

**Global Assessment Instrument for Quality of Nursing Doctoral Education with a Research
Focus: Validity and Reliability Study**

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Author contributions:

Mi Ja Kim: Supervision, Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Data curation, Project administration, Writing-original draft; review & editing; **Hugh McKenna:** Conceptualization, Methodology, Validation, Investigation, Data curation, Writing-original draft; review & editing; **Chang Gi Park:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data curation, Visualization, Writing-original draft; review & editing; **Shake Ketefian:** Conceptualization, Methodology, Validation, Investigation, Data curation, Writing-original draft; review & editing; **So Hyun Park:** Validation, Formal analysis, Data curation, Writing-original draft; review & editing; **Kathleen Galvin:** Investigation, Writing-original draft; review & editing; **Larisa Burke:** Software, Validation, Formal analysis, Investigation, Data curation, Writing-original draft; review & editing

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Abstract

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Objectives: This study was designed to assess the content and construct validity and reliability of the Quality of Nursing Doctoral Education (QNDE) instrument for nursing doctoral programmes with a research focus.

Design: A cross-sectional, survey study.

Settings: Using Qualtrics survey, the research team sent emails to potential participants providing a link to the study and the QNDE instrument.

Participants: A total of 234 faculty and doctoral students participated: 17 faculty from 14 countries in the first stage; 111 faculty and 106 doctoral students from 20 countries in the second stage.

Methods: The content validity, internal consistency reliability, and construct validity of the four domains (program, faculty, resources, and evaluation) of the QNDE were examined in two stages. Data were collected from purposive samples of faculty and students between June 2018 and March 2019. Confirmatory factor analysis was conducted in ordinal scale using robust weighted least square mean and variance (WLSMV) adjusted estimator in MPlus 8.

Results: Content validity of the items in the four domains was accepted when the item showed content validity ($I-CVI > .78$). Internal consistency reliability in four domains was computed using Cronbach's alpha, $\alpha = 0.88$ to 0.97 . Construct validity of the QNDE was established by confirmatory factor analysis based on model fit statistics. Factor loading coefficients for all items in each domain were statistically significant ($> .5$; $p < .001$).

Conclusions: Participation of 234 faculty and doctoral students from 20 countries on four continents confirmed content validity, internal consistency reliability, and construct validity of

24 the QNDE instrument. These findings support the credibility of this revised QNDE instrument
25 for assessing the quality of nursing doctoral education with a research focus. This is a significant
26 step forward in enhancing the capability for evaluating doctoral programmes.

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28 *Keywords:* Assessment instrument, Construct validity, Global, Quality, Reliability, Nursing
29 doctoral education with a research focus

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Introduction

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As the number of doctoral education programmes in nursing increases worldwide (Molzahn and Clark, 2015), a valid and reliable instrument that assesses the quality of doctoral education in nursing is required. According to International Network for Doctoral Education in Nursing (INDEN), currently, 34 countries offer 370 nursing doctoral programs in the world and these numbers are conservative (McIlpatrick, 2017). Nurse scholars around the globe have recognised that the quality of doctoral education is essential to improving the scholarly preparation of students in research-focused doctoral programmes (e.g. PhD programme). For example, PhD candidates and supervisors in South Africa stressed the need for monitoring the quality of their nursing doctoral education programme (Comiskey et al., 2015). Byrne et al. (2013) described how the quality of European doctoral education had developed around the concepts of accountability, quality enhancement, and a quality culture that engages university management, staff/faculty, and students. More recently, the European University Association reported that the doctoral programmes in most institutions were evaluated by an internal system (88%) or external agency (61%) (Hasgall et al., 2019). Research showed that establishing high-quality doctoral programmes in nursing and evaluating the quality of existing programmes are two imperatives for the advancement of the profession (Breslin et al., 2015; Smeltzer et al., 2015). Thus, a reliable and valid instrument that enables researchers to assess the quality of nursing doctoral programmes would fulfill a global imperative. A psychometrically strong instrument could also be used for marketing purposes; for providing students and parents with evidence of the quality of different programmes, and for faculties and universities to enhance their programmes. However, undertaking a study to test an instrument for global usage poses

55 challenges. These include selecting appropriate target countries for recruitment of respondents,
56 and dealing with curriculum differences and different terminologies used in diverse educational
57 systems. Nursing continues to be the largest health profession in the world and generates the
58 largest salary bill for health care providers (All-Party Parliamentary Group on Global Health,
59 2016). Therefore, the focus on nursing is underpinned by the need to ensure that nursing science
60 is of the highest standard.

61 The literature identifies factors associated with quality in nursing doctoral programmes,
62 including supportive academic learning environments, faculty who provide supervision and
63 support and who are active scholars and leaders in their fields of expertise, as well as the
64 availability of resources (Evans and Stevenson, 2011; Minnick et al., 2010; Minnick et al., 2017;
65 Nabolsi et al., 2014; Volkert et al., 2018). Moreover, such programmes should be staffed with
66 doctorally prepared nursing faculty who can provide high-quality mentorship to prepare the next
67 generation of nurse scientists (Smeltzer et al., 2015). Mentorship by the nursing faculty
68 significantly influences students' decision to pursue academic careers (Fang et al., 2016). In a
69 recent Turkish study, Kapucu and Bulut (2019) found that the curriculum, academic personnel,
70 and academic environment were major factors affecting the quality of nursing doctoral education.
71 While the continual evaluation of nursing doctoral programmes is an important element in
72 supporting their long-term success (Nabolsi et al., 2014; Kapucu and Bulut, 2019), the literature
73 raises concerns about the lack of a coherent instrument to systematically evaluate the quality of
74 nursing doctoral education worldwide (Molzahn and Clark, 2015).

75 **Background**

76 Three decades ago, the Educational Testing Service, the world's largest private nonprofit
77 educational testing and assessment organization, used the Graduate Program Self-Assessment

78 (GPSA) questionnaire to evaluate the quality of doctoral education in the disciplines of nursing,
79 history, and psychology in the United States (Chambers and Holzemer, 1988). The GPSA
80 focused on seven areas of quality: programme purposes, faculty training and accomplishments,
81 student ability and performance, resources, academic and social environments of the programme,
82 programme processes and procedures, and alumni achievements. Holzemer and Chambers
83 (1986) used the GPSA to measure the environment and productivity and reported a significant
84 relationship between both student and faculty perceptions of the academic environment and their
85 scholarly productivity from 1979 to 1984, during which time the number of nursing doctoral
86 programmes increased in the United States.

87 To meet the need for a standardised instrument, nursing scholars from eight countries on
88 five continents developed quality criteria, standards, and indicators (QCSI), using the AACN
89 position statement on doctoral education developed in 2001 as the basis (Blinded authors, 2006).
90 Several nursing scholars who participated in the QCSI development helped refine it and created
91 the Quality of Nursing Doctoral Education (QNDE) instrument to evaluate the quality of
92 programmes internationally.

93 The QNDE instrument has four main domains: program, faculty (called "academic staff" in some
94 countries), resources, and evaluation (Blinded authors, 2015). Global experts in nursing doctoral
95 education confirmed its formative construct validity and reliability (Blinded authors, 2012;
96 Blinded authors, 2014). Based on four domains, a team of nursing scholars from seven countries
97 (Blinded countries) used it to evaluate nursing doctoral programmes in each of their countries
98 (Blinded authors, 2015). The data analysis showed that the Faculty domain among the four
99 domains had highest association with QNDE with statistical significance (Blinded authors, 2015).

124 sampling was also used for faculty members in 14 countries who were considered experts in
125 nursing doctoral education by their managers and 17 faculty participated. Experts were defined
126 based on their experience in nursing doctoral education, research publications, extensive global
127 consultation on the topic, and conference presentations, etc. In Stage 2, the perceived quality of
128 research-focused nursing doctoral education was assessed by purposive samples of faculty (n =
129 111) and students (n = 106) from 20 countries that were known to have nursing doctoral
130 programs with a research focus. The number of participants exceeded the recommended
131 minimum number of subjects for the conduct of factor analysis (five subjects per test item for 45
132 items) (Costello and Osborne, 2005).

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134 **Procedures**

135 The research team revised the original QNDE instrument used in a study by (Blinded
136 authors, 2015) addressing the limitations referred above. Revisions included reducing the
137 number of items (Figure 1), eliminating duplicative items, clarifying items, and attending to
138 nomenclature matters. It was then formatted for a survey software package called Qualtrics
139 (Qualtrics, Provo, UT). The utility of the Qualtrics survey form was pilot tested by the research
140 team members and several faculty and doctoral students. They clarified confusing, overlapping
141 item terminology, and tested the ease of use of the Qualtrics survey tool.

142 This study was conducted in two stages; the Stage 1 examined the content validity of the
143 QNDE instrument. The results of the Stage 1 formed the basis for Stage 2, which tested internal
144 consistency reliability and construct validity.

145 In the Stage 2, the perceived quality of research-focused nursing doctoral education was
146 assessed. Email addresses were obtained from public sources within universities that offer

147 nursing doctoral programmes with a research focus and the deans/directors or senior faculty of
148 colleges of nursing with research focused doctoral programmes. In addition, with permission of
149 its board of directors, access was gained to the membership directory of the INDEN (McIlfatrick,
150 2017). Using the Qualtrics survey software, potential participants were sent an email with a link
151 to the QNDE instrument.

152 The online link included an introduction/guidance about the study and a consent form,
153 which once agreed, allowed participants to complete the questionnaire; this took approximately
154 30 minutes. Participants received reminders two weeks after the initial email. Data for the first
155 and the second stages were collected between June 2018 and March 2019.

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157 **Revised QNDE Instrument**

158 Demographic information sought included age, gender, educational background, country
159 of current employment or study, position title (faculty), and percentage of time spent on
160 academic duties (faculty). The QNDE instrument consists of 45 items within four domains:
161 program, faculty, resources, and evaluation. The program domain (15 items) is concerned with
162 aspects of the nursing doctoral programme, including scholarship, learning environment, and
163 programme administration. The faculty domain (16 items) evaluates the overall quality, research,
164 and academic work of the faculty. The resources domain (9 items) deals with resources available
165 (i.e., financial, personnel, infrastructure) in the university and school/department of nursing. The
166 evaluation domain (5 items) seeks to obtain information on the school/department's evaluation
167 system for its doctoral programme. The QNDE instrument is a 4-point Likert-type scale (1 =
168 *strongly disagree*, 2 = *disagree*, 3 = *agree*, and 4 = *strongly agree*). Comments on their

169 experience of completing the QNDE instrument were also sought from participants using one
170 open-ended question at the end of the questionnaire (Stage 2).

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172 **Ethical considerations**

173 Ethics committee approval was obtained from the lead author's University's Institutional
174 Review Board.

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176 **Data Analysis**

177 From the online survey tool (Qualtrics), data were exported to SPSS version 24.0 and
178 Mplus 8.0 for data analysis. Data for content validity were analysed using an item content
179 validity test (I-CVI; Polit and Beck, 2006). The 17 faculty experts in nursing doctoral education
180 rated items using a 4-point rating scale (1 = *not relevant*, 2 = *less relevant*, 3 = *relevant*, 4 = *very*
181 *relevant*). The internal consistency reliability was determined using Cronbach's alpha, computed
182 for the QNDE instrument and its four domains. A Cronbach's alpha higher than 0.7 was
183 considered acceptable (Cortina, 1993).

184 Demographic information was analysed using descriptive statistics, which included
185 calculating (1) means and minimum and maximum values for continuous items and (2) counts
186 and percentages for categorical items. Construct validity was tested by confirmatory factor
187 analysis, which is commonly used for assessing psychometric properties (Angel et al., 2012;
188 Haraldstad et al., 2011). Confirmatory factor analysis was conducted in ordinal scale using
189 robust WLSMV (weighted least square mean and variance) adjusted estimator in MPlus 8. The
190 model fit was evaluated by Chi-square statistics and fit indices such as Root Mean Squared Error
191 of Approximation (RMSEA) and Comparative Fit Index (CFI), Tucker Lewis index (TLI), and

192 Standardised Root Mean Square Residual (SRMR). The cutoff values for good model fits were
193 adopted as CFI, TLI > .95; SRMR < .08; RMSEA < .06 (Hu and Bentler, 1999; MacCallum et
194 al., 1996). The estimated factor loadings should be greater than 0.5 for better results (Hair et al.,
195 2009).

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Results

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Characteristics of Participants

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Faculty from 14 countries participated in Stage 1: Australia, Belgium, Brazil, Canada,
China, Ireland, Japan, Jordan, Slovenia, Sweden, Thailand, Republic of Korea, United Kingdom,
and United States. No students were included for Stage 1 as the investigators sought experts in
doctoral education to ascertain content validity. In Stage 2, participants were from 20 countries.
Table 1 shows the demographic characteristics of participants and their countries of origins.

Stage 1: Content Validity

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Table 2 shows the content validity of the instrument with I-CVI. Items with content
validity indexes (I-CVI) higher than .78 were retained (Polit and Beck, 2006). Three items in the
program domain and one item in the evaluation domain were retained though they had I-CVI's
less than .78, because content experts judged that their content was important to their respective
domain. Based on feedback from participants and consensus among content experts, nine items
(I-CVI = 0.47 to 0.76) were excluded from the original content validity study: three items from
the program domain, three from the faculty domain, one from the resources domain, and two
from the evaluation domain. The QNDE instrument was revised based on these results and this
version was used in the second stage to test its internal consistency reliability and construct
validity.

215 **Stage 2: Internal Consistency Reliability and Construct Validity**

216 The Cronbach's alpha calculation of the QNDE instrument was $\alpha = 0.97$. Alpha scores
217 for the four domains were: program ($\alpha = 0.91$), faculty (0.95), resources (0.88), and evaluation
218 (0.92; Table 3).

219 The construct validity of the QNDE instrument was verified by confirmatory factor
220 analysis (CFA; Table 4). The four-domain model was statistically confirmed based on the model
221 fit statistics RMSEA of .053, CFI of .958, TLI of .956, and SRMR of .063. Factor loading
222 coefficients for all items in each domain were $> .5$, which satisfied the minimum acceptable
223 requirement, and the coefficients were statistically significant ($p < .001$).

224 There were correlation coefficients of .632 between resources and evaluation domains;
225 and .848 between program and faculty domains, which was the highest. The average factor
226 correlation coefficient was 0.75. Correlation coefficients across pairs of domains were less than
227 .85 demonstrating the discriminant validity of the QNDE (Kline, 1998) (Figure 2). Convergent
228 validity was shown by average variances extracted (AVE) that were greater than .5 (i.e. Program
229 = .55, Faculty = .73, Resources = .62, and Evaluation = .85). This was also shown by all
230 standardized coefficients that were higher than .5 (Fornell and Larcker, 1981).

231 **Participant Comments on the QNDE Instrument and Discussion**

233 Participants provided feedback on the instrument in response to one open-ended question at the
234 end of the questionnaire (Stage 2); both faculty ($n = 29$, 26%) and students ($n = 25$, 24%)
235 responded. The following presents their substantive remarks, and discussion about their remarks.

236 **Organisational and nomenclature issues.** Faculty titles were confusing to some
237 participants ($n = 5$) as faculty (USA) and academic staff (UK) refers to the same personnel who
238 instruct students. Such difference can be expected given the global nature of this study.

239 Comments on the QNDE instrument included suggestions to add *don't know*, or *not applicable*
240 as a fifth option in the scale (three faculty and seven students). Ten students and five faculty
241 made favorable comments ranging from “it was easy to use and comprehensive,” “a great help to
242 improve research competencies,” “reflective of essential components in doctoral education,” and
243 “the questions made sense.”

244 One faculty requested that gender and ethnic identity questions to be revised, perhaps
245 allowing self-designation and showing greater sensitivity in these areas reflecting recent societal
246 trends. Two faculty thought the instrument was skewed toward the North American model of
247 doctoral education where campuses have graduate schools or colleges, even though these types
248 of units exist in many countries. Nonetheless, this suggests that organizational structures are not
249 universal and that the concept may need further clarification. One faculty member objected to the
250 exclusion of professional nursing doctorates, even though it was stated that this was not the focus
251 of this study.

252 **Other issues.** Other concerns were more fundamental. For example, one faculty member
253 felt that *nursing science* was outdated as a term, especially for those working or studying in more
254 generic health-focused settings. The research team recognizes this individual's viewpoint yet
255 remains concerned that the substance of nursing science such as nursing theory and nursing
256 philosophy may become diluted in the more generic interdisciplinary health science programmes
257 in which some nursing doctoral programs reside: unless the integrity and uniqueness of nursing
258 as a discipline are maintained while benefiting from the interdisciplinary nature of such
259 organisational structures. Also, we are aware of the increasing ground gained by ‘caring science’
260 as a focus of nursing, particularly in Europe, which indicates the evolving nature of nursing
261 science (Rehnsfeldt et al., 2017). Given the current emphasis on interdisciplinary research and

262 teaching, coupled with a shortage of nursing faculty and the increase in non-nursing faculty in
263 nursing schools, nursing science may potentially lose its identity in some settings. One faculty
264 felt that questions should be more heterogeneous and pertain to areas such as genetics, data
265 science, and emerging scientific developments. This reflects Henly et al. (2015) assertion that
266 research-focused nursing doctoral programmes should offer courses in emerging areas of science
267 and technology such as genomics. Questions on this issue were included in the Stage 1 of this
268 study (for content validity), but two items were deleted due to very low item content validity
269 index (I-CVI = 0.47 and 0.65). Their low I-CVIs may reflect the fact that such content is not
270 commonly included in nursing doctoral programmes in many countries.

271 One student indicated difficulty in socialisation in the programme that have an online
272 element. With increasing online education offered by doctoral programs, particularly in the USA
273 and Australia (Grad School Hub, 2018), the opportunity for socialisation is decreasing. It could
274 be argued that activities to facilitate socialisation would enhance professional networking and
275 enrich learning. A possible approach to consider may be periodic in-person or virtual seminars
276 on campus, both with faculty and students, especially those students involved in dissertation
277 research, and for those students participating in “research only” type programmes. Such seminars
278 could create opportunities for students to interact, to share information, to provide mutual
279 support, and receive guidance and input from the faculty.

280 One faculty commented that, while they are expected to do research and scholarship, they
281 were not allocated formal time for such activities. They tended to engage in these activities in
282 their own personal time. This meant that they found it difficult to include in the questionnaire a
283 formal percentage of time allocation for such undertakings. Allowing research/scholarship time
284 for faculty, particularly in research intensive universities, needs to be encouraged.

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286 **Discussion**

287 This study provides evidence of good content validity, internal consistency reliability,
288 and construct validity of the QNDE instrument. Such findings add credibility to the instrument,
289 and it means that internationally scholars can use it with a degree of trust and confidence when
290 assessing the quality of their research focused doctoral education programmes.

291 The literature highlights concerns about the poor quality of some doctoral programmes
292 (Hasgall et al., 2019), and numerous researchers have called for the assurance of quality of such
293 doctoral programmes to advance good practices in nursing (Breslin et al., 2015; Smeltzer et al.,
294 2015). While we declined requests from international colleagues to use the earlier version of the
295 QNDE instrument due to lack of psychometric rigor, it does reflect the importance of having
296 such an instrument and the significance placed upon it by the international nursing community.

297 The QNDE instrument has the advantage of being applicable to both the thesis-oriented
298 European doctorate model and USA doctorate model: independently conducting research under
299 faculty supervision for the former and taking coursework with dissertation research under faculty
300 supervision for the latter. Byrne et al. (2013) highlighted that the quality of European doctoral
301 education has developed around the aim of creating a quality culture that engages university
302 management, staff, and students. This study reflects this aim by including such participants.

303 Furthermore, the results from applying the instrument may be used to showcase schools'
304 high-quality programmes and instill confidence in existing students, faculty, and the potential
305 employers of new doctorally prepared nurses. By highlighting deficiencies in relation to doctoral
306 programmes, the QNDE instrument can also help to identify areas for quality improvement;
307 schools may be able to seek and commit funds based on areas suggested by the findings.

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309 **Considerations for the Future**

310 It is estimated that approximately 34 countries worldwide are offering research focused
311 nursing doctoral programmes (McIlpatrick, 2017). Therefore, the extent to which this instrument
312 is responsive to quality assessment of such programmes needs to be determined more broadly.
313 Similarly, at this time we know little about how newer programmes are performing, what their
314 needs are, how nursing science is being taught, the nature of mentorship practices they employ,
315 the types of students being recruited, and other features. It is important to learn about the
316 adequacy, responsiveness, and utility of the QNDE instrument in addressing these and other
317 emerging issues.

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319 **Limitations**

320 The purposive sampling frame came from the INDEN membership list, public
321 information from nursing schools offering doctoral programs with a research focus, and senior
322 academic colleagues that the research team accessed from publically available sources. It is
323 possible that they were positively predisposed to existing models of research focused nursing
324 doctoral education, and this could have biased their responses to the questionnaire. Larger
325 samples from a wider range of countries is recommended for future studies to help ascertain the
326 instrument's utility in meeting varied global needs.

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328 **Conclusions**

329 This was a global study where purposive samples of faculty and students participated
330 across 20 different countries on four continents to establish the content validity, internal
331 consistency reliability, and construct validity of the QNDE. This, and the rigorous way that the

332 analysis of data was handled, adds credibility to the instrument. Doctoral programmes in nursing
333 are proliferating across the globe and prestigious organizations such as European Universities
334 Association are calling for doctoral programs in general to be evaluated (Byrne et al., 2013). In
335 such a context, this instrument can make an important potential contribution to nursing doctoral
336 education.

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338 **Conflict of Interest**

339 No conflict of interest has been declared by the author(s).

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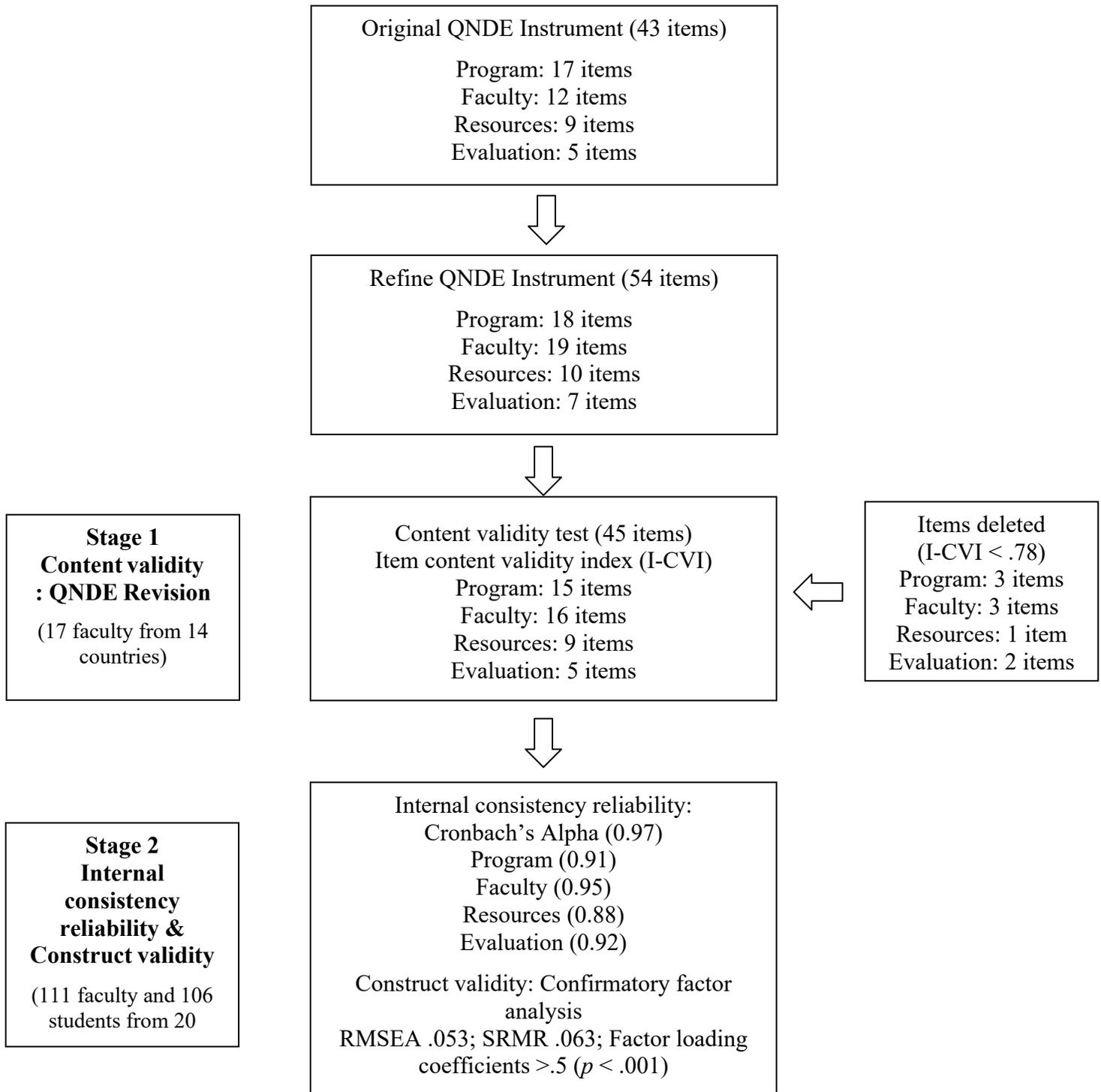
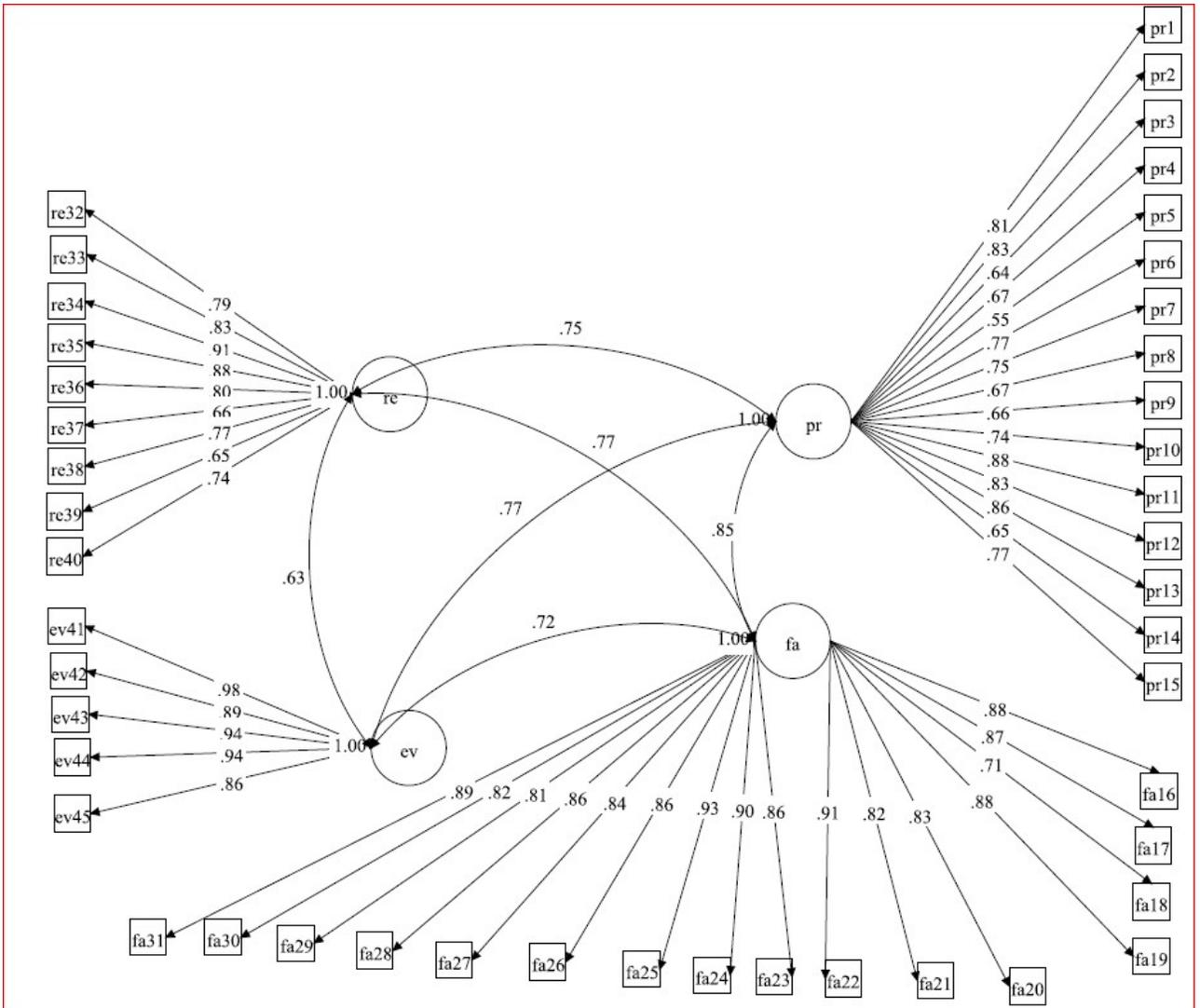


Figure 1. QNDE Instrument Psychometric Analysis Process



All item factor loading coefficients > .5. *significant < .001.
 RMSEA = .053, CFI = .958, TLI = .956, SRMR = .063
 Re = Resources, Pr = Program, Fa = Faculty, Ev = Evaluation

Figure 2. QNDE Confirmatory Factor Analysis Results

Table 1. Demographic Characteristics of Study Participants (Stage 2; $N = 217$)

Variables		Faculty ($n = 111$)	Students ($n = 106$)
		Mean (range) or n (%)	Mean (range) or n (%)
Age		55.96 (29-77)	40.75 (25-58)
Years since obtained/started degree		15.20 (1-42)	3.87 (0-23)
Gender	Male	16 (14.3)	13 (12.3)
	Female	95 (84.8)	93 (87.7)
	Other	1 (0.9)	0 (0.0)
Degree obtained/sought	Ph.D.	103 (92.0)	98 (94.2)
	D.Phil	2 (1.8)	1 (1.0)
	DNS	1 (0.9)	2 (1.9)
	EdD	3 (2.7)	1 (1.0)
	Other	3 (2.7)	2 (1.9)
Continents*	America	47 (42.3)	25 (23.6)
	Asia	23 (20.7)	34 (32.1)
	Europe	34 (30.7)	42 (39.6)
	Oceania	7 (6.3)	5 (4.7)
Faculty rank	Professor	48 (42.9)	
	Assistant professor (Reader)	6 (5.4)	
	Assistant professor (Senior lecturer)	15 (14.3)	
	Associate professor	13 (11.6)	
	Lecturer	11 (9.8)	
	Other: please specify	18 (16.1)	
Faculty track	Tenure track (Permanent)	91 (82.1)	
	Non-tenured track (Fixed term)	8 (7.1)	
	Clinical track	7 (6.3)	
	Joint appointment (Clinical/Academic)	2 (1.8)	
	Other: please specify	3 (2.7)	
Percentage of time	Graduate (postgraduate) level	28.75 (0-100)	

spent on duties	teaching/student mentoring	
	Research	30.22 (0-100)
	Program academic administration	16.05 (0-100)
	Undergraduate student teaching	10.54 (0-75)
	Committee work and community service	11.30 (0-60)
	Other	3.15 (0-65)

* Continents

America: Brazil, Canada, United States (3 countries)

Asia: China, Hong Kong, India, Japan, Jordan, Philippines, Republic of Korea, Taiwan, Thailand (9 countries)

Europe: Belgium, Denmark, Greece, Ireland, Slovenia, Sweden, United Kingdom (7 countries)

Oceania: Australia (1 country)

Table 2. Results of Content Validity for the QNDE Instrument ($N = 17$)

Items	I-CVI
Program domain (15 items)	
1. The importance of research is clearly stated as a goal of the program	1.00
2. Your institution values students and support them in their scholarly activities	1.00
3. Theoretical and philosophical underpinnings of nursing science are emphasized in the program	0.88
4. The program includes core courses (e.g., theory development, research methodologies for qualitative and quantitative research, research ethics) and other courses deemed appropriate by the faculty	1.00
5. The program includes interdisciplinary research training for research development	0.76
6. The program includes up-to-date approaches for data analysis	0.94
7. The program includes dissertation research seminars, interdisciplinary courses, and leadership development	0.88
8. Program/module descriptions are written and available to students and faculty	0.82
9. All students receive formal training in research ethics	0.94
10. Physical environment are supportive of doctoral students' learning	1.00
11. Academic environments (conducive for teaching, learning and research) are supportive of doctoral students' learning	0.94
12. The program facilitates social interaction among students	0.76
13. The program facilitates interaction between faculty and students	0.82
14. There are administrative systems in place to ensure that faculty carry out regular and appropriate supervision of the students' progress	0.82
15. The program of study offers knowledge and skills on how to implement research findings	0.76
Faculty domain (16 items)	
16. Faculty members meet the requirements of the university for graduate research and doctoral education	1.00
17. Faculty members have expertise in the subject areas in nursing or nursing related field	1.00
18. Faculty members have external grant support for their research	0.82
19. Faculty members have evidence of scholarship by publishing books or articles in peer-reviewed journals	0.94
20. Faculty members have evidence of scholarship by presenting at conferences (national,	1.00

 international)

21. Faculty members challenge students to expand their learning (e.g., from social, ethical, cultural, economic, and political domains with import to nursing and health care)	0.94
22. Faculty members hold membership in professional organizations/societies	0.94
23. Faculty members are actively engaged in shaping the discipline of nursing through leadership in professional organizations/societies	0.88
24. Faculty members demonstrate fulfillment of diverse responsibilities appropriate for university faculties (e.g., teaching, research, administration, service, and mentoring)	1.00
25. Faculty members mentor and assist students to understand the value of programs of research and scholarship	0.94
26. Faculty members use resources within the university and broader community to support the doctoral program goals	0.82
27. Faculty members devote significant time to supervising students' research	0.88
28. Faculty members give timely and quality feedback on students' research	0.88
29. Faculty recommend/nominate their peers, students, and graduates for significant grants, awards, and positions	0.82
30. Faculty members facilitate career development including references/recommendation letters	0.82
31. Faculty members' research and expertise are in the scientific areas offered by the PhD program	0.94
Resources domain (9 items)	
32. Technical staff (e.g., statistician, librarian) are available	0.88
33. Support staff (for registration, progression) are available	0.94
34. Research infrastructure is in place for facilitating research: research office/center that provides funding opportunities/support, consultation for research grant development	0.82
35. Research infrastructure is in place for facilitating research: administrative support for processing grant applications	0.82
36. Advanced computing facilities are available to enable cutting edge approaches to data analysis	0.82
37. Advanced information technology is available for distance education (e.g., online courses), if offered	0.82
38. Library has sufficient and up-to-date holdings, search engines, and databases	1.00
39. University/school provides laboratory and equipment for biological/clinical research	0.94
40. The university has a doctoral college or graduate school to support students and monitor quality of doctoral education	1.00

Evaluation domain (5 items)

41. Program evaluation systems adhere to ethical and procedural standards for formal program evaluation (e.g., confidentiality)	0.93
42. Students and graduates participate in program evaluation activities	0.93
43. Program evaluation is rigorous, systematic, ongoing, and comprehensive	0.80
44. Program evaluation focuses on the university's and program's specific mission	0.87
45. The school provides data on doctoral students' performance and their needs to faculty and external constituents on a regular basis and recommend modifications as indicated	0.71

Table 3. Reliability of the Four Domains of the QNDE Instrument

	Domains				
	Total	Program	Faculty	Resources	Evaluation
N	201	217	209	205	206
# of items	45	15	16	9	5
Cronbach's α	0.97	0.91	0.95	0.88	0.92

Table 4. Confirmatory Factor Analysis Results ($N = 217$)

Domain	Item	Estimate	S.E.	Est./S.E.	P-Value
Program	PR1	0.806	0.05	15.98	<.001
	PR2	0.832	0.036	23.372	<.001
	PR3	0.64	0.049	12.971	<.001
	PR4	0.672	0.05	13.481	<.001
	PR5	0.552	0.052	10.542	<.001
	PR6	0.768	0.037	20.567	<.001
	PR7	0.747	0.038	19.519	<.001
	PR8	0.667	0.048	14.042	<.001
	PR9	0.659	0.048	13.786	<.001
	PR10	0.743	0.037	20.071	<.001
	PR11	0.877	0.024	36.41	<.001
	PR12	0.831	0.027	30.251	<.001
	PR13	0.865	0.023	37.77	<.001
	PR14	0.651	0.046	14.214	<.001
	PR15	0.766	0.039	19.546	<.001
Faculty	FA16	0.875	0.024	36.513	<.001
	FA17	0.866	0.03	29.187	<.001
	FA18	0.709	0.038	18.748	<.001
	FA19	0.878	0.024	36.501	<.001
	FA20	0.834	0.032	26.215	<.001
	FA21	0.822	0.029	28.404	<.001
	FA22	0.905	0.021	43.706	<.001
	FA23	0.861	0.027	32.484	<.001
	FA24	0.902	0.02	44.652	<.001
	FA25	0.933	0.019	48.663	<.001
	FA26	0.863	0.024	35.331	<.001
	FA27	0.838	0.03	27.996	<.001
	FA28	0.862	0.026	32.898	<.001
	FA29	0.81	0.031	26.199	<.001
	FA30	0.822	0.028	29.638	<.001
	FA31	0.886	0.023	39.072	<.001
Resources	RE32	0.786	0.039	20.025	<.001
	RE33	0.832	0.038	21.652	<.001
	RE34	0.907	0.02	44.303	<.001
	RE35	0.884	0.024	37.166	<.001
	RE36	0.799	0.034	23.476	<.001
	RE37	0.658	0.049	13.357	<.001
	RE38	0.765	0.048	16.055	<.001
	RE39	0.653	0.049	13.221	<.001
	RE40	0.742	0.047	15.894	<.001
Evaluation	EV41	0.976	0.024	39.978	<.001
	EV42	0.885	0.027	32.372	<.001
	EV43	0.942	0.015	61.628	<.001

GLOBAL QNDE INSTRUMENT VALIDATION

EV44	0.945	0.018	52.675	<.001
EV45	0.86	0.026	33.357	<.001

All item factor loading coefficients > .5. *significant < .001.

**Global Assessment Instrument for Quality of Nursing Doctoral Education with a Research
Focus: Validity and Reliability Study**

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