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ORIGINAL

Incorporation of a digital health literacy model into the curricula of medical and rehabilitation science courses in higher education

Incorporación de un modelo de alfabetización digital en salud en el currículum de carreras de ciencias de la salud y rehabilitación en Educación Superior

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ABSTRACT

Introduction: currently, digital resources have changed the way we live in areas such as education and health. This scenario was reinforced after the COVID-19 pandemic, where society had to quickly adapt to virtual scenarios to access health services. In this way, electronic health (eHealth) is positioned as a relevant issue in the training of university health professionals and as a way to make higher education relevant to the innovation and digital transformation experienced by the health system. This research proposes as a general objective to analyze the degree of association between university education models and the development of health literacy for health and rehabilitation students.
Method: the study, quantitative descriptive-correlational and cross-sectional design, brings together the self-perception in eHealth competences, through the application of the eHealth Literacy Scale (eHeals), to 60 participants who were studying their professional practice to access the title of Speech Therapist.
Results: the results reveal a significant difference between students who participated in an electronic health skills training pro-gram compared to those who were not part of such a program in their university education.
Conclusion: the implementation of digital health literacy programs in higher education increases the ability to search for and evaluate the quality of health information online.

Keywords: Health Professionals; Digital Tools; E-Health; Higher Education; E-Heals; E-Health Literacy; Digital Health Literacy; Health Careers.

RESUMEN

Introducción: en la actualidad, los recursos digitales han cambiado la forma en que vivimos el día a día en ámbitos como la educación y la salud. Este nuevo escenario, se agudizó después de la pandemia por COVID-19, donde la sociedad se debió adaptar rápidamente a escenarios virtuales para acceder a prestaciones sanitarias. De este modo, la salud electrónica (eSalud) se posiciona como una temática relevante en la formación de profesionales de la salud universitarios y como una forma de hacer pertinente la educación superior para la innovación y la transformación digital que vivió el sistema sanitario. Esta investigación propone como objetivo general medir el grado de asociación de un modelo en la formación universitaria para el desarrollo de la alfabetización en salud para estudiantes del área de la medicina y rehabilitación.

Método: el estudio, cuantitativo descriptivo correlacional y de diseño transversal, reúne la autopercepción en competencias de eSalud, a través de la aplicación de la escala eHealth Literacy Scale (eHeals), a 60 participantes quienes cursaban su práctica profesional para acceder al título de Fonoaudiólogo.
Resultados: los resultados revelan una diferencia significativa entre los estudiantes que participaron en un programa de formación en alfabetización digital en salud en comparación con aquellos que no formaron parte de dicho programa en educación universitaria.
Conclusión: la implementación de programas de alfabetización digital en salud aumenta la capacidad de buscar y evaluar la calidad de la información de salud en línea

Palabras clave: Profesionales de la Salud; Herramientas Digitales; Salud Electrónica; Alfabetización Digital En Salud (E-Health); Educación Superior; E-Heals; Carreras de la Salud

INTRODUCTION

Over the last two decades, scientific research has increasingly focused on the intersection of health and virtual environments. This includes both the development and analysis of health information websites and the examination of patients' experiences with digital treatment tools. An important milestone in this field has been the rise of telehealth, defined as the use of information and communication technologies (ICT) for a broad spectrum of health ser-vices, including prevention, promotion, diagnosis, intervention, and rehabilitation.[1,2,3] Tele-health has emerged as a strong alternative in healthcare delivery, addressing access issues, reducing costs, and waiting times, and improving the quality of patient care.[4]

The World Health Organization has expanded the concept of telehealth to encompass the training of health professionals for research and continuing education purposes. However, there is a notable lack of standardized models for teaching health literacy in higher education. This absence means that there is a pressing need for structured strategies to equip future health professionals with essential digital health literacy skills.[5]

In response, the Organization for Economic Co-operation and Development (OECD) advocates the integration of eHealth competencies into medical and rehabilitation curricula. This effort aims to drive innovation in healthcare and ensure that emerging healthcare professionals can meet the changing needs of society.[6] There is general agreement on the value of digital health literacy in university education, but debate continues the best approach to this integration.[7] Proposed strategies include curricula that integrate digital competences and teaching methods that combine theoretical knowledge with practical patient care experiences.[8,9]

In this context, the curricula of health science programs in higher education have evolved over the last decades, following these guidelines and incorporating aspects related to globalization in health, interdisciplinary work and the incorporation of technologies in the health field, in order to meet the new challenges posed by global issues in university education and subsequent insertion in the labor market.[10] Suggestions for adapting to current needs include adapting curricula, integrating digital health technologies and tools into the curriculum. All before, benefiting the education of university students and the health sector by con-tributing to professionals with greater digital health skills.[11]

The need for digital health competences in today's healthcare environment is undeniable. The proliferation of e-health platforms provides healthcare professionals with a variety of options for accessing online health information. To use these resources effectively, professionals need basic skills to locate, understand and evaluate health information from electronic media, as well as to apply this knowledge to health-related problems.[12,13]

Literature reviews highlight the need for health professionals to be adequately prepared to intervene in the digital health domain. This includes developing skills in the use of eHealth tools, literacy, software, and knowledge of evidence-based practices for digital healthcare de-livery. However, there is a significant gap due to the lack of established models in higher education to develop these skills. The COVID-19 pandemic has further highlighted the urgency of addressing this gap. Integrating innovation, science and technology into the training of health professionals is crucial to strengthen health systems and enhance human resource capacities for informed health decision-making.[14,15]

The transition to digital health platforms poses challenges, in particular ensuring that health professionals master the use of digital tools. Competence goes beyond basic operational skills and includes a thorough understanding of navigating and critically evaluating online health information.[16]

To address these challenges, educational institutions and healthcare organizations are seeking to collaborate in the development of comprehensive training curricula. These programs aim to improve digital competencies, with an emphasis on critical thinking and problem solving in a virtual health environment. Some authors argue that this literacy should start at the earliest stages of healthcare education to prepare students for a rapidly changing healthcare technology landscape.[17] In addition, these programs should focus on interpersonal skills, such as communication, empathy and patient-centered care in a digital context. As healthcare moves

increasingly online, effective digital communication becomes as important as face-to-face interactions.[14,15]

Within this framework, regulatory bodies and professional associations also play a crucial role in setting standards and guidelines for digital health education and practice. Their collaboration with educational institutions could provide greater assurance that training curricula are more comprehensive, up-to-date and aligned with the needs of the health sector.[16]

Integrating digital health literacy into the education of future health professionals is a complex but essential task. It requires a multi-faceted approach, including curriculum development, practical training, collaboration between educational and professional bodies, and continuous adaptation to the changing healthcare technology landscape. Understanding, analyzing and addressing these challenges is essential to ensure that the next generation of healthcare professionals is best equipped to deliver high quality, patient-centered care in an increasingly digital world.[11]

In this context, this research aims to answer the question: Is there a relationship between the proposed model of university education and the development of health literacy for medical science students? The aim of this study is to analyze the association between the proposed model of university education and the development of health literacy for health and rehabilitation science students. Among the specific objectives are: To describe the model of development of e-health competencies in health professionals in university training; to know the sociodemographic characteristics of the population under study in order to describe the possible characteristics that influence digital skills in health; To analyze the impact of the digital health literacy model on medical science professionals in university education. Finally, the hypothesis is that incorporating digital health training models into the higher education of health professionals increases their health literacy skills. The study aims to contribute to the updating of health professions curricula to contribute to health promotion, prevention and intervention through a quality approach.

METHOD

Model for the Development of Digital Skills in Health

The Faculty of Rehabilitation Sciences of the Andrés Bello University of Chile contemplates three professional careers, among which are Speech Therapy, Physical therapy, and Occupational Therapy.

The Speech Therapy Career trains professionals trained to manage and implement promotion, prevention, diagnosis, habilitation, and rehabilitation programs, in the areas of human communication, swallowing-feeding and vestibular system throughout the life cycle in an interdisciplinary way, from an inclusive perspective and with a human rights approach. The career is taught in three different cities in the country (Santiago, Concepción and Viña del Mar), but all are homologated in their curricula.

Its new curriculum (start year 2022) includes two parts: The first of them to achieve the degree of bachelor in speech therapy with 40 subjects, distributed in 4 years of; and a second stage, to obtain the professional title of speech therapist of 1 year of professional habilitation, distributed in 4 subjects of professional practice. Each of these 4 placements will be chosen by the students according to their order and clinical center, with the obligation to choose 1 of them in telerehabilitation mode.

The incorporation of aspects related to Digital Health Literacy is included in 4 of the 40 career subjects (first 4 years of training) and in 1 of the 4 compulsory professional practices (last year of career). The population incorporated in this study is part of a first part of the measurement of the model, where students had to take 1 of the 4 professional practices in telehealth modality, allowing them to develop skills in digital health. This population did not take the 4 subjects of the first years of training, as they correspond to students of the old curriculum (2018-2022 cohort). Students in the 2022-2026 cohort will have completed the complete innovative curricula with both parts of the model.

The professional practice in telerehabilitation modality contemplated an initial course of "Digital Transformation in Health" for the students, with a total of 20 hours of training. This course is divided into two parts: a theoretical one, whose qualification is equivalent to 25 % of the final grade, evaluated in 1 individual control; and on the other hand, the practical hours, where technological tools in eHealth are exercised, whose grade constitutes 75 % of the final grade, evaluated in 4 group practical activities. Both grades must be greater than or equal to 4,0 to obtain certification. All students who passed the certification, continue with 9 weeks of telehealth practices of users in the selected speech therapy specialty area.

Type of study and participants

The career of Speech Therapy at the Andrés Bello University of Chile proposes a model that incorporates actions for the formation of digital health literacy throughout its training itinerary. In this context, the quantitative correlational study of cross-sectional design incorporated students of speech therapy, who were studying their final period of professional clinical habilitation (clinical internship).

The study, quantitative descriptive-correlational and cross-sectional, included the total population of 60 participants divided into two groups, the first of them, 22 subjects who studied tele-rehabilitation (C-

TR) practice, and a second group, composed of 38 subjects who had not started tele-rehabilitation (NC-TR) practices. The group of subjects C-TR received a training of Digital Transformation in Health, prior to the virtual practice, and then, developed direct digital intervention activities in the specific population of patients for 9 consecutive weeks accompanied by a tutor with training in telecare.

Instruments and procedures

To measure the variable of the competence in digital health, was applied the Spanish translation of the eHealth Literacy Scale (eHeals) developed by Norman C., was used.[18,19] This instrument contains a total of eight items, aimed at examining different aspects of eHealth competencies. Each of the responses uses a five-level Likert scale, scoring from strongly disagree (1 point) to strongly agree (5 points). The total score is calculated from the average of the scores obtained in each of the items that include questions such as: "I know what health resources are available on the Internet", "I know where I can find useful health resources on the Internet", "I know how I can find useful health resources on the Internet", "I know how to use the Internet to find answers to my health questions", "I know how to use the health information I find online to help me," "I have the skills to evaluate the health resources I find online," "I can distinguish high-quality health resources from low-quality health resources found online," and "I am confident in using Internet information to make health decisions."

Subsequently, the adjustment of the SL instrument was verified by means of a confirmatory factor analysis (CFA). The results already described in the Instruments section used Chi-squared, CFI (Comparative Correction Index) and RMSEA (Mean Square Approximation Error) and SRMR (Standardized Mean Square Residue) which were used as fitting indices. We assume results above ,9 for CFI and results below ,05 for RMSEA and SRMR to be excellent.[20,21]

The reliability of the instrument has been previously reported in university students, its Cronbach's alpha was ,87.[18] To analyze the structural validity of the construct formed by the 8 items, a Confirmatory Factor Analysis (CFA) was performed in our study. The AFC showed an acceptable adjustment for this model [X2(16, N = 60) = 36,64, p = 0,002; CFI = 0,923, RMSEA = 0,014, SRMR < 0,001].[22] Additionally, in our study, Cronbach's alpha reliability test was performed for the scale that was ,87, which is considered satisfactory.[23]

In addition, a short survey was used to collect characterization data, the variables of which were: the type of internship carried out (telerehabilitation or face-to-face modality), the place to which the student belongs (Concepción City, Santiago City or Viña del Mar City) and whether the student had previously failed an internship.

Data analysis

First, the competence in digital health variable were described in terms of percentages, mean and standard deviation. Then the survey EHEALS was analyzed from each reagent, comparing the scores obtained (Likert scale) between students who have already developed the telerehabilitation course (C-TR) and those who have not yet completed NC-TR (Mann-Whitney U test). Subsequently the survey EHEALS was analyzed as an instrument considering the average scores obtained by each student, and then compare these averages between students who have already developed the telerehabilitation course and those who have not yet completed the course (T Student). Each of the calculations described previously considered the normality of distribution test (Kolmogorov-Smirnov). The effect size was calculated for each of the comparisons made. To interpret the magnitude of the effect size, the criteria established.[24]

The main analyses were developed in the IBM software SPSS Version 25 (IBM Inc., Armonk, NY, USA) and the AMOS v,23 tool for CFA. considering a significance level of 0,05.

RESULTS

Description of incorporating a digital health literacy model into the curricula

The updated curriculum, which will come into effect in 2022, consists of two phases: The first phase involves the completion of 40 subjects over four years, leading to the award of a bachelor's degree in speech and language therapy. This will be followed by a second phase of one year, focusing on professional qualification as a speech and language therapist. This later phase includes four subjects dedicated to professional practice.

The integration of components related to digital health literacy is embedded in four of the 40 professional subjects during the first four years of training. It is also included in one of the four mandatory professional placements during the final year of training. The cohort studied here corresponds to the first phase of this model, in which students participated in one of the four professional placements carried out via telemedicine, thus promoting digital health literacy. Notably, this group did not take the four subjects in the first years, as they were part of the previous curriculum (2018-2022). However, the 2022-2026 cohort will complete the entire innovative curriculum, which includes both phases of the model.

In terms of professional practice in telerehabilitation, an introductory course entitled 'Digital Transformation

in Health' has been designed for students, with 20 hours of training. This course is divided into a theoretical part, which contributes to 25 % of the final grade, evaluated through an individual assessment. At the same time, there are practical hours in which students work with technological tools in eHealth, accounting for 75 % of the final grade, assessed through four group activities. A grade of 4,0 or above in both components is required for certification. Those who are successfully certified proceed to a nine-week tele-health placement within their chosen speech and language therapy specialty.

Characterization of the population

This study examined a group of 60 students, all in their final year of a speech therapy program at the university level, offering a nuanced view into their educational experiences in the realm of digital health. These students were divided into two groups to assess the impact of telerehabilitation training (as mentioned in the "method" section, the student decides the order of the internship and the clinical center, so the assignment to the group with telerehabilitation or without telerehabilitation was the student's decision and not the researcher's). The first group, labeled C-TR, consisted of students who had successfully completed a telerehabilitation course. This course represents a cutting edge approach in speech therapy education, incorporating telecommunication technology for remote diagnosis and treatment, a skill set increasingly vital in modern healthcare. The second group, NC-TR, included students who had not yet had the opportunity to engage in this telerehabilitation training, providing a vital comparison group for the study. This division was instrumental in exploring the potential benefits and impacts of telehealth education on the competence and readiness of future healthcare professionals. Detailed demographic and academic data, crucial for a comprehensive analysis, were systematically cataloged in table 1 of the study. This table is key to understanding the specific backgrounds, educational journeys, and other pertinent characteristics of these two distinct student cohorts, offering valuable insights into the effects of innovative digital health training in higher education.

Table 1. Descriptive characteristics of participants (n=60)

NC-TR (n,%)	38 (63,3)
C-TR (n,%)	22 (36,7)
Concepción City(n,%)	22 (36,7)
Santiago City (n,%)	25 (41,7)
Viña del Mar City (n,%)	13 (21,7)
No failed internship	49 (81,7)
One failed internship	6 (10,0)
Two failed internship	4 (6,7)
Three or more failed internship	1 (1,7)

Standard deviation (SD) or percentage.

Table 2 contains the distribution in terms of mean and standard deviation for the complete eHeals scale and for each of its reagents.

Analysis of the digital health literacy model

The results show statistically significant differences between the group that developed the telerehabilitation course, with respect to the group that has not yet developed this course. For the complete scale, as well as for each of the items associated with eHealth competencies, students who have developed the telerehabilitation course have a significantly higher average perception ($p<,05$). In this same line, the reagents related to knowing "how to use the health information found on the Internet, the perception about the skills necessary to evaluate the health resources found on the Internet and the ability to distinguish high-quality health resources from low-quality health resources found on the Internet", had a large effect. Also, when examining differences between groups with respect to the full scale, a large effect size was observed. The rest of the reagents examined also had moderate effects of the differences.

The questions most likely to show significant changes after the application of the proposed intervention model are those related to the development of the ability to evaluate and understand health information obtained on the Internet (Q6 and Q7), followed by the ability to know how to search for information online (Q1, Q2 and Q3). Regarding the ability to apply the information obtained, two of the questions (Q4 and Q5) yield significant results, but not the confidence expressed by the subjects in using the information obtained to make decisions about their health. The largest effect size is obtained in the questions related to the evaluation of the information.

Table 2. Comparative analysis of the distribution of the eHeals scale and its items between the groups with and without the telerehabilitation course

How much do you agree with the following statements?	Group (n=60)	NC-TR (n=38)	C-TR (n=22)	p value	ES
Q1. I know what health resources are available on the Internet.	3,08 (0,93)	2,92 (0,91)	3,36 (0,90)	,023	,49
Q2. I know where I can find helpful health resources on the Internet.	3,23 (0,81)	3,05 (0,87)	3,55 (0,60)	,014	,67
Q3. I know how I can find helpful health resources on the Internet.	3,22 (0,83)	3,05 (0,87)	3,50 (0,67)	,026	,58
Q4. I know how to use the Internet to find answers to my health questions.	3,30 (0,83)	3,11 (0,92)	3,64 (0,49)	,021	,72
Q5. I know how to use the health information I find on the Internet to help me.	3,32 (0,68)	3,13 (0,66)	3,64 (0,58)	,003	,82
Q6. I have the skills to evaluate the health resources I find on the Internet	3,08 (0,74)	2,87 (0,74)	3,45 (0,60)	,002	,86
Q7. I can distinguish high-quality health resources from low-quality health resources found on the internet.	3,28 (0,74)	3,08 (0,78)	3,64(0,49)	,004	,86
Q8. I am confident in using information from the Internet to make health decisions	3,07 (0,90)	2,89 (1,01)	3,36 (0,58)	,071	,57
EHEALS	3,21 (0,60)	3,03 (0,62)	3,54 (0,38)	,001	,99

Standard deviation (SD). EHEALS, mean of eHealth Literacy Scale scores. NC-TR, group that has not yet completed the telerehabilitation course. C-TR, group that has completed the telerehabilitation course. TE, effect size.

DISCUSSION

Digital health literacy is a crucial skill in the modern healthcare landscape, where health information is increasingly abundant on the web.[2] So, too, is the increase in the number of digital interventions in the fields of rehabilitation and speech therapy.[1,3,15]

Digital literacy in the field of health has been the subject of previous studies, both in university health students and in the general student population. Contrasting the results obtained in this and other research, contradictory results can be seen. Paramio-Pérez[7] states that medical and rehabilitation students have more digital health literacy skills than students in other areas, however, the present study identifies that final-year Speech Therapy students still show gaps in knowledge of health information sources on the Internet and in assessing the quality of their resources. Previous research has identified the same negative perceptions of students in these two fields, with students' low self-perceptions of their e-health competencies. However, when measuring eHealth skills, a discrepancy is observed between the perception of skills and the actual skills students have. This may be explained by findings suggesting that self-reported skill levels may not accurately predict actual health information competencies, which emphasises the importance of direct measures of skills and knowledge.[25] In this vein, the present study resolves an issue raised by Stellefson.[26]

With regard to digital health literacy intervention models, there are studies reporting on the effectiveness of electronic interventions aimed at users.[27] However, these studies have not always applied a model of digital health literacy to either users or health professionals [14,15] which compromises the effectiveness and quality of virtual health programs.[28] Similarly, there is a paucity of scientific literature assessing whether health professionals have the necessary skills to manage electronic information effectively,[8] which raises doubts about whether users can acquire these skills.[29,30] Consistent with these findings, our research confirmed that health professionals without eHealth training have low competencies to evaluate online health resources and learn what resources are available on the Internet. This underlines the need to implement e-health literacy models in the training of health professionals, with the aim of subsequently incorporating these practices into patient care.[31,32]

It is important to note that most of the current literature in this field comes from North America and Europe,[26,28] even though health inequity is a global problem.[33] All these investigations agree that research in Digital Literacy in Health is incipient or of low methodological quality. Despite the limitations of our study, such as sample size and sampling bias, this work marks a starting point for research on the impact of digital health from the perspective of university education on health professionals. It is also suggested to conduct studies that include in their methodology the comparison of data before and after the intervention in the same population. We hope that, in the future, digital health literacy can be addressed in a formative context, both for professionals and patients, in order to promote equity and overcome disparities in health care in Latin American countries.

CONCLUSIONS

This research highlights a significant trend among aspiring health professionals in Chile, mirroring a global pattern, where there is a noticeable deficiency in their understanding of electronic health resources. These future practitioners often exhibit limited awareness of the array of health-related information available online. Furthermore, they generally lack the requisite skills to critically evaluate and discern the quality of this information. This gap in digital health literacy is not just about identifying credible resources; it extends to making informed judgments about the reliability and applicability of health information found on the Internet. The study underscores the need for comprehensive training in digital health literacy, emphasizing the importance of equipping future health professionals with the skills to navigate, analyze, and utilize online health resources effectively and responsibly in their professional practices.

In this regard, as mentioned in the introduction to the article, this research set out to answer the following question: Is there a relationship between digital health teaching models in higher education and students' health competencies? The study finds significant differences in digital health literacy between students who participated in a digital health competency training program and those who did not. This suggests that implementing digital health literacy skills programs in higher education can improve students' abilities to search for and evaluate the quality of online health information. These results highlight the importance of incorporating digital health training models into higher education curricula for health professionals. This incorporation is considered crucial to improve their health literacy skills, especially in the wake of the COVID-19 pandemic, which has highlighted the need for innovation, science, and technology in health education.

Our findings highlight the effectiveness of a university educational model that integrates eHealth into medical and rehabilitation curricula. This approach not only increases the knowledge of professionals in the field of eHealth, but also equips them with the skills necessary for the effective use of online health information for the care of future patients.

If governments and health professionals want to make the most of the digital tools available in this century to improve access and quality of healthcare, especially in terms of prevention and health promotion, it is imperative to establish a comprehensive model of digital health literacy. This process should start with the training of medical and rehabilitation professionals during their university education, continue with refresher programs for already qualified professionals and, finally, include specific training aimed at the users of the healthcare system.

This article presents a starting point based on the experience of a Chilean university that has adopted an innovative approach in adapting its curriculum to current and future health challenges. The aim is to train professionals adequately prepared to meet the challenges of a constantly evolving health system.

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