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Technological products and processes for innovation in health education: report of technological innovation

Produtos e processos tecnológicos para inovação do ensino na saúde: relato de inovação tecnológica

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ABSTRACT

Objective: To report on technological products and processes developed for innovation in health education. **Method:** Report on the production of 12 graduates guided by a permanent professor of a professional master's program at a federal university, located in southern Brazil. Data collection in the own collection. **Results:** Most of the research was directed to the subject of patient safety in different health contexts. The typologies that led the technological processes were varied, and the methodological study was the most frequent. The products developed were: nine instructional materials, most educational videos available on the free online platform; four social technologies, multi-professional residency in onco-hematology, navigation program in a center of high complexity in oncology, translation and transcultural adaptation of *the National Early Warning* Score 2 to Brazilian Portuguese; and municipal patient safety program in Porto Alegre; and an event.**Conclusion:** The technological processes allowed to develop 14 products contributing to health education and allowing the integration of the university with the health service and the community.

Descriptors: Teaching; Health; Nursing; Graduate Programs in Health; Scientific and Technological Activities; Research.

RESUMO

Objetivo: relatar sobre produtos e processos tecnológicos desenvolvidos para a inovação do ensino na saúde. **Método:** relato sobre a produção de doze egressas orientadas por uma docente permanente de um programa de mestrado profissional de uma Universidade Federal, localizada no Sul do Brasil. Coleta de dados no acervo próprio. **Resultados:** a maioria das pesquisas foi direcionada ao tema da segurança do paciente, em diferentes contextos de saúde. As tipologias que conduziram os processos tecnológicos foram variadas, sendo o estudo metodológico o mais frequente. Os produtos desenvolvidos foram: nove materiais didáticos instrucionais, a maioria vídeos educacionais disponibilizados na plataforma on-line gratuita; quatro tecnologias sociais, residência multiprofissional em onco-hematologia, programa de navegação em um centro de alta complexidade em oncologia, a tradução e adaptação transcultural da *National Early Warning Score* 2 para o português brasileiro; e programa municipal de segurança do paciente em Porto Alegre; e um evento. **Conclusão:** os processos tecnológicos permitiram desenvolver quatorze produtos contribuindo para o ensino na saúde e permitindo a integração da Universidade com o serviço de saúde e a comunidade.

Descritores: Ensino; Saúde; Enfermagem; Programas de Pós-Graduação em Saúde; Atividades Científicas e Tecnológicas; Pesquisa.

INTRODUCTION

Teaching in health is a process of training professionals who work in health making it more qualified. In the last decade, the health area has invested in the integration of teaching-service-community, to ensure qualified training for professionals. Thus, health education has

been highlighted in education and health policies, resulting in more resolute and better quality care [1].

In Brazil, the postgraduate degree is divided into *lato sensu and stricto sensu ,*the first one refers to the specialization courses and residencies programs , the second to the Masters and PhD, academic and professional. The *stricto sensu academic* programs form individuals to act in academia, while professionals are directed in the elaboration of a product for the service, supported in the research [2] .

The *stricto sensu graduate programs (PPG)* are evaluated by the Coordination of Improvement of Higher Education Personnel (CAPES), determining and ensuring the standard of quality of the courses. The scientific productions and their social impact of the programs offered by Higher Education Institutions (HEIs) of Brazil are evaluated periodically [3] . CAPES has nine major areas of knowledge, distributed in 49 areas [4] , Teaching is from the multidisciplinary area classified as area 46, with reference to the last four-year evaluation (2017-2020) [4-5] .

The scientific production of the PPG stricto sensu determines its development by encouraging new theoretical and methodological approaches qualifying the training of researchers, contributing to the production of knowledge, professional education and development of critical professionals [3] . PPG in Health Education are interdisciplinary and drive the advancement of science, technology, innovation, improving health services and their practices.

The integration of this PPG with service providers and the community brings healthcare professionals closer to pedagogical practices, enabling innovation and transformation of teaching-learning processes. Thus, they enhance permanent education actions and articulate the qualification of professionals, scientific production, teacher training, strategies of best practices of health services and greater integration of teaching-service-community[6] .

Professors from a Brazilian federal university, driven by the implementation of the Pro-Teaching Health project entitled "Teaching in Health, an integrative proposal for the Unified Health System", elaborated, in 2013, a proposal for a New Post-Graduation Course (APCN) of a Professional Master in Health Education, evaluated and approved by CAPES, aiming to provide theoretical, conceptual and methodological foundations to a multiprofessional audience working in various areas of health performing teaching practices, formal or informal. Based on the work carried out by the orientation of a permanent teacher of this program, emerged the motivation to write this article that aims to report on technological products and processes developed for the innovation of teaching in health.

METHOD:

This is an account of the research that generated products of 12 graduates guided by a nurse teacher inserted in the research line "University integration, health service and community".

The *stricto sensu* PPG in Health Education (PPGENSAU) offered by a Brazilian federal university, the only specialized in health, located in the southern region of Brazil, was the first PPG Professional of this university, started its activities in 2014[7] . Since it is a public university all the courses offered, 16 undergraduate and 21 PPG, nine *lato sensu* and 12 *stricto sensu*[8]), are free.

PPGENSAU started with 13 permanent professors in the multiprofessional area. From 2014 to September 2023, a period fully reported in this research, the researcher professor guided 15 masters, and presented in this report the production of 12 graduates (10 nurses, a pharmacist and a physiotherapist). The themes addressed were: Health Education; Materials and Sterilization Center; Surgical Center; Intensive Care; and Patient Safety in the hospital area.

The results were analyzed and interpreted through the review of the teacher's own collection, with descriptive method, focusing on the identification of the types of technological processes developed, their products and contribution to health education, being presented in a figure, classifying the product generated by the research, as stated in the "Evaluation Form" of Academic and Professional Programs of Area 46 of Teaching. The products linked to the dissertation/thesis or developed by students/graduates involving PPG teachers are called Technical-Technological Production (PTT), classified by CAPES as PTT1 to PTT10, with a score for each PTT [5].

RESULTS

Figure 1 presents the research carried out by 12 graduates of PPGENSAU, the methodologies used and the classification of Technical-Technological Production (PTT), according to area 46 of education.

Figure 1 - Dissertations with their methodological approaches and products generated in the PPGEN-SAU of a federal university guided by a professor, from 2014 to 2022.

DISSERTATION	RESEARCH METHODOLOGY	PRODUCT
Multi-professional residency in onco-hematology: service teaching product based on strategic management [9]	Typology: applied intervention Field of Action: Irmandade Santa Casa de Misericórdia de Porto Alegre (ISCMPA) and UFCSPA. Sample: 10 professionals and nine professors in the areas of Nursing, Physiotherapy, Speech and Language Pathology and Nutrition who acted as preceptors and fifteen professors of theoretical disciplines. Period the research was conducted: 2014 – 2016.	PPT3. Social Technology: Multi-professional Residency Program in onco-hematology
Thermal disinfection of health products and their preservation in barrier system[10]	Typology: experimental study Field of Action: Materials and Sterilization Center (CME) and Microbiology Laboratory. Sample: 272 semi-critical pieces of ventilatory care products (PPS) initially processed and sterilized at low temperature by hydrogen peroxide. Period the research was conducted: 2015 – 2017.	PTT1. Educational/instructional material: Educational video on Thermal Disinfection of PPS ventilatory assistance
Alcoholic Surgical Hand Antisepsis: from Practice to Teaching [11]	Typology: comparative descriptive. Field of Action: private tertiary hospital in Porto Alegre, RS in collaboration with the Microbiology Laboratory of UFCSPA. Sample: microbiological samples collected from the hands of 54 surgeons in two moments: after simple hand washing procedure and after alcoholic surgical antisepsis of the hands. Period the research was conducted: 2015 – 2017.	PTT1. Educational/instructional material: Educational video on Surgical Brushing and Surgical Antisepsis
Development of a Navigation Program at a High Complexity Center in Oncology[12]	Typology: convergent care research. Field of Action: SUS Outpatient, from a Center of High Complexity in Oncology, a private and philanthropic institution, located in the Southern region of Brazil. Sample: 14 nurses (seven area managers and seven health care providers), four doctors (two clinical oncologists, a head and neck surgeon and a palliative), a psychologist, a speech therapist and a nursing professor. Period the research was conducted: 2016 – 2018.	PTT3 Social Technology: NP Program Model, EANN, browser profile PTT1. Educational/instructional material: Guide to the development and implementation of NP programs for high complexity centers in oncology in Brazil and Manual.
Translation and cross-cultural adaptation of the *National Early Warning* Score 2 to Brazilian Portuguese[13]	Typology: methodological study of cross-cultural adaptation of scales. Field of Action: hospitalization and emergency units of a university hospital in southern Brazil Sample: 35 nurse assistants. Period the research was conducted: 2016 - 2018	PTT3 Social Technology: *National Early Warning* Score 2 translated and adapted to Brazilian Portuguese.
Implementation of a Municipal Patient Safety Program in Porto Alegre [14]	Intervention based on the tool of the systematic process developed by the World Health Organization (WHO), adapted to the local reality, for the projection and implementation of strategies to promote quality and safety in health systems. Field of Action: General directorate of Sanitary Surveillance (DGVS) of the Municipal Health Secretariat (SMS) of the municipality of Porto Alegre, RS. Sample: data collected in the patient safety centers of 25 hospitals in the city of Porto Alegre. Period the research was conducted: 2017 - 2019	PTT3 Social Technology Municipal Ordinance that establishes actions for patient safety in health services and publishes the Municipal Patient Safety Program of Porto Alegre, in the form of an annex. Product: PTT5 Organized Events I Patient Safety Day in Porto Alegre at UFCSPA.
Safe Surgical Positioning: educational actions to assess the risk of injury in the patient[15]	Typology: qualitative descriptive exploratory and educational intervention. Field of Action: Surgical Center of Private Hospital of Porto Alegre, RS. Sample: 8 nurses working in a CC. Period the research was conducted: 2017 – 2019.	PTT1. Educational/instructional material: Educational Manual: health teaching strategy inspired by Problem Based Learning Methodology (ABP)
Educational tutorials on the registration of clinical activity of the hospital pharmacist in the patient's medical record[16]	Typology: cross-sectional study. Field of Action: private and public educational institutions and hospitals. Sample: 47 professors and 248 pharmacists. Period the research was conducted: 2018 – 2020.	PTT1. Didactic/instructional material: three educational tutorial videos on Pharmaceutical Registration in the Patient's Medical Record. Portuguese and subtitled in English.
Culture of patient safety in six Brazilian hospitals: Development of an educational plan[17]	Typology: retrospective documentary study and development of an educational plan Field of Action: six Brazilian hospitals Sample: 1,930 instruments completed by professionals working in the hospitals surveyed. Period the research was conducted: 2018 – 2020.	PTT1. Educational/instructional material: Educational Plan with Strategic Actions aimed at Strengthening the Patient Safety Culture in Hospitals.
Development of educational tutorials on processing health products in primary care[18]	Typology: methodological study in three stages: 1) integrative review; 2) exploratory research descriptive quantitative approach; and 3) elaboration of an educational product by the Design of Instructional Systems applying the ADDIE model. Field of Action: second stage were the 25 health units of the North District Axis Baltazar of the Municipal Health Secretariat (SMS) of POA Sample: 31 participants Period the research was conducted: 2019 – 2021.	PTT1. Didactic/instructional material: three educational tutorial videos on processing of health products in primary care, in Portuguese subtitled in English.
Development of an educational technology on use protocol[19]	Typology: Delphi Modified research Field of Action: Health Technology Assessment Centers (NATS) registered in the Brazilian Technology Network in Health (REBRATS). Sample: first round 12 and second round 10 participants Period the research was conducted: 2020 – 2022.	PTT1. Didactic/instructional material: E-book "What is Protocol of Use: health Technology in Brazil"
Safety Culture: experimental learning through the development of scenarios for realistic simulation[20]	Typology: methodological study in three stages: 1) documentary study; 2) application an educational plan for strengthening the safety culture of leaders; and 3) construction of two simulation scenarios through the *NLN Jeffries Simulation Theory* method validated by a group of evaluators. Field of Action: private hospital Sample: seven leaders and a group of expert evaluators composed of five nurses and one pharmacist. Period the research was conducted: 2020 – 2022.	PTT1. Didactic/instructional material: two realistic simulation scenarios on leadership-oriented safety culture.

DISCUSSION

In the figure presented, 12 studies carried out by the graduates were evidenced. Among these, two surveys generated two products each, resulting in 14 products. In the CAPES evaluation sheet there is an item to evaluate the quality of the intellectual production of students and graduates, classifying each Technical-Technological Production (PTT) and assigned a score for each of these, with the strata higher T1 to T3[5] . The most present productions in Figure 1 are defined by CAPES as: PTT1 - Didactic/instructional material: teaching proposals, involving suggestions of experiments and other practical activities, didactic sequences, intervention proposals, workshop scripts; textual material ", such as manuals, guides, supporting texts, articles in technical or dissemination journals, textbooks and whereabouts, comics and the like, dictionaries; educational media such as videos, simulations, animations, video-classes, virtual experiments and audios; learning objects; learning environments; internet pages and blogs; educational games of table or virtual, and the like; among others; PTT3 - Social technology products, devices or equipment; processes, procedures, techniques or methodologies; services; organizational social innovations; management social innovations, among others [5]".

Figure 1 shows nine products classified as PTT1 didactic/instructional material, four as PTT3 social technologies and one as PTT5 organized event, indicating a predominance of higher PPG scores. The four studies that resulted in social technologies were: Multi-professional residency program in Onco-Hematology; Navigation program for oncological patients ; National Early Warning Score 2 Transcultural adaptation to Brazilian Portuguese; and Municipal Patient Safety Program in Porto Alegre.

The product " Multiprofessional Residency Program in Onco-Hematology" was structured based on the experience of the egress; on the implementation of Ordinance No. 140, of 2014 of the Ministry of Health (MS); on the guidelines of strategic planning of the hospital institution; and in the Institutional Development Plan of the Federal University, whose focus was expansion of undergraduate and graduate courses and programs. The product was developed through a strategic planning of efficient actions, seeking to meet the need of qualified professionals in the field of oncology and offer qualified health care aligned with technological evolution and new products [9]. Implemented in 2015, it qualifies, annually, eight professionals in the areas of: Nursing, physiotherapy, speech therapy and nutrition. These residents are trained to plan, implement and evaluate oncology services according to the policies and guidelines of the Unified Health System (SUS)[9] .

A new product in Brazil "A navigation program for oncological patients adapted to the reality of a Brazilian Center for High Complexity in Oncology (CACON)" was developed to provide specialized and comprehensive care to head and neck cancer patients, as well as to provide a comprehensive and specialized care for patients with cancer of the head and neck, as well as for the use of cancer. as provided for in the National Policy for the Prevention and Control of Cancer in the Health Care Network of People with Chronic Diseases. Prior to the publication of this product, this type of program was exclusive in developed countries [12] . A program led by nurses was conceived, with the aim of guiding people diagnosed or suspected of oncological diagnosis and facilitating access to treatment within the recommended deadlines, promoting their adherence[12] . This study triggered other studies in this area and provided a new field of action for nurses in Brazil.

Considered a production of social technology, the translation into Brazilian Portuguese of the *instrument National Early Warning Score 2*, a tool created by *the Royal College of Physicians* ,updated in December 2017 and the following year adapted transcultural, it allows to evaluate the clinical deterioration of patients in Brazilian hospitals [13]. The fragility identified, in Brazilian practice, where many scores are translated literally, motivated the realization of this methodological study of cross-cultural adaptation of the scale, based on Beaton et al. Authorized by *the Royal College of Physicians followed* the stages of translation, synthesis of translations, reverse translation and committee evaluation of experts of the semantic, idiomatic, conceptual and cultural equivalences of each translated item[13]. The cross-cultural adaptation and its stages guarantee equivalence between the final product and the original. The result was a highly reproducible tool, applicable for teaching, research and hospital management area, benefiting assistance [13].

Another social technological production was the "implementation of a municipal patient safety program in Porto Alegre". As a result of the professional experience of the Brazilian Health Surveillance Regulatory Agency in Porto Alegre, the program was planned with the contribution

of a group *of* experts in the subject, aiming to promote safe practices in health services[6] . As a result, in conjunction with the Porto Alegre Municipal Patient Safety Program, a regulatory ordinance was created that establishes patient safety as a public health policy[14].

The importance of the Materials and Sterilization Center (CME) in the hospital, boosted the research entitled "Thermal disinfection of health products and their preservation in barrier system". Initially an experimental research was carried out to substantiate the product to be developed. The experience of the student as manager of a CME of a hospital complex, instigated the research to verify the time of preservation of the disinfection of semi-critical products used in respiratory care. The effectiveness of the process was obtained through microbiological tests, proving the good practice. The results supported the construction of an educational video on processing of semi-critical Health Products(PPS) used in respiratory care for health professionals [10]. This practice boosted the care routine and the video was incorporated in the nursing undergraduate education and released on YouTube for public access [21].

Another research sought to know the understanding of professionals working in Primary Health Care (PHC) on good practices performed in PPS, investigating the theme in three stages: integrative review; descriptive exploratory research with quantitative approach; and elaboration of educational videos. In the first stage, 10 articles were selected that reinforced the importance of educational interventions for the training of health professionals[22]. In the second, there were numerous shortcomings in PPS among the participants, inferred doubts and knowledge gaps in PPS, due to the diversity of activities in PHC, however they demonstrated to master their practices and routines, valuing the relevance of the safe reprocessing theme[18]. Based on these results, three educational videos were built, addressing the reception, inspection, cleaning, preparation, packaging, disinfection, sterilization and storage of health products. This educational technology, available free of charge, seeks to strengthen and stimulate learning teaching, training nursing and dentistry professionals, promoting good practices and aiming to improve health services related to PPS in APS[23] .

Experimental research developed regarding the alcoholic surgical antisepsis of surgeons' hands, it allowed to generate a digital educational resource based on evidence, addressing one of the central themes of patient safety, the prevention of Health Care-Related Infections (IRAS). The aim was to disseminate good practices among health professionals and prevent infections by avoiding contamination of the surgical site through surgical antisepsis of the team's hands[11]. In addition to encouraging scientific discussion, it was identified the absence of visual educational materials, which demonstrate the practice with quality. So an educational video was built, demonstrating the two forms of surgical antisepsis for the surgical team, used for academic nursing education[24].

Another qualitative research carried out in a Surgical Center (CC) with nurses emerged from the need evidenced by the student to improve patient safety, concerned with the risk of skin injury, arising from surgical positioning and immobility of the patient during surgery. The researcher sought to implement educational strategies for learning in the workplace, stimulating critical sense, and the collaboration of professionals in the evaluation stage of risks of skin injury of the surgical patient[15] . Thus, the investigation founded an educational product, the "Educational Manual: Health teaching strategies inspired by problem-based learning" to be used by other health professionals guiding the implementation of educational strategies that assist in patient safety[25].

Still in the area of patient safety, a multicenter study, carried out in six Brazilian hospitals, sought to know the culture of patient safety by health professionals and, later, develop an educational plan to strengthen it. Student involved in the Program of Support to Institutional Development of the Unified Health System (Proadi-SUS) carried out the investigation in two stages: retrospective documentary study of participating hospitals; and elaboration of the educational plan. The first stage used data collected by an instrument that quantified the participants' perception regarding the patient safety culture in each hospital, evidencing its potentialities and weaknesses. The results of this stage allowed to develop an educational plan aimed at the patient safety culture for health institutions, made available to the Ministry of Health and to the institutions participating in the research, with the aim of strengthening the topic[17].

Simulation-based education is a highly widespread strategy to improve the quality of health care, teaching in health requires methodological actions and pedagogical strategies that allow

the student or professional experience in the teaching-learning process, improving the development of knowledge, skills, attitudes and results, with safe methodologies. Thus, an egress promoted experimental learning with leaders in a health institution about security behavior, with realistic simulation. The research consisted of three stages: retrospective experimental; application of an educational plan to strengthen the safety culture for the leaders who participated in the research; and development of two simulation scenarios through the *NLN Jeffries Simulation Theory* method evaluated by a group of six expert evaluators. After the application of the simulation, the satisfaction and self-confidence of the participants was measured. This study developed as didactic material two realistic simulation scenarios for application to students and health professionals, improving and qualifying care in health services[20] .

Pharmacist, graduate of the program, investigated the perception and practices of clinical pharmacists and university professors of pharmacy courses in Brazil, in relation to the performance and development related to the registration of activities in medical records to, later, build an educational product. The research took place in three stages: Integrative review; quantitative cross-sectional study; and educational product development [16]. The results of the first two stages grounded the elaboration of educational technology, producing three videos that address the registration/evolution of the pharmacist in the patient's medical record, available free of charge, for teaching [24].

Research on Health Technology Assessment (HTA) investigated the understanding and recommendation of Brazilian HTA experts on "use protocol", using the modified Delphi methodology. The research allowed to know the opinion of the experts and to base the elaboration of an e-book on the subject investigated directed to health professionals, contributing to a more qualified care based on evidence and encouraging innovation in the use of health technologies in favor of qualified care, standardized and safe [19].

This study was limited in presenting productions of graduates guided by a teacher, however, allows the reader a vision about the professional master's degree and how a product is developed. The products and technological processes developed imply the innovation of health education, promoting integration between educational institutions, health services and community.

CONCLUSION

This article highlighted the results of 12 technological research produced by graduates of a professional master's program in health. In most of the studies the subject "patient safety" in different health contexts stood out. Of the 14 resulting products, nine were didactic/instructional materials, four social technologies, and an organized event. The products of social technologies were: teaching in the format of multiprofessional residency in onco-hematology; navigation program to oncological patients; scale to evaluate the clinical deterioration of the hospitalized patient; and ordinance for the improvement of the safety of patients hospitalized in hospitals of Porto Alegre. The educational materials produced included videos, manual, e-book, educational plan and simulation scenarios. All emerged from the practical needs experienced by graduates during professional performance. The products presented are part of the research line "University integration, health service and community" and the research area of the professor.

It is believed that this article has the potential to help future candidates to *stricto sensu* who do not know the dynamics of the professional master's degree. The papers and products disclosed can trigger reflections on the needs of the workplace, generating future research and products.

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