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An Instrument to Assess the Digital Competence of Nurse Educators

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ABSTRACT

Background: The Educators and Educator Candidates' Competence in Digital Pedagogy instrument needed to be tested before using it in nursing education.

Purpose: This study describes the further testing of this instrument to measure nurse educators' digital competence.

Methods: The study is reported according to the 7 steps of the MEASURE Approach. Psychometric testing was conducted with a sample of 111 Finnish nurse educators from 9 universities of applied sciences. The study was conducted during the years 2020 and 2023.

Results: The exploratory factor analysis results explained 56% of the variance with 3 factors, including 20 items. The factors were labeled to describe the nurse educators' digital competence: implementing appropriate independent and community learning, acting safely and responsibly, and guiding learning based on the evidence. Cronbach α and McDonald ω coefficients showed good reliability.

Conclusions: The instrument can be used to assess digital competence and identify the development needs to facilitate educators' continuous professional development.

Keywords: competence, digital technology, education, instrument validation, nursing faculty

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Digital transformation has changed society and everyday life, revealing the need for education institutions to have a wide range of digital readiness.[1] The digitalization of health care also increases the need for new competencies.[1,2] For example, nurse educators should be able to use technology and operate in a rapidly changing environment.[2,3] In addition to innovative digital teaching, learning, and interaction activities, the COVID-19 pandemic revealed challenges related to the digital resources of education institutions, educators' preparation for digital teaching, and overall levels of digital competences.[1] To solve these challenges, teaching and training activities need to support continuous professional development for educators.[4] To develop these educational activities, research on the digital competence level of nurse educators and a valid instrument that can be used to assess digital competence are needed.[5,6]

Both the use of an existing instrument and the development of a new one require careful familiarization with the phenomenon being studied and the current knowledge about it.[5,6] For this reason, it is necessary to consider the heterogeneity of the term digital competence, which has also been used interchangeably in various contexts.[7,8] For example, the terms digital competence, digital literacy, computer literacy, eHealth literacy, computer competence, and nursing informatics have been used to describe the ability to use technology effectively for various actions.[7-9] Skantz-Åberg et al argued that digital competence is the most widely used concept, and it is becoming more central in the research literature.[9] Despite the intention to define digital competence, the term has no precise definition for nurse educators. However, frameworks and models have been published to structure educators' digital competence. Applying these, the digital competence of educators in

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this study is seen as an innovative and a systematic utilization of technology in the planning, implementation, and evaluation of learning and teaching strategies, and the development of educators' and students' digital competence.[7-10] Moreover, the view of educators' digital competence in this study is based on the European Digital Competence Framework for Educators (DigCompEdu framework) (Table).[11] Supplemental Digital Content 1, Table 1, available at: http://links.lww.com/NE/B554, provides more detail on this framework.[11,12]

It seems that no instrument exists to assess the digital competence of nurse educators. A literature review[5] has shown that at least 19 instruments measure nurse educators' competence, but of the 10 specific competence areas that have been identified from these instruments, none measures digital competence.[5] The 19 instruments include individual items related to the ability to use information and communication technology (ICT) for teaching and learning. As an example, the area related to enabling digital collaborative learning has been measured by 4 items in the Health and Social Care Educators' Competence instrument.[13]

In addition, a systematic literature review by Zhao et al showed that in higher education, digital competence has generally been studied with different dimensions among the 33 reviewed publications.[14] They noticed that most of these studies used quantitative methodology, but only 2 studies focused on the validation of an instrument for measuring digital competence.[14] Of the 2 studies, the participants in the first study,[15] which was conducted in Spain, were university students. The questionnaire about Digital Competences in Higher Education instrument includes 52 items. In the second Spanish study,[10] the authors used an instrument based on the publication by the European Union, the DigCompEdu Check-In Self-reflection Tool.[16] This tool is based on the DigCompEdu framework, where 22 items describe how often or how much educators use digital technology in their teaching.[11,12] In this way, educators can reflect on their digital activities.[11]

From the perspective of existing instruments that assess educators' digital competence, the DigCompEdu framework has been a source for several other instruments. These instruments have been used in studies conducted in various contexts. One study[17] focused on business administration professors' digital competence in universities in Spain. The instrument in that context contained 18 items. In Finland, the digital competence in the work of health sciences educators was studied. An instrument with 21 items reflected how often or how much health sciences educators use digital technology in education.[18] The DIGIGLO (Competencia Digital Docente Global, in Spanish) instrument, corresponding to the DigCompEdu framework, has added items relating to digital resources and opportunities. This 29-item instrument has been validated in the context of Spanish and Latin American teacher educators.[19]

Moreover, to assess educators' digital competence, validated instruments have been developed in recent studies.[20,21] One of the studies[20] presented the Teacher Digital Competence Scale with 46 items. In this study, the target group was teachers who worked at primary, secondary, and high school levels in Turkey. Another study[21] developed and validated an instrument to measure preservice teachers' ICT competencies. The ICT Competence Scale includes 19 items. In the study, participants were last-year preservice teachers in Belgium.

Table. Educators' Digital Competence in Accordance With the European Digital Competence Framework for Educators[11,12]

Area	Description of Digital Competence Area
Professional engagement	Educators can use digital methods for interaction in various encounters and communication situations. They can promote their continuous professional development through technology and the continuous development and innovation of the work community and practices.
Digital resources	Educators can identify and select appropriate digital sources and materials, considering teaching and learning objectives, pedagogical solutions, and the learning environment. Educators can produce, edit, and store digital material, considering copyright rules and accessibility.
Teaching and learning	Educators can manage, plan, select, and implement the most appropriate digitally implemented pedagogical solutions for the stages of the teaching and learning process. Using technology, educators can enable students and groups to learn independently, with educators acting as learning facilitators.
Assessment	Educators can develop new ways to gather evidence of students' activities and learning. This evidence can be used for assessment. This will also allow for the diversification of assessment methods and the provision of timely feedback to support learning. This enables personal guidance of the students in their progress toward their learning goals.
Empowering learners	Using technology, educators can make teaching more individual from the students' perspective by offering learning assignments and activities according to each student's level of knowledge and skill. Students participating in the classroom and remotely can be considered.
Facilitating learners' digital competence	Educators can guide the student in searching, organizing, processing, analyzing, interpreting, and critically evaluating and comparing information in digital environments. Students can be guided to use technology for interaction and collaboration in various methods and environments. Educators can guide students in security and responsible behavior in digital environments to protect identity and deal with security guidelines.

Based on these publications, the existing instruments that assess the digital competence of educators have variations in content, and no psychometrically validated instrument exists that is suitable to measure nurse educators' digital competence levels. There is a need for such an instrument to assess digital competence and identify the development needs of nurse educators.

Methods

Context of the Study

In the Finnish national project that aimed to develop the competence and continuous education of health sciences educators, the Educators and Educator Candidates' Competence in Digital Pedagogy (OODI; Opettajien ja Opettajaopiskelijoiden Digipedagogisenosaamisen Itsearviointi, in Finnish) Scale was developed and tested in a pilot study.The instrument was developed before the COVID-19 pandemic, and it was designed to measure educators' levels of digital competence.[22]

After the beginning of the COVID-19 pandemic, the OODI instrument was used to collect data on the digital competence of nurse educators. This was part of the New Nurse Educator project (funded by Erasmus+) taking place from 2020 to 2023, which aimed to examine the competence and education of nurse educators in 5 European countries: Finland, Spain, Malta, Slovakia, and the United Kingdom.

Aim of the Study

The aim of this study was to further develop and psychometrically test the OODI instrument. More specifically, the goals were to determine the face and content validity of the renewed OODI instrument and the construct validity and reliability of the OODI in the Finnish context. The research question was: What are the validity and reliability of the OODI instrument in measuring nurse educators' digital competence?

Design

A quantitative, cross-sectional study design was used.

Participants

The participants were Finnish nurse educators from 9 purposely selected health care education organizations (universities of applied sciences). The organizations selected for this study were from various parts of Finland. In Finland, nurse educators must have a professional qualification as a registered nurse, 3 years clinical experience, and at least a master's degree. In addition, health care education organizations may demand 60 credits of pedagogical studies, but they are not compulsory.[23]

Instrument Development Process

The instrument's development and validation process was based on research,[24] and the process was reported, as applicable, according to the 7 steps of the MEASURE Approach (Supplemental Digital Content 2, Figure, available at: http://links.lww.com/NE/B555).[25] The research group, consisting of nurse educators, assessed the DigCompEdu framework as the most appropriate for the Finnish context, being quite new and published in Europe. One reason for choosing the framework was that its development had mapped the contents of other digital competence frameworks.[11,12] In this way, it has been possible to ensure that the description of the educators' digital competence in the DigCompEdu framework would be as broad as possible and would include previous knowledge of the educators' digital competence.[11] The choice of the DigCompEdu framework was also supported by the fact that it can be used and modified for various contexts and purposes to describe and develop the digital competence of educators at different levels of education.[11,12] It is noteworthy that it has been used globally in recent studies.[9,14] However, the framework has not been used more widely in research and education from the perspective of nurse educators.

After the literature review, the content of the DigCompEdu framework and relevant publications, such as the research articles on digital interventions used in the context of higher education and in health care, formed the theoretical background. From this background, items describing digital competence (n = 32) were generated and divided into 6 competence areas according to the DigCompEdu framework. The instrument was scored using a Likert scale to reflect competence (1 = I can't at all to 5 = I can very well). In addition, the research group added 2 visual analog scale items related to the assessment of one's digital competence and interest in digital technology used for teaching. The items were set on a scale from 0 (weak) to 5 (strong). A panel of 8 experts was used to ensure the instrument's face and content validity, and the instrument's comprehensibility was pretested by 13 educator candidates.[22] Assessing the validity of the content was important because it manifested the consensus of experts on the relevance of the instrument's content.[24,26] The instrument was drafted in Finnish.[22]

A pilot study was conducted, and in every competence area, Cronbach α values varied from 0.783 to 0.935. Reliability coefficient values greater than 0.70 are considered acceptable for newly developed instruments, values greater than 0.80 for well-established instruments, and clinically reliable instruments should have values greater than 0.90.[24,26]

In the New Nurse Educator project, the OODI was translated into English. The international research group members (n = 23) considered the structure and suitability of the OODI in an international European context.[25] An international group was used because the data were collected internationally with the instrument, although Finnish data are reported in this study. Consisting of experienced nurse educators from higher education institutions, the group evaluated the content of the OODI independently and in joint email conversations. Six

items were omitted to reduce items with similar content and to enhance the clarity of the instrument. Thereafter, an OODI instrument containing 26 items with 2 visual analog scale items was evaluated as being appropriate.

Data Collection and Analysis

The New Nurse Educator project partners sent an electronic link to the survey to the contact persons of the health care education organizations (n = 9). The contact persons forwarded the survey link to the educators. A reminder of the study was sent 3 times. The OODI instrument was one part of a wider questionnaire in the survey.

The data were analyzed using SPSS for Windows version 27.0 (IBM Corp, Armonk, New York). Cronbach α and McDonald ω coefficients were calculated to determine the OODI instrument total and the factors' internal consistency reliability.[27] Construct validity was tested using explorative factor analysis (EFA). The Kaiser-Meyer-Olkin test and Bartlett's test of sphericity were conducted to evaluate EFA sampling adequacy. The original data were collected with an OODI instrument containing 26 variables. Due to the high inter-item correlations (>0.70) and because the total α of the instrument was high (>0.95), 6 variables were removed after the research group discussion.

Then, the EFA was conducted on the 20 variables using principal axis factoring with direct oblimin rotation. The Kaiser-Meyer-Olkin test for the EFA gave a result of 0.884 for the OODI instrument. At the same time, the Bartlett's test of sphericity result was significant ($\chi^2 = 1461.832$, $df = 190$, $P < .001$), which supported the EFA. During the analysis, 3 factor models were considered. The 3-, 4-, and 6-factor models were supported by the resulting eigenvalues ≥1.00 and the analysis obtained the EFA scree plot. The factor loadings of the items were examined, and a statistically meaningful cutoff limit was set at <0.30.[28] In the 4- and 6-factor models, individual variables were cross-loaded to more than 1 factor, and in the 6-factor model, there were less than 3 loadings in 1 factor. However, the contents of the factors were not theoretically meaningful. Extraction communalities were examined and were desirable when they were greater than 0.30. The principal axis factoring with the 3-factor model proved to be appropriate.[26,29] Performing the EFA, if more than 30% of a respondent's values were missing in the OODI questions, the respondent was removed (n = 9). Moreover, individual missing values were not included in the analysis.[24]

Ethical Considerations

This study was conducted in accordance with ethical guidelines. The university's ethics committee authorized the study (February 16, 2021). Research permissions from universities of applied sciences were granted according to the Finnish data protection regulations. All educators were informed about the study through an information letter sent by email via contact persons. Participation in the study was voluntary. Permission to use, develop, and reproduce the OODI instrument was granted by the original authors.[30]

Results

Invitations to participate in the study were sent to 388 educators in Finland, with 111 agreeing to participate for a response rate of 29%. The average age of educators was 49 years (SD = 9.0) and the majority were 50 to 59 years old. Most of them had a university degree (87.4%). The clinical work experience of educators ranged from 2 to 35 years. Half of the educators (50.4%) had a maximum of 10 years of teaching experience, with an average of 12 years (Supplemental Digital Content 3, Table 2, http://links.lww.com/NE/B556).

As a result of the EFA, 20 items were extracted into 3 factors. Three factors were supported by the resulting eigenvalues of ≥1.00 from the EFA and the scree plot pattern. In the chosen 3-factor model, the lowest eigenvalue was 1,164. The first factor consisted of 8 items related to *implementing appropriate independent and community learning*. The second factor included 7 items related to *acting safely and responsibly*. The third factor consisted of 5 items related to *guiding learning based on the evidence*. Overall, 3 factors explained a cumulative 56.56% of the total variance. Extraction communalities varied from 0.403 to 0.812. The research team labeled the factors to describe their content and the nurse educators' digital competence (Supplemental Digital Content 4, Table 3, http://links.lww.com/NE/B557).

In this study, inter-item correlations ranged from 0.161 to 0.822. The OODI instrument's total Cronbach α value was 0.938, and its McDonald ω was 0.940. Individual factor values ranged from 0.833 to 0.889 for α and from 0.885 to 0.902 for ω.

The nurse educators' digital competence was highest in "implementing appropriate independent and community learning" (M = 3.84, SD = 0.57) and then in "guiding learning based on the evidence" (M = 3.44, SD = 0.75). In individual items, the highest competence was in using technology to collaborate with colleagues, students, and other partners (M = 4.31, SD = 0.62) and using technology to give feedback to learners (M = 3.47, SD = 0.96). Digital competence was the weakest in "acting safely and responsibly" (M = 3.32, SD = 0.74), in which the weakest competence was guiding learners to protect the material they produce in accordance with copyright law (M = 2.89, SD = 1.07).

Discussion

The study's results show that the OODI is a valid and reliable instrument to measure nurse educators' digital competence. Using the OODI instrument, nurse educators' digital competence was assessed as moderate based on their self-assessment. In addition, competence development needs were identified. The instrument can be

used to assess educators' ability to use information technology as part of their work in health care education. In this way, it is possible to identify areas in which digital competence should be increased. This information can be used to plan and implement educators' education and continuing education.[4] In the future, the standards of nurse educators' digital competence should be defined. This would illustrate the required competence more thoroughly, such as what type of technology use is required for the highest competence.[4-6,22]

The reliability of the OODI instrument's development process and, more broadly, of this study was ensured throughout the process. The previous methodological literature and the MEASURE Approach were followed to increase the reliability of the OODI instrument development and validation process.[25] In addition, the STROBE checklist was used to assess the quality of the study.[31] In this study, both α and ω were examined because ω has been shown to be a more sensible index of internal consistency when compared to α. When using ω, there is a lower risk of misestimation of reliability.[27,32] In this study, minor differences occurred between these reliability coefficients. Similar results to these differences in reliability coefficients have been noticed earlier.[32] Both coefficients showed good reliability for the OODI instrument.[24,26]

The study has some limitations. The OODI instrument was tested only with data from Finnish nurse educators. However, the instrument is based on the widely used DigCompEdu framework and therefore could be utilized more widely across countries. When the OODI instrument is generalized more broadly, cultural differences and differences in the educational structures of nurse educators must be considered.[3,6] The response rate was moderate. According to the literature, the number of responses was sufficient to meet the requirement of respondents per item in the EFA.[24] A power analysis was conducted in advance in the New Nurse Educator project to determine a sufficient sample size.[26] The resulting factorial structure did not fully correspond to the structure of the 6 areas of the DigCompEdu framework.[11,12] Nevertheless, different factor structures have also been found in other studies,[17] and modification of the framework to the specific context and purpose is possible.[11] In addition, the theoretical structure of the OODI is consistent with the content of the framework, and the content validity was assessed as theoretically meaningful.

The different factor structure is partly explained by the fact that views on the definition of the concept of digital competence also vary.[7,9] Further research to test the OODI in a more heterogeneous population internationally and for cultural appropriateness is needed.[6,29] In addition, as technological development continues, the OODI content needs to be developed accordingly.[1,6] Further construct validity testing is needed, among other aspects, by testing the instrument with new data using confirmatory factor analysis to confirm the relationships between items and their factors.[26]

Conclusions

The OODI instrument presented in this study is a validated instrument to assess the level of digital competence of nurse educators. OODI can be used to assess digital competence and identify nurse educators' needs to achieve continuous professional development. This study clarifies the concept of nurse educators' digital competence. For further research, this study provides knowledge for discussion about competence requirements and for further validation of the OODI instrument in different contexts internationally.

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