study designs should combine baseline RIPLS assessment with measures of outcomes during and after interprofessional learning. Modeling of the causal paths will improve confidence in the content validity of the instrument as well as providing a more robust assessment of the instrument's psychometric properties and utility.

5. CONCLUSION

Over the last decade, much research has been done regarding the factor structure of the RIPLS instrument. The research on RIPLS has spanned the globe and demonstrated some basic consistency in the instrument across contexts. This study was a replication of these efforts in the United States for the first time in many years. With a comparably large sample size, this study suggests that latent variables measured by RIPLS' are best understood as a three-factor structure. Even though this study reports the largest percentage of cumulative variance explained, the authors are skeptical regarding the theoretical and practical value of the third latent variable in assessing readiness for meaningful participation in interprofessional education. Therefore educators interested in assessing student readiness using the RIPLS instrument should consider findings regarding the third variable related to role clarity with care. Future research will explore the relationships between these three latent variables and outcome variables related to the experience of and effectiveness of interprofessional education.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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