

## VALIDAÇÃO DE TECNOLOGIAS EDUCACIONAIS: ESTUDO BIBLIOMÉTRICO EM TESES E DISSERTAÇÕES DE ENFERMAGEM

## VALIDATION OF EDUCATIONAL TECHNOLOGIES: BIBLIOMETRIC STUDY IN NURSING THESES AND DISSERTATIONS

## VALIDACIÓN DE TECNOLOGÍAS EDUCATIVAS: ESTUDIO BIBLIOMÉTRICO EN TESIS Y DISERTACIONES DE ENFERMERÍA

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### RESUMO

**Objetivo:** Analisar as estratégias metodológicas utilizadas para a validação de tecnologias educacionais em teses e dissertações de enfermagem no Brasil. **Método:** Trata-se de um estudo documental bibliométrico. A busca foi realizada no catálogo de Teses e Dissertações da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. O mapeamento considerou o perfil das produções e das tecnologias educacionais, as estratégias de validação e a aplicação da lei de Zipt. A análise foi realizada com o *Statistical Package for the Social Sciences* 21.0 e o *IRaMuTeQ 0.7 alpha 2*. **Resultados:** Obtiveram-se 156 produções. O perfil das produções foi de dissertações de mestrado acadêmico, consideradas estudos metodológicos, estando a maioria desenvolvida na região Nordeste do País. As tecnologias educacionais corresponderam a materiais impressos ou audiovisuais, direcionados à comunidade e à área de enfermagem médico-cirúrgica. O processo de validação ocorreu, em sua maioria por concordância, com participação de juízes especialistas e da população-alvo, com uso de instrumentos validados e aplicação do Índice de Validação de Conteúdo. A partir da aplicação da Lei de Zipt, destacaram-se validação, juiz e estudo metodológico. **Conclusão:** O mapeamento propiciou a visibilidade da produção científica, indicando um conhecimento com distribuição desigual no que tange à região onde se produz tal capital intelectual.

**Descritores:** Estudo de Validação; Tecnologia educacional; Enfermagem; Bibliometria; Dissertação Acadêmica.

### ABSTRACT

**Objective:** To analyze the methodological strategies used for the validation of educational technologies in nursing theses and dissertations in Brazil. **Method:** This is a bibliometric documentary study. The search was carried out in the catalog of Theses and Dissertations of the Coordination for the Improvement of Higher Education Personnel. The mapping considered the profile of productions and educational technologies, validation strategies and the application of the Zipt's law. The analysis was performed in the *Statistical Package for the Social Sciences* 21.0 and *IRaMuTeQ 0.7 alpha 2*. **Results:** A total of 156 productions were obtained. The profile of the productions was of academic master's dissertations, considered methodological studies, mostly developed in the Northeast region of the country. The educational technologies corresponded to printed or audiovisual materials directed to the community and the medical-surgical nursing area. The validation process took place, mostly by agreement, with the participation of expert judges and the target population, using validated instruments and applying the Content Validation Index. With the application of the Zipt's Law, validation, judge and methodological study stood out. **Conclusion:** The mapping provided the visibility of the scientific production, indicating knowledge with an unequal distribution regarding the region where such intellectual capital is produced.

**Descriptors:** Validation Study; Educational technology; Nursing; Bibliometric; Academic Dissertation.

### RESUMEN

**Objetivo:** Analizar las estrategias metodológicas utilizadas para validar las tecnologías educativas en tesis y disertaciones de enfermería en Brasil. **Método:** Este es un estudio bibliométrico documental. La búsqueda se realizó en el catálogo de Tesis y Disertaciones de la Coordinación para la Mejora del Personal de Educación Superior. El mapeo consideró el perfil de las producciones y tecnologías educativas, las estrategias de validación y la aplicación de la ley de Zipt. El análisis se realizó con el Paquete Estadístico para Ciencias Sociales 21.0 e *IRaMuTeQ 0.7 alpha 2*. **Resultados:** Se obtuvieron 156 producciones. El perfil de las producciones fue de disertaciones de maestría académica, consideradas estudios metodológicos, la mayoría de los cuales se desarrolló en la región noreste del país; las tecnologías educativas correspondían a materiales impresos o audiovisuales, dirigidos a la comunidad y en el área de enfermería médico-quirúrgica; El proceso de validación se realizó principalmente mediante un acuerdo con la participación de jueces expertos y la población objetivo, utilizando instrumentos validados y aplicando el Índice de Validación de Contenido. De la aplicación de la Ley Zipt, se destacó la validación, el juez y el estudio metodológico. **Conclusión:** El mapeo proporcionó la visibilidad de la producción científica indicando conocimiento con una distribución desigual con respecto a la región donde se produce dicho capital intelectual.

**Descritores:** Estudio de Validación; Tecnología Educativa; Enfermería; Bibliometría; Tesis Académica.

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## INTRODUCTION

Educational Technologies (ET) are tools that contribute to the expansion of knowledge, skills, attitudes and self-knowledge necessary to assume responsibility related to teaching and care practices. They are the basis for enhancing and empowering the autonomy of individuals, the community, students and health professionals<sup>(1-2)</sup>. Most of the ET are considered as light technologies, which are characterized as types of production of bond, embracement and management of work processes that pervade interpersonal relationships<sup>(3)</sup>.

In the results of an analysis of the concept of ET, the following characteristics of the support tool were identified as attributes of the construct: provision of skills, mediator of knowledge, promoter of health, useful for care, and interactive. As a consequence, for those who use it, there is an improvement in the quality of life, in the development of skills, in the satisfaction of care, in the adoption of healthy behaviors, in stimulating reflection, in favoring the bond and creative capacity, in promoting adherence, minimizing anxiety, standardizing information and promoting empowerment<sup>(4)</sup>.

In nursing, technologies aimed at education are expressed through three trends: technologies for technical and higher education, with students; technologies for health education, with the community; and technologies for continuing education, with professionals<sup>(5)</sup>. The construction and validation of technologies, to be incorporated into nursing care and teaching, has achieved exponential growth in recent decades with the purpose of promoting the health of various population groups and facilitating the training of health professionals.

In this perspective, research has made use of dynamic and innovative strategies that facilitate access to knowledge, as well as the development of people's autonomy. Similarly, methodological paths adopted for the validation process are diversified, in order to verify the capacity of the technologies to achieve the proposed objective. Examples include: simulated teaching, course platforms, videos, individual counseling, presentation on slides, manuals, printed materials, booklets, educational games, websites, booklets, software, theater, among others, which were created and validated with use of different methodologies<sup>(4)</sup>.

Thus, it is understood that the production of studies of this nature should be stimulated, due to

its benefits, both for teaching and for the health of individuals and the population<sup>(5)</sup>. However, despite its relevance, there is no consensus in the literature as to the most suitable methods for the scientific validation process of educational technologies. Therefore, it is possible to identify different theoretical references and methodological paths adopted by the Brazilian Nursing Theses and Dissertations.

Thus, the study aimed to analyze the methodological strategies used for the validation of educational technologies in Nursing theses and dissertations in Brazil. In view of the objective, it is intended to answer the following guiding questions: What is the profile of validated productions and educational technologies? What are the methodological strategies used for processes of validation of ET?

## METHODS

This is a bibliometric documentary study with a quantitative approach. Bibliometrics is a statistical technique that aims to measure the production and dissemination index of scientific knowledge in different areas, including nursing. This has also been used to identify authors, paradigms of science, methodologies, and the most used journals<sup>(6)</sup>.

The search for works was carried out in the catalog of theses and dissertations of the Coordination for the Improvement of Higher Education Personnel (CAPES) of the Ministry of Education of Brazil (MEC) during the month of October 2019. No filters, such as time interval, selection of advisor, among others, were defined.

The search strategy used the following descriptors consulted in the Health Sciences Descriptors (DeCS): validation studies, educational technology, technology and nursing. The following crosses were applied with the Boolean operator AND: (# 1 validation studies AND # 2 technology AND # 3 nursing); and (# 1 validation studies AND # 4 educational technology AND # 3 nursing).

The inclusion criterion corresponded to research developed in the nursing area and that addressed the validation of ET with the object of study. Duplicated theses and dissertations, those that validated assistive and non-educational technologies, as well as those that were not available in full length were excluded. For this reason, after selection of works whose full texts were unavailable, the authors were contacted via electronic address in order to obtain the full manuscript. Theses and dissertations whose

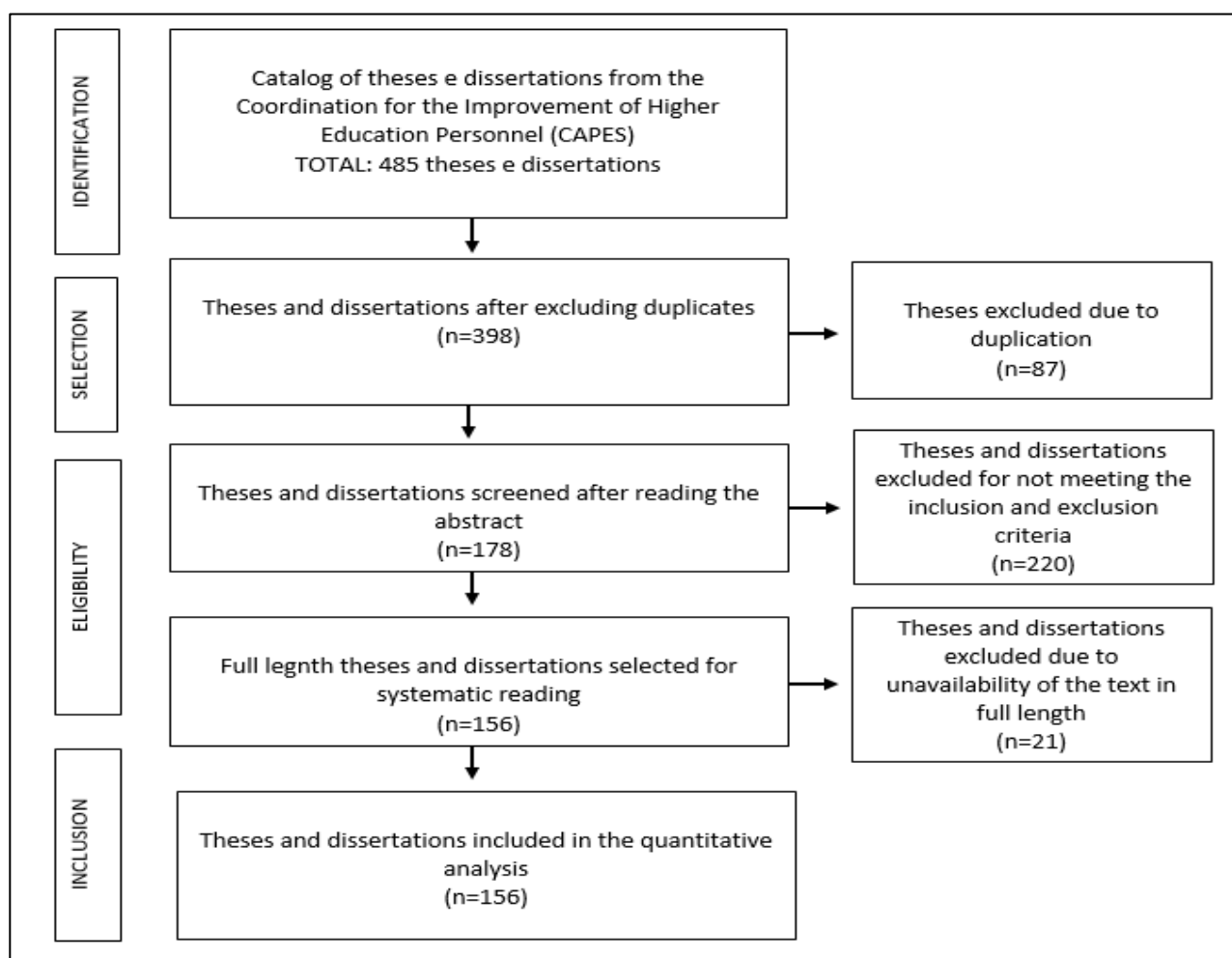
authors did not respond to the contact or opted for the not providing the text were considered as losses.

After obtaining the complete work, the text was systematically read in order to collect the information pertinent to the study. This process was carried out by simultaneous paired analysis, by four nurses, students of the Nursing Graduate Program at Federal University of Rio Grande do Norte (UFRN). In this dynamic, one researcher could consult the others in case of doubts.

A total of 485 studies were obtained using this search strategy, of which 87 were excluded

due to duplication. Then, 398 abstracts were read, 220 of which were excluded for not meeting the eligibility criteria. Of these, 21 studies were unavailable in full length and were requested by the authors after contact via email. Two authors responded, whereby one made available the requested material, and the other explained it was not possible to provide the manuscript in an online file. At the end of the selection, the sample comprised a total of 156 theses and dissertations, as shown in Figure 1.

Figure 1 - Flow chart of the collection of theses and dissertations in the CAPES catalog. 2019.



Source: Data collected by the authors.

The critical reading of the selected studies was guided by a database prepared by the authors in the Microsoft Excel, which contained variables of interest to the study. Variables related to the profile of the Theses and Dissertations were: origin, year and geographic region; those related to the profile of educational technologies were: purpose, nursing knowledge area, typology, and reference used for the production. Regarding the

strategies of the validation process of the educational technology, the following variables were investigated: methodological framework, number of expert judges and the target audience, criteria for selection of the judges, number of Delphi rounds, instruments used, minimum value of the Content Validity index (CVI), type of study carried out with the target audience, and techniques employed in data analysis.

The content of the database in relation to the profile of the productions, educational technologies and validation strategies was analyzed using the Statistical Package for the Social Sciences (SPSS) 21.0 for the calculation of descriptive statistics with relative and absolute frequency. Data were presented in a descriptive way by means of graphs, in order to facilitate the understanding of the result.

The global content of the productions was analyzed using the IRaMuTeQ 0.7 alpha 2 to create a textual corpus. The basic matrix for the production of the corpus was the summary of the methodologies of each work. The software assesses the occurrence of the terms in excerpts of 60 words, on average, and forms clusters of the most relevant phenomena of the excerpt. Data related to lexical analysis were presented in the form of figures, of the graphic type and word cloud. Such analysis aims to comply with Zipf's

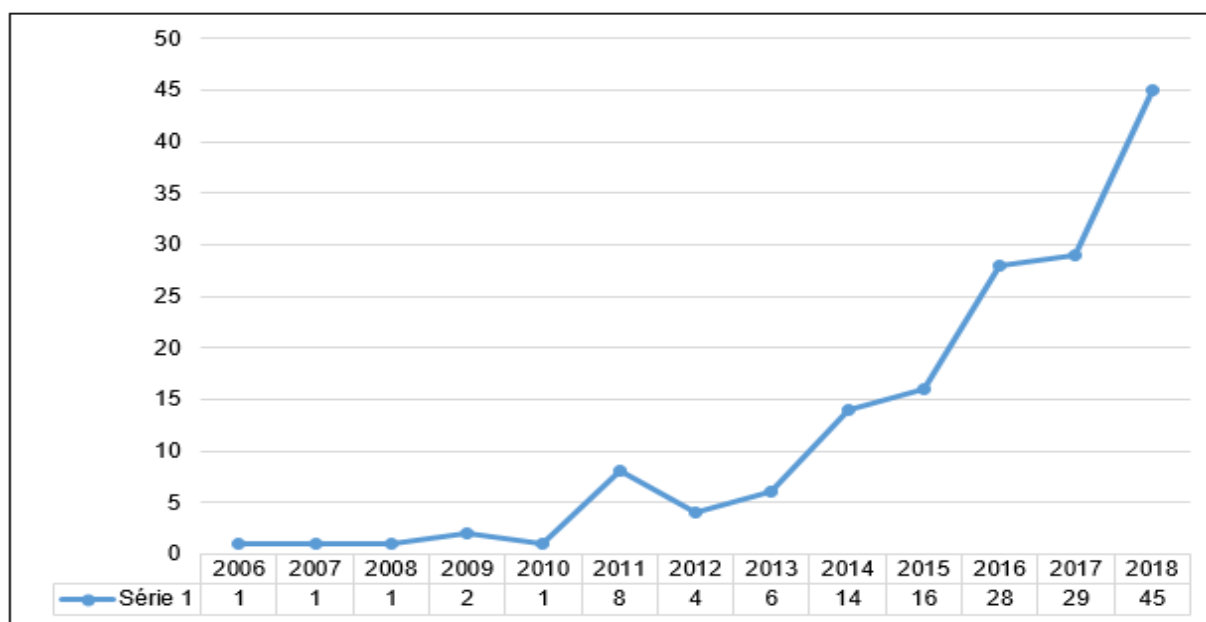
Law, the third law of bibliometry, which relates the frequency of words used in the research area in order to identify nomenclatures for the phenomena or variables highlighted in the study. It is inferred that a small number of words can be used very frequently, indicating the main subject of the document<sup>(6)</sup>.

**RESULTS AND DISCUSSION**

**Profile of Validated Educational Products and Technologies**

The highest percentage of productions 114 (73.1%) corresponded to research originating from dissertations developed in academic 81 (51.9%) or professional 33 (21.2%) master's programs, while 42 (26.9%) came from theses. Exponential growth was observed over the last two decades, starting in 2011, with eight papers, until reaching the number of 45 in 2018, as can be seen in Figure 2.

Figure 2 - Theses and dissertations on validation of educational technologies published per year. 2019.



Source: Data collected by the authors.

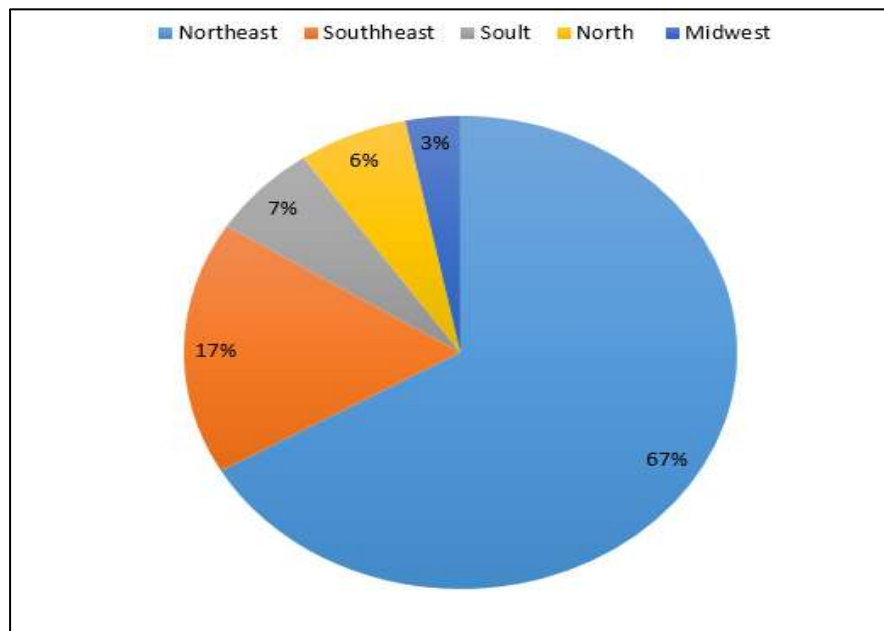
The advancement of the technological development of society influences not only the modes of production and social reproduction, but, mainly, has an impact on the production of knowledge from different courses, such as Nursing. This is because the transformations mediated by the technological apparatus in people's lives, in health practice and health teaching, emerge from needs that did not exist before.

As a reflex, the creation of *latu sensu* graduate programs and the creation of research groups in nursing with a focus on technology among their lines of research have shown an exponential growth rate in recent decades. This context that boosted the training of masters and PhDs in Nursing allowed the increasing presence of these professionals in research groups across the country<sup>(7)</sup>. It is not by chance that, in this study, there was an increasing development of dissertations 114 (73.1%) and theses 42 (26.9%) in

the period between 2011 and 2018, which, in general, are linked to research groups and lines that focus on technological development.

When considering the geographic region of the productions, there is a difference in the distribution of the productions, as shown in Figure 3.

Figure 3 - Distribution of theses and dissertations by region of origin. 2019.



Source: Data collected by the authors.

The institutions Federal University of Ceará (UFCE), State University of Ceará (UECE), University of Fortaleza (UNIFOR), University of São Paulo (USP), and Federal University of Pernambuco (UFPE) were the mainly responsible for the development of research on the theme, representing, respectively, 54 (34.6%), 17 (10.9%), 14 (9.0%), 12 (7.7%) and 9 (5.8%) of the productions. The Federal University Fluminense (FUF) and University of Amazonas (UFAM) carried out 5 (3.2%) studies. Also, the Federal University of Piauí (UFPI), Federal University of Espírito Santo (UFES), Federal University of Rio Grande do Norte (UFRN), and Federal University of Santa Maria (UFSM) had the same percentage of works, with a total of 4 (2.6%). The Federal University of Santa Catarina (UFSC) had 3 (2.0%) studies. Other institutions, such as the Franciscan University (UFN), University of Brasília (UNB), State University of Pará (UEPA), and Santa Casa de Misericórdia do Pará Foundation (FSCMP) developed 2 (1.3%) studies each. Only 1 (0.6%) work was developed by the following institutions: Federal University of São Paulo (UNIFESP), Federal University of Health Sciences of Porto Alegre

(UFCSPA), Federal University of Sergipe (UFS), Federal University of Mato Grosso (UFMT), São Paulo State University (UNESP), Federal University of Alagoas (UFAL), Federal University of Paraíba (UFPB), Federal University of Rio de Janeiro (UFRJ), State University of Maringá (UEM), University of Vale do Rio dos Sinos (UNISINOS), University for International Integration of the Afro-Brazilian Lusophony (UNILAB), University of Cruz da Alta (UNICRUZ), and Federal University of Alfenas (UNIFAL).

The finding that the origin of the studies, which deal with ET, is concentrated in the Northeast region (67%) is a counterpoint. In a study carried out on the scientific production of Brazilian Nursing, it was possible to verify the Southeast as the region with the largest number of published articles<sup>(8)</sup> and with the highest proportion of research groups that investigate the theme of technology<sup>(7)</sup>. Thus, the discrepancy between the proportion of the production of theses and dissertations by place of origin and the proportion of publications of scientific articles, according to the location, leads to a reflection on the need to promote greater visibility, and

national and international expression of the intellectual content produced by northeastern universities.

With regard to validated educational technologies, 113 (72.4%) were considered technologies for health education of the community, 22 (14.1%) for education in technical or higher education, and 21 (13.5%) for continuing education of health professionals. Thus, there is a growing commitment to the construction and validation of health education technologies aimed at the community.

The expressiveness of projects for the development of this technology is justified by the benefits that ET provide to the population, such as improved quality of life through the adoption of healthy behaviors, while developing the autonomy and empowerment of subjects<sup>(9)</sup>.

Regarding to areas of knowledge, the following distribution was observed: 60 (38.5%) in the medical-surgical nursing area, 32 (20.5%) in pediatric nursing, 20 (12.8%) in obstetric nursing, 20 (12.8%) in teaching methods and techniques, 14 (9.0%) in gynecology and obstetrics, in addition to 10 (6.4%) in public health nursing.

Although a variety of areas of nursing knowledge applied to technology were identified, themes related to medical-surgical (38.5%), pediatric (20.5%) and obstetric (12.8%) nursing stood out. This trend converges with what the National Policy for Science, Technology and Innovation in Health (PNCTIS) advocates, through the National Agenda for Health Research Priorities (ANPPS) and the Nursing Research Priorities (NRP)<sup>(10)</sup>.

Nursing Research Priorities, discussed since 2011, focus on adjusting research in this area of action, towards nursing care, the population and national problems. Thus, the 11 thematic axes include clinical nursing research, nursing care for women's health, and nursing care for the health of children and adolescents as primary themes to be researched<sup>(10)</sup>.

Among the validated technological artifacts, 66 papers (42.3%) developed printed materials; 24 (15.4%) software or applications; 22 (14.1%) videos; 19 (12.2%) Virtual Learning Environments (VLE); 10 (6.4%) simulators; five (3.2%) assisted technologies; four (2.6%) games; four (2.6%) audios or podcasts; 1 (0.6%) toys and comic books; and 1 (0.6%) associated technologies (prints, videos and programs).

It was observed that the studies made use of various technological products, especially

printed materials, software or applications, videos and VLE. Traditionally, some modalities of ET have been used, more often, by nurses, such as booklets, printed matter, manuals, educational albums, videos, games, and other audiovisual resources<sup>(5,11)</sup>. It is suggested that the choice for the aforementioned instruments may be influenced by the practicality, ease of access and playfulness that they can guarantee for learning, making them more participatory and integrated with the reality of people.

The predominant type of study was methodological, mentioned by 120 (76.9%) authors. Technological development was mentioned in 17 works (10.9%), multi-methods in 11 works (7.1%), and quasi-experimental designs by eight works (5.1%).

In order for the technologies to be used by health professionals and applied to the target audience, it is necessary that they be subjected to validation. This process comprises the degree of empirical evidence and theoretical rationale that supports the adequacy of the inferences through the application of evaluative and testing modes<sup>(11)</sup>. In other words, it provides scientific validity, security and uniformity of the contents covered, in order to achieve the objectives to which they are proposed.

Regarding the production of validated educational technologies, the adoption of the following references was observed: instructional design, contextualized in 1 (one) (0.6%) study; participatory interaction, user-centered design in 1 (one) (0.6%); user-centered design in 1 (one) (0.6%); Galvis-Panqueva in two (1.2%); and Echer in five (3.2%) studies. Different theories were also mentioned, such as: Dorothea Orem's theory of self-care in seven (4.5%) studies; Brandura's self-efficacy in three (1.9%); knowledge translation in 1 (one) (0.6%); and transpersonal in 1 (one) (0.6%). Pedagogical contributions were also used, such as Vygotsky's theory of social interaction in five (3.2%) studies; Paulo Freire's dialogical approach in two (1.2%); and Piaget's constructivism in 1 (one) (0.6%).

In addition, the use of the following models in the construction of technologies was mentioned: Roper, Logan and Tierney's life activity model in 1 (one) (0.6%) study; health belief model in 1 (one) (0.6%); and Falkemback's model for the design and development of digital educational material in six (3.8%).

## Validation Strategies

As for the validation process, 19 (12.1%) studies adopted Pasquali's validation model as a reference. For the validation process, health researchers adopted Pasquali's model, despite the fact that 12.1% of the analyzed studies considered it as a methodological reference. Because it is widely used in Psychology for the development of psychometric scales, adaptations of the model to the peculiarities of the development of technologies were made in the studies, but maintaining the set of procedures that constitute the theoretical, empirical (experimental) and analytical poles<sup>(12)</sup>

In methodological terms and in detail, it was found that expert judges in the health field participated in 148 (94.9%) studies, and judges from other areas such as designer, marketing, information technology, communication and pedagogy participated in 81 (51.9%). The target audience participated in 94 (60.3%) productions. Above all, 60 (38.5%) studies were validated by consensus, involving only technical judges; 84 (53.8%) through the validation of agreement, whose process involves evaluation by judges and the target population; and 12 (7.7%) underwent clinical validation with the target population only.

The specialized literature cites validation by agreement (appreciation by expert judges and by the target audience) and validation by consensus (appreciation only by experts) as possible paths, being the stimulus for the participation of the subjects, who make up the target audience, an increasing trend<sup>(4)</sup>. Thus, it was observed in this study that 84 (53.8%) of the studies adopted validation by agreement with an emphasis on the participation of the target audience, as recommended.

The number of judges varied widely, with a minimum of three and a maximum of 75, with an average of 16. There are controversies about the number and selection criteria used to define expert judges. In fact, there was a variation of references used for the criteria for selection of the judges and the sample number. However, there is a consensus that they must be clear, and for their definition, the characteristics of the instrument used, the qualification and availability of the necessary professionals must be evaluated<sup>(11)</sup>.

For the selection of expert judges, the criteria adopted were: Fehring's (1994) in 63 (43%) studies; prepared by the author in 53 (35.5%); Jasper's (1994) in 16 (10.8%); Barbosa's (2008) in 10 (6.7%); and other authors in six (4.0%). In

studies that used validation with expert judges, the Delphi technique was used with one evaluation round in 129 (87.2%), two rounds in 15 (10.1%), and three rounds in four (2.7%).

Once the participating specialists were identified and contact was made to provide the information, it was possible to carry out two rounds of the Delphi technique, in order to achieve the CVI above of the considered<sup>(5)</sup>. Although two Delphi rounds are recommended, 88.2% of the papers investigated in this review achieved a satisfactory result in just one Delphi cycle.

The types of studies carried out with the target audience were: exploratory and descriptive in the case of 47 (30.2%), followed by quasi-experimental in the case of 24 (15.4%), and clinical trials in which the sample ranged from 1 to 596 subjects, with an average of 54 participants, in the case of seven (4.5%). Thus, it was found that exploratory and descriptive studies (30.2%) predominated, which have a level of scientific evidence of V (five). This fact suggests the need for nurses to undertake more robust research, in terms of evidence, when compatible with the objects of studies, such as quasi-experimental research and clinical trials.

Of the instruments used, 98 (62.8%) were validated and adapted to the context of the technology in question. The authors chose to prepare their own instruments in 58 (37.2%) studies. The contact with participants, judges or subjects of the target audience was carried out online and by individual approach in 82 (52.6%) studies, only online in 44 (28.2%), or by individual approach in 30 (19.2%).

As for the data collection stage, authors recurrently make use of previously validated instruments and questionnaires, such as the Suitability Assessment of Materials (SAM), but they are adapted to the specificities of the study in question, mainly, with regard to the characteristics of the population<sup>(13)</sup>.

Data analysis was performed using various techniques, with a predominance of descriptive statistics, in which all papers used the application of relative and absolute frequencies. One of the measures most frequently used was the CVI, applied in 127 (81.4%) analyses, whose reference values were diversified, with greater use of the minimum value of 0.80 in 71 (55.9%) studies. The average CVI obtained in the analyzed studies was 0.90, with a minimum of 0.70 and a maximum of 1.00. The qualitative approach was used in 112





these steps and, mainly, enabling the participation of subjects that make up the target population is one of the great challenges of this field of study<sup>(5)</sup>.

In light of this, it is understood that methodological studies are investigations aimed at obtaining and organizing data in order to rigorously validate and evaluate research tools and methods. Their goal is the development of reliable, accurate and applicable instruments in different realities, by different researchers and people, who deal with complex phenomena, such as behavior or the health of individuals, which have been widely used by Nursing, in several areas of knowledge, with the purpose of developing and validating different technologies, such as ET<sup>(14)</sup>.

## CONCLUSION

The strategies for validating educational technologies are multiple and raise their potential to link health education with technology, methods, techniques and theoretical research frameworks. In short, research aimed at validating technologies of this nature started to have considerable growth since 2008, with the Northeast being the region of the country that most develops this study. The predominant type of study was the methodological, and the methods employed included validation by specialist judges in the health field and validation by the target audience. For the latter, exploratory and descriptive studies were commonly carried out.

Data analysis, using descriptive and inferential statistics, was present in almost all studies, and the CVI was also used with significant frequency. There a notable diversity of theoretical references used and this demonstrates the difficulty of the respondents in establishing a consensus on the most adequate theoretical basis for the validation process.

The mapping presented provided the visibility of scientific production regarding the validation of educational technologies, indicating knowledge with an unequal distribution regarding the region where such intellectual capital is produced. The study contributed to the advancement of nursing knowledge, by clarifying the methods used by nurses, in research on technology validation, which may contribute to the development of new studies.

As limitations, due to the unavailability of theses and dissertations that were initially part of the sample, it was not possible to analyze all the literature produced and published in the CAPES catalog. Finally, further studies mapping the

validation of other types of technologies are recommended.

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