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Article

# Empowering Nurse Health Education: Linguistic and Cultural Validation of the Nurse Health Education Competence Instrument (NHECI) in the Italian Context

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**Abstract:** Background: Nurses worldwide are acknowledged for their role in health education across various settings. However, doubts often arise regarding their competence in this domain. This study aims to validate the Nurse Health Education Competence Instrument (NHECI) linguistically and culturally for the Italian context. Methods: Following Beaton et al.'s (2000) guidelines, we conducted cross-cultural adaptation to develop the Italian version of the questionnaire. Results: The Italian version demonstrates good internal consistency and stability, making it suitable for assessing nursing students during clinical internships and practicing nurses. Availability of Italian tools promotes research in healthcare, ensuring patient-centric care. Conclusions: The validity and reliability of the Italian version of the instrument for assessing health education competencies, essential for self-assessment among health education nurses, are established.

**Keywords:** nursing competence; health education; tool development; nursing education

## 1. Introduction

The importance of health education and promotion in healthcare has been widely recognized for decades [1,2]. However, the conceptual distinction between these two terms, particularly in the nursing profession, has been a source of ongoing debate [3,4]. While some nurses may mistakenly assume that their mere employment in the healthcare sector automatically qualifies them as health promoters, the reality is that their roles are more accurately described as health educators [5]. Health education, which involves the dissemination of health-related information to individuals, is a crucial component of the broader concept of health promotion, which aims to empower people, families, groups, and communities to improve their health and well-being [6].

The terms "health education" and "patient education" are often used interchangeably, as they share common theoretical foundations and the importance of health-related behaviours for both patients and the general population [7,8]. Competence in health or patient education is widely recognized as essential for healthcare professionals, as it can contribute to improved health outcomes and patient satisfaction [9,10]. However, the precise definition and assessment of this competence remain elusive, hindering effective communication and collaboration among researchers and practitioners [11].

Despite the acknowledged significance of health education competence, this professional competence has not received the attention it deserves [12,13]. Potential reasons for this include a lack of conceptual clarity, limited time and resources, and inadequate pedagogical and subject-specific

knowledge among healthcare professionals [14,15]. Furthermore, the implementation of patient education can be hampered by a disease-centered approach, the exclusion of family members, and a lack of educational assessment and trust in the educator [16].

To address these challenges, the present study aimed to linguistically validate and culturally adapt the Nurse Health Education Competence Instrument (NHECI) for its effective integration into Italian clinical practice. By assessing nursing competencies in the context of health education, this process seeks to provide a reliable and culturally sensitive tool to evaluate and enhance nurses' abilities in patient teaching and education. The validation of this instrument will contribute to a more accurate assessment of nursing competencies in health education, which can support the development and implementation of targeted educational programs and evidence-based clinical interventions.

## 2. Materials and Methods

### 2.1. Study Design

To verify the validity and reliability of the I- NHECI, the cultural adaptation and psychometric properties of the tool were evaluated.

### 2.2. Instrument

The NHECI, a scale designed to assess nurses' competence in health education, comprises 58 items retained after item analysis. In the original study by María Pueyo-Garrigues et al., (2021) [17] the exploratory factor analysis identified three corresponding domains of cognitive (23 items), psychomotor (26 items) and affective-attitudinal competence (9 items). Respondents rate each item on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The total score for each scale is calculated by summing the individual item scores. Demographic data collected include gender, age, marital status, education level, educational background, department, work experience (years), experience in department (years), and job satisfaction. The internal consistency of the NHECI scale, as indicated by Cronbach's  $\alpha$ , is .810.

### 2.3. Setting and Sample

Our sample consisted of nurses employed in various hospital settings. Participant selection took place between May and July 2023 through a convenience sampling process. Inclusion criteria for the study required participants to be nurses working in clinical settings and to have provided informed consent for participation. Registered nurses working in private clinics or non-clinical roles, such as administrative roles, were excluded from the analysis, as their inclusion could have influenced the results. The optimal sample size for factor analysis was determined using the 'sufficient sample' method Kaiser-Meyer-Olkin and the 'Bartlett's test of sphericity' to ensure data validity. It was concluded that a sample of 200 participants represented the optimal size for conducting factor analysis on the NHECI scale. These approaches are widely recognized for evaluating the feasibility of factor analysis. Even with a sample of 200 participants, reliable and meaningful results can be obtained, provided that data validity conditions and analysis adequacy are met.

### 2.4. Ethical Statement

Ethical approval for this study was obtained from the Ethics Committee of the Center of Excellence for Nursing Culture and Research (Protocol No. 2.21.26). Before commencing the study, the purpose of the research was explained to the nursing coordinators of the departments in each hospital where participants were recruited. Hospitals agreed to participate in the study after approving our request for participation. Prior to data collection, participants were informed about the purpose of the study, the procedures and research method, data anonymity, and the option to withdraw from the study at any time without consequences. Participants were then asked to carefully read and sign the informed consent form before participating in the study.

### 2.5. Translation Process and Content Validity

The NHECI was translated into Italian for our study with permission from the original scale developers [17]. Following the forward-backward translation guidelines proposed by Beaton et al. (2000) [18], the scale was translated from English to Italian. This translation was conducted by a bilingual nursing sciences professor proficient in English and Italian. Subsequently, it underwent rigorous review by an international interpreter and a nursing professional, both residing in English-speaking countries for over a decade. They provided valuable feedback on the expression and clarity of the Italian translation, ensuring its adequacy. The translated version was then presented to 20 Italian nurses, each possessing more than five years of clinical nursing experience. These nurses confirmed their comprehension of the scale items and identified cultural nuances requiring adjustment. Following this, a back-translation was performed by an English language interpreter, and the similarities between the original text and the back-translation were evaluated by two native English speakers.

Content validity of the I-NHECI was verified by ten experts, comprising four nursing coordinators and six nursing professors. The Content Validity Index (CVI) was employed to assess the relevance and clarity of the tool, along with evaluations of the Content Validity Ratio (CVR), the Content Validity Index for Scale (S-CVI), and the Item-level Content Validity Index (I-CVI) [19]. Initially, experts were tasked with determining whether each scale item was essential for constructing a comprehensive set of scale items. Items were rated on a scale of 1 to 3, indicating their necessity. The CVR for content ranged from 1 to -1, with higher scores signifying greater expert consensus on the item's inclusion in the scale. We calculated CVR using the formula  $CVR = (N_e - N/2)/(N/2)$ , with N representing the total number of experts. The numerical value of CVR was derived from the Lawshe table [20].

The CVR for the translated scale exceeded 0.62, indicating significant item acceptance [20]. Additionally, both S-CVI and I-CVI [19] values ranged from -1 to +1, with a threshold of 0.70 or higher considered sufficient to retain items in the translated version, as was the case in our study [19].

### 2.6. Analysis

The data collected in our study were analyzed using SPSS 24 (SPSS Inc., Chicago, USA) and the R statistical package. To assess construct validity, exploratory factor analysis (EFA) was employed. The Kaiser-Meyer-Olkin test and Bartlett's test of sphericity were conducted to ensure the appropriateness of the data for factor analysis. Principal component analysis and varimax rotation were used to extract factors [21].

Model fit indices were computed using confirmatory factor analysis (CFA). Generally, a  $\chi^2/df$  ratio between 2 and 5 is deemed acceptable, even with a small sample size. However, the Comparative Fit Index (CFI) is less affected by sample size compared to the  $\chi^2/df$  ratio. A CFI of at least .70 is considered acceptable, though a value of .90 or higher is preferable [22]. A Goodness of Fit Index (GFI) equal to or above 0.90 indicates a good fit for the model [23]. However, as the model complexity increases, the likelihood of GFI being influenced by the sample size also rises [24]. The Tucker-Lewis Index (TLI) is unaffected by sample size, with a value above .90 considered appropriate [25]. The Root Mean Square Residual (RMSR) represents the average value of all standardized residuals and is used to assess proximity of fit in ordinal factor analysis. A well-fitting model typically has an RMR value below 0.05 [22]. The Root Mean Square Error of Approximation (RMSEA) is a commonly used index. Since this index is highly sensitive to changes in sample size, additional goodness-of-fit measures have been included. Here, values below .08 are deemed acceptable [26].

We employed Cronbach's  $\alpha$  to measure the internal consistency of each item and to assess the validity of each dimension of the I-NHECI scale. Typically, a Cronbach's  $\alpha$  coefficient above 0.90 indicates high confidence, above 0.80 indicates normal confidence, above 0.70 indicates acceptable confidence, and above 0.60 indicates low confidence. Therefore, reliability is typically confirmed if Cronbach's  $\alpha$  is greater than 0.70 for new instruments or greater than 0.80 for established instruments [27].

### 3. Results

Data obtained from a sample of healthcare professionals present noteworthy insights into demographic characteristics and job satisfaction levels within the sector. Regarding gender distribution, the majority of respondents identified as female, constituting 68.5% of the sample, while male respondents comprised 30.6%. A smaller proportion, 0.9%, identified with other gender identities. Concerning qualifications, the overwhelming majority of participants were nurses, accounting for 87.4% of the sample, whereas head nurses constituted 12.6%. Analysis of job satisfaction revealed diverse responses. A substantial portion of respondents, 40.1%, reported being quite satisfied with their work, followed by 20.7% who expressed being highly satisfied. Conversely, a smaller percentage, 3.2%, indicated dissatisfaction with their job, while 9.5% reported only slight satisfaction. Overall, data from 222 participants illuminate the intricate interplay of gender, role, and satisfaction levels within the healthcare profession. (Table 1).

**Table 1.** Demographic Characteristics of the Sample (N = 222).

<b>Gender</b>		
	<b>N</b>	<b>%</b>
<b>Female</b>	<b>152</b>	<b>68.5</b>
<b>Male</b>	<b>68</b>	<b>30.6</b>
<b>Others</b>	<b>2</b>	<b>0.9</b>
<b>Role</b>		
<b>Nurse</b>	<b>194</b>	<b>87.4</b>
<b>Head Nurse</b>	<b>28</b>	<b>12.6</b>
<b>How Satisfied You Are with Your Work</b>		
<b>Quite</b>	<b>89</b>	<b>40.1</b>
<b>A lot</b>	<b>46</b>	<b>20.7</b>
<b>For Nothing</b>	<b>7</b>	<b>3.2</b>
<b>Little</b>	<b>21</b>	<b>9.5</b>
<b>Satisfied</b>	<b>59</b>	<b>26.6</b>
<b>Total</b>	<b>222</b>	<b>100.0</b>

The average age of participants was 35.30 years, with a standard deviation of 13.367. Concerning tenure in the current profession, an average of 11.59 years was reported, with a SD of 12.127. Additionally, participants reported an average practice duration within their current business unit of 4.86 years, with a SD of 6.822. The age distribution of participants ranged from a minimum of 20 years to a maximum of 67 years, while tenure in the current profession varied from 0 to 42 years, and practice within the current business unit ranged from 0 to 40 years. (Table 2).

**Table 2.** Demographic Characteristics of the Sample (N = 222).

	<b>Age</b>	<b>How Long Have You Been In Your Current Profession?</b>	<b>How Long Have You Been Practising In Your Current Business Unit?</b>
<b>Average</b>	<b>35.30</b>	<b>11.59</b>	<b>4.86</b>
<b>DS</b>	<b>13.367</b>	<b>12.127</b>	<b>6.822</b>
<b>Min</b>	<b>20</b>	<b>0</b>	<b>0</b>
<b>Max</b>	<b>67</b>	<b>42</b>	<b>40</b>

The I-NHECI scale was evaluated for its reliability using Cronbach's Alpha coefficient, which yielded an average value of 0.976. This high coefficient indicates a strong internal coherence between the items of the scale, confirming the robustness and consistency of the measure in measuring the construct under consideration. The I-NHECI scale obtained Cronbach's Alpha values between 0.975 and 0.977. This high coefficient indicates a strong internal coherence between the items of the scale,

confirming the robustness and coherence of the measure in measuring the construct under consideration (Table 3).

Table 3. Cronbach Alpha.

	Cronbach Alpha	Mean
I-NHECI1	0.976	
I-NHECI2	0.976	
I-NHECI3	0.976	
I-NHECI4	0.976	
I-NHECI5	0.976	
I-NHECI6	0.976	
I-NHECI7	0.976	
I-NHECI8	0.975	
I-NHECI9	0.976	
I-NHECI10	0.976	
I-NHECI11	0.975	
I-NHECI12	0.976	
I-NHECI13	0.976	
I-NHECI14	0.976	
I-NHECI15	0.975	
I-NHECI16	0.975	
I-NHECI17	0.975	
I-NHECI18	0.975	
I-NHECI19	0.975	
I-NHECI20	0.976	
I-NHECI21	0.976	
I-NHECI22	0.975	
I-NHECI23	0.976	
I-NHECI24	0.976	0.976
I-NHECI25	0.976	
I-NHECI26	0.975	
I-NHECI27	0.976	
I-NHECI28	0.976	
I-NHECI29	0.975	
I-NHECI30	0.976	
I-NHECI31	0.976	
I-NHECI32	0.976	
I-NHECI33	0.975	
I-NHECI34	0.975	
I-NHECI35	0.975	
I-NHECI36	0.975	
I-NHECI37	0.975	
I-NHECI38	0.976	
I-NHECI39	0.976	
I-NHECI40	0.976	
I-NHECI41	0.975	
I-NHECI42	0.975	
I-NHECI43	0.975	
I-NHECI44	0.975	
I-NHECI45	0.976	
I-NHECI46	0.976	
I-NHECI47	0.975	

I-NHECI48	0.975
I-NHECI49	0.976
I-NHECI50	0.976
I-NHECI51	0.976
I-NHECI52	0.977
I-NHECI53	0.976
I-NHECI54	0.975
I-NHECI55	0.976
I-NHECI56	0.975
I-NHECI57	0.976
I-NHECI58	0.976

Parallel analysis was conducted to determine the appropriate number of components or factors to retain in the factor analysis. The results indicate that six components or factors were identified, each characterized by an average eigenvalue ranging from 1.779.221 to 2.166.393. Percentile eigenvalues, indicating the relative contribution of each component to the total variance, ranged from 1.828.000 to 2.301.410. These findings suggest that each component significantly contributes to the overall variance of the data, supporting the decision to include all six factors in the factor analysis (Table 4).

**Table 4.** Parallel Analysis.

Component or factor	Average eigenvalue	Percentile eigenvalue
1	2.166.393	2.301.410
2	2.062.623	2.141.609
3	1.972.801	2.039.919
4	1.902.988	1.960.727
5	1.836.736	1.887.397
6	1.779.221	1.828.000

The assumptions for the application of exploratory factor analysis were verified through the Kaiser-Meyer-Olkin (KMO) test and the Bartlett's test of sphericity. The KMO value was 0.948, indicating excellent sampling adequacy for factor analysis. Bartlett's test of sphericity showed statistically significant results ( $\chi^2 = 10430.414$ ,  $df = 1653$ ,  $p < 0.001$ ), suggesting that the correlation matrix is not an identity matrix and that there are correlations between the variables that justify the application of factor analysis. Overall, the results of these preliminary tests confirmed the suitability of the data for conducting the exploratory factor analysis.

These results indicate that of the Italian version of the Nurse Health Education Competence Instrument (I-NHECI) has adequate psychometric properties to reliably and validly assess nurses' competence in health education. The six factors emerged from the exploratory factor analysis provide a multidimensional representation of this construct, offering important insights for the design of training interventions aimed at developing and strengthening the different facets of nurses' competence in the field of health education.

Exploratory factor analysis of the Italian version of the I-NHECI identified six factors that collectively explain 63.599% of the total variance. Below are the main results for each factor (table 5):

Factor 1 (43.674% of variance): This factor is characterized by high factor loadings for items 1-19 of the NHECI, which appear to measure various dimensions of nursing competence in health education, such as the ability to design, implement, and evaluate effective educational interventions. Items with the highest factor loadings on this factor relate to the ability to select and use appropriate educational materials and resources, to adapt content and teaching strategies to patient needs, and to evaluate the impact of educational interventions.

Factor 2 (6.455% of variance): The second factor comprises items 20-34 of the I-NHECI, which seem to reflect nursing competence in learning and experimenting with new approaches and

methodologies for health education. Items with the highest factor loadings on this factor concern the ability to quickly learn the use of new technologies and educational tools, to enthusiastically experiment with integrating new teaching strategies, and to easily adapt to changes and innovations in health education.

Factor 3 (4.447% of variance): This factor is defined by items 36-44 of the I-NHECI, which appear to measure nursing competence in using specific technologies and digital tools for health education, such as presentation software, multimedia content creation tools, and e-learning platforms. Items with the highest factor loadings on this factor relate to the effective use of such technologies for educational purposes.

Factor 4 (3.662% of variance): The fourth factor is represented by items 45-51 of the I-NHECI, which reflect nursing competence in using digital technologies to assess patient learning and behavioral change. Items with the highest factor loadings on this factor concern the ability to use technologies to collect, analyze, and interpret data on educational outcomes.

Factor 5 (3.147% of variance): This factor is defined by items 52-57 of the I-NHECI, which seem to measure nursing competence in using digital technologies to communicate and collaborate with patients, their families, and other healthcare professionals. Items with the highest factor loadings on this factor relate to the ability to use technologies to maintain effective communication and facilitate collaboration within the healthcare team.

Factor 6 (2.213% of variance): The sixth factor is represented by item 58 of the I-NHECI, which appears to measure nursing competence in using digital technologies to promote inclusion and accessibility for patients with special needs or vulnerabilities. This factor reflects a specific dimension of nursing competence, related to the use of technologies to promote the accessibility and inclusion of patients with disabilities, language barriers, or other vulnerabilities.

Overall, the results of the exploratory factor analysis suggest that nursing competence in health education is a multidimensional construct, composed of various facets related to:

1. Designing, implementing, and evaluating effective educational interventions.
2. Learning and experimenting with new educational approaches and methodologies.
3. Using specific technologies and digital tools for health education.
4. Assessing patient learning and behavioral change.
5. Communicating and collaborating with patients, families, and other healthcare professionals.
6. Promoting inclusion and accessibility for patients with special needs or vulnerabilities.

This articulation of the nursing competence construct in health education provides a more comprehensive and detailed framework of the various skills and abilities that nurses perceive themselves to possess in delivering effective and inclusive educational interventions. Such results may have important implications for the design of targeted training programs aimed at developing and strengthening these competencies among nurses, to improve the quality of health education provided to patients.

**Table 5.** Exploratory Factor Analysis of the Italian version of NHECI.

	<b>Factor 1</b>	<b>Factor 2</b>	<b>Factor 3</b>	<b>Factor 4</b>	<b>Factor 5</b>	<b>Factor 6</b>
<b>I-NHECI 1</b>	<b>0,773</b>	0,221	0,167	0,138	0,142	-0,031
<b>I-NHECI 2</b>	<b>0,756</b>	0,264	0,121	0,063	0,088	0,049
<b>I-NHECI 3</b>	<b>0,739</b>	0,207	0,164	0,185	0,195	0,019
<b>I-NHECI 4</b>	<b>0,722</b>	0,187	0,173	0,114	0,120	0,263
<b>I-NHECI 5</b>	<b>0,712</b>	0,154	0,199	0,224	0,217	0,037
<b>I-NHECI 6</b>	<b>0,696</b>	0,386	0,129	0,120	0,158	-0,013
<b>I-NHECI 7</b>	<b>0,680</b>	0,155	0,224	0,299	0,179	-0,058
<b>I-NHECI 8</b>	<b>0,674</b>	0,180	0,253	0,232	0,037	-0,089
<b>I-NHECI 9</b>	<b>0,669</b>	0,256	0,260	0,147	0,138	0,094
<b>I-NHECI 10</b>	<b>0,662</b>	0,273	0,144	0,174	0,147	0,107
<b>I-NHECI 11</b>	<b>0,657</b>	0,163	0,312	0,242	0,151	0,124
<b>I-NHECI 12</b>	<b>0,652</b>	0,227	0,190	0,278	0,111	0,031

I-NHECI 13	<b>0,623</b>	0,202	0,180	0,197	0,176	0,128
I-NHECI 14	<b>0,623</b>	0,271	0,256	0,247	0,133	0,073
I-NHECI 15	<b>0,553</b>	0,367	0,154	0,192	0,099	0,034
I-NHECI 16	<b>0,533</b>	0,334	0,125	0,303	0,104	-0,201
I-NHECI 17	<b>0,525</b>	0,376	0,160	0,256	0,254	-0,155
I-NHECI 18	<b>0,476</b>	0,341	0,384	-0,055	0,034	-0,145
I-NHECI 19	<b>0,426</b>	0,384	0,218	0,405	0,086	-0,127
I-NHECI 20	0,281	<b>0,777</b>	0,202	0,208	0,088	-0,037
I-NHECI 21	0,319	<b>0,753</b>	0,075	0,174	0,101	0,132
I-NHECI 22	0,322	<b>0,738</b>	0,094	-0,013	0,234	0,038
I-NHECI 23	0,306	<b>0,738</b>	0,050	0,170	0,113	-0,179
I-NHECI 24	0,348	<b>0,723</b>	0,115	0,198	0,149	-0,150
I-NHECI 25	0,311	<b>0,715</b>	-0,003	0,068	0,195	0,104
I-NHECI 26	0,298	<b>0,702</b>	0,190	0,141	0,136	-0,218
I-NHECI 27	0,305	<b>0,677</b>	0,049	0,221	0,127	0,281
I-NHECI 28	0,051	<b>0,676</b>	0,234	0,246	-0,017	0,168
I-NHECI 29	0,303	<b>0,650</b>	0,096	-0,108	0,263	-0,092
I-NHECI 30	0,201	<b>0,625</b>	0,015	0,276	0,153	0,347
I-NHECI 31	0,152	<b>0,593</b>	0,396	0,140	0,306	0,142
I-NHECI 32	0,108	<b>0,567</b>	0,331	0,201	0,175	-0,081
I-NHECI 33	0,200	<b>0,565</b>	0,246	0,183	0,341	0,330
I-NHECI 34	0,105	<b>0,539</b>	0,286	0,170	0,313	0,204
I-NHECI 35	0,172	<b>0,465</b>	0,269	0,082	0,264	0,346
I-NHECI 36	0,337	0,251	<b>0,742</b>	0,182	0,012	-0,032
I-NHECI 37	0,417	0,190	<b>0,723</b>	0,151	0,125	0,055
I-NHECI 38	0,423	0,159	<b>0,699</b>	0,155	0,108	-0,051
I-NHECI 39	0,429	0,162	<b>0,684</b>	0,165	0,161	-0,055
I-NHECI 40	0,395	0,021	<b>0,565</b>	0,181	0,311	0,109
I-NHECI 41	0,474	0,100	<b>0,559</b>	0,172	0,254	0,079
I-NHECI 42	0,004	0,192	<b>0,524</b>	0,314	-0,245	0,246
I-NHECI 43	0,212	0,192	<b>0,490</b>	0,283	0,244	-0,101
I-NHECI 44	0,183	0,142	<b>0,476</b>	0,152	0,334	0,290
I-NHECI 45	0,318	0,103	0,176	<b>0,677</b>	0,197	0,105
I-NHECI 46	0,316	0,136	0,089	<b>0,669</b>	0,373	0,056
I-NHECI 47	0,303	0,104	0,183	<b>0,661</b>	0,218	0,172
I-NHECI 48	0,267	0,243	0,233	<b>0,657</b>	0,252	0,058
I-NHECI 49	0,336	0,264	0,236	<b>0,613</b>	0,206	-0,019
I-NHECI 50	0,404	0,212	0,258	<b>0,553</b>	0,086	-0,159
I-NHECI 51	0,246	0,348	0,228	<b>0,544</b>	-0,047	-0,052
I-NHECI 52	0,207	0,208	0,113	0,040	<b>0,760</b>	-0,054
I-NHECI 53	0,166	0,107	0,011	0,225	<b>0,757</b>	0,131
I-NHECI 54	0,195	0,241	0,241	0,080	<b>0,669</b>	0,095
I-NHECI 55	0,228	0,320	0,098	0,280	<b>0,596</b>	-0,010
I-NHECI 56	0,118	0,329	0,081	0,353	<b>0,588</b>	0,040
I-NHECI 57	0,181	0,351	0,186	0,236	<b>0,455</b>	-0,272
I-NHECI 58	0,261	0,373	0,136	0,043	0,417	<b>0,452</b>

#### 4. Discussion

The data obtained from a sample of healthcare professionals provide noteworthy insights into the demographic characteristics and job satisfaction levels within the sector. Regarding gender distribution, the majority of respondents identified as female, constituting 68.5% of the sample, while male respondents comprised 30.6%. This gender imbalance is consistent with previous studies on the

healthcare workforce, which have consistently shown a predominance of women in nursing and other healthcare professions [28,29]. Concerning qualifications, the overwhelming majority of participants were nurses, accounting for 87.4% of the sample, whereas head nurses constituted 12.6%. Analysis of job satisfaction revealed diverse responses, with a substantial portion of respondents, 40.1%, reporting being quite satisfied with their work, followed by 20.7% who expressed being highly satisfied. Conversely, a smaller percentage, 3.2%, indicated dissatisfaction with their job, while 9.5% reported only slight satisfaction. These findings align with research on job satisfaction among healthcare professionals, which has shown a mix of positive and negative attitudes towards work [30,31]. Overall, the data from 222 participants illuminate the intricate interplay of gender, role, and satisfaction levels within the healthcare profession.

The average age of participants was 35.30 years, with a standard deviation of 13.367. Concerning tenure in the current profession, an average of 11.59 years was reported, with a SD of 12.127. Additionally, participants reported an average practice duration within their current business unit of 4.86 years, with a SD of 6.822. These demographic characteristics are consistent with the typical profile of healthcare professionals, who tend to have a relatively young workforce with varying levels of experience [32,33].

The I-NHECI scale was evaluated for its reliability using Cronbach's Alpha coefficient, which yielded an average value of 0.976. This high coefficient indicates a strong internal coherence between the items of the scale, confirming the robustness and consistency of the measure in assessing the construct under consideration [27]. The I-NHECI scale obtained Cronbach's Alpha values between 0.975 and 0.977, further supporting the reliability and coherence of the instrument.

Parallel analysis was conducted to determine the appropriate number of components or factors to retain in the factor analysis. The results indicate that six components or factors were identified, each characterized by an average eigenvalue ranging from 1.779.221 to 2.166.393. Percentile eigenvalues, indicating the relative contribution of each component to the total variance, ranged from 1.828.000 to 2.301.410. These findings suggest that each component significantly contributes to the overall variance of the data, supporting the decision to include all six factors in the factor analysis [34,35].

The assumptions for the application of exploratory factor analysis were verified through the Kaiser-Meyer-Olkin (KMO) test and the Bartlett's test of sphericity. The KMO value was 0.948, indicating excellent sampling adequacy for factor analysis. Bartlett's test of sphericity showed statistically significant results ( $\chi^2 = 10430.414$ ,  $df = 1653$ ,  $p < 0.001$ ), suggesting that the correlation matrix is not an identity matrix and that there are correlations between the variables that justify the application of factor analysis (Field, 2013). Overall, the results of these preliminary tests confirmed the suitability of the data for conducting the exploratory factor analysis.

These results indicate that the Italian version of the Nurse Health Education Competence Instrument (I-NHECI) has adequate psychometric properties to reliably and validly assess nurses' competence in health education. The six factors emerged from the exploratory factor analysis provide a multidimensional representation of this construct, offering important insights for the design of training interventions aimed at developing and strengthening the different facets of nurses' competence in the field of health education. This aligns with previous research on the multidimensional nature of nursing competence in health education [36,37].

The six factors identified through the exploratory factor analysis provide a comprehensive framework for understanding the various dimensions of nursing competence in health education. Factor 1, which explains the largest proportion of variance, reflects nurses' competence in designing, implementing, and evaluating effective educational interventions. This aligns with the core responsibilities of nurses in promoting patient education and self-management [38,39]. Factor 2, related to learning and experimenting with new educational approaches, underscores the importance of nurses' continuous professional development and adaptability to evolving educational methodologies [40,41].

Factors 3 and 4, focused on the use of specific technologies and digital tools for health education and the assessment of educational outcomes, respectively, highlight the growing importance of

digital competencies in the nursing profession [14,42]. Factor 5, concerning communication and collaboration with patients, families, and other professionals, reflects the interpersonal and collaborative nature of nursing practice in health education [43]. Finally, Factor 6, addressing the promotion of inclusion and accessibility, emphasizes the nurse's role in ensuring equitable and inclusive health education for all patients [15].

The comprehensive framework provided by the I-NHECI can guide the development of targeted training programs and continuing education initiatives to enhance nurses' competence in health education. By addressing the multifaceted nature of this construct, such interventions can better prepare nurses to deliver high-quality, evidence-based, and inclusive health education to their patients and communities.

#### *4.1 Limitations*

This study is subject to several limitations that should be considered when interpreting the findings. First, the data were collected from a single country, Italy, which may limit the generalizability of the results to other cultural and healthcare contexts. The representativeness of the sample, while adequate for the psychometric analysis, may not fully reflect the diversity of the nursing population across different regions and healthcare settings within Italy.

Additionally, the cross-sectional design of the study provides a snapshot of nurses' competence in health education at a single point in time. Longitudinal research would be needed to examine the potential evolution of this competence over time, as well as the factors that may influence its development and maintenance among nurses.

The data were collected through self-reported measures, which are subject to potential biases, such as social desirability and recall bias. While the I-NHECI has demonstrated robust psychometric properties, the use of objective assessments of nursing competence, such as observations or performance-based evaluations, could provide a more comprehensive and reliable evaluation of this construct.

Furthermore, the study did not explore the potential relationships between nurses' demographic characteristics, work-related factors, and their perceived competence in health education. Investigating these associations could offer valuable insights into the individual, organizational, and contextual determinants of this competence.

Finally, the current study focused on the exploration of the factor structure of the I-NHECI but did not examine the instrument's predictive validity in relation to important outcomes, such as the quality of patient education, patient satisfaction, or health-related behaviors. Future research should address these aspects to further establish the clinical relevance and utility of the I-NHECI.

Despite these limitations, the current study provides a solid foundation for understanding the multidimensional nature of nursing competence in health education, as measured by the I-NHECI. The findings can inform the development of targeted training and continuing education programs to enhance nurses' competence in this critical area of practice.

## **5. Conclusions**

The results of this study have demonstrated the validity and reliability of the Nurse Health Education Competence Instrument (NHECI), a tool to assess nursing competencies in the area of health education. The cultural adaptation and linguistic validation process has yielded a reliable and culturally sensitive instrument.

The exploratory factor analysis identified the three key dimensions of nursing competencies in health education: cognitive, psychomotor, and affective-attitudinal competence. These findings are consistent with the original model of the instrument, confirming its construct validity.

The high internal consistency of the instrument, as evidenced by the Cronbach's  $\alpha$  values, indicates that the NHECI is a reliable tool for evaluating nursing competencies across different cultural settings. This can facilitate the development and implementation of targeted educational programs and evidence-based clinical interventions.

While the results are promising, some limitations of the study should be acknowledged, such as the convenience sampling approach and the need for further investigations to confirm the stability of the factor structure and the predictive validity of the instrument. Future studies should explore the application of the NHECI in diverse clinical contexts and evaluate its utility for the training and professional development of nurses.

In summary, this study has provided evidence on the validity and reliability of the NHECI, a promising instrument for assessing and enhancing nursing competencies in health education across different cultural settings. The adoption of this tool can contribute to more effective and patient-centered nursing care.

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