RBE Revista Baiana de Enfermagem

Original Article
DOI 10.18471/rbe.v40.67185

DIGITAL HEALTH LITERACY IN NURSING EDUCATION: ASSESSMENT OF FIRST-YEAR AND GRADUATING STUDENTS

LETRAMENTO DIGITAL EM SAÚDE NA FORMAÇÃO EM ENFERMAGEM: AVALIAÇÃO DE ESTUDANTES INGRESSANTES E CONCLUINTES

ALFABETIZACIÓN DIGITAL EN SALUD EN LA FORMACIÓN DE ESTUDIANTES DE ENFERMERÍA: EVALUCIÓN DE INGRESANTES Y GRADUADOS

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How to cite this article: Roballo EC, Fiorentin L, Adamy EK, Cogo ALP. Digital health literacy in nursing education: assessment of first-year and graduating students. Rev baiana enferm. 2026;40:e67185.

Objective: to assess the level of Digital Health Literacy among first-year and graduating Nursing students from a federal university in southern Brazil. Method: cross-sectional study with 139 students (81 first-year, 58 graduating). Data were collected through a digital form with sociodemographic and academic variables and the eHealth Literacy Scale, which was used to assess digital health literacy. Statistical analyses included Mann-Whitney and Kruskal-Wallis tests ($p<0.05$). Results: mean digital health literacy level was high and significantly higher among graduating students compared to first-year students ($p<0.001$), especially in skills related to critical appraisal of online information. Participation in community outreach projects was associated with higher digital health literacy levels ($p=0.001$). Confidence in using digital information for health decisions was the weakest item in both groups. Conclusion: academic training contributes to the development of digital health literacy, although gaps remain.

Descriptors: Computer Literacy. Nursing Students. Internet Use. Health Literacy. Students.

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Objetivo: avaliar o nível de Letramento Digital em Saúde entre estudantes de Enfermagem, iniciantes e concluintes, de uma universidade federal do sul do Brasil. Método: estudo transversal com 139 estudantes (81 ingressantes, 58 concluintes). Utilizando formulário digital, coletou-se dados sociodemográficos, acadêmicos e escala eHealth Literacy Scale para avaliar o letramento digital em saúde. Análises estatísticas incluíram testes de Mann-Whitney e Kruskal-Wallis (p<0,05). Resultados: o nível médio de letramento digital em saúde foi alto, sendo significativamente maior entre os concluintes em relação aos ingressantes (p<0,001), especialmente em habilidades de avaliação crítica de informações online. Participação em projetos de extensão associou-se a maiores níveis de letramento digital em saúde (p=0,001). A confiança no uso de informações digitais para decisões em saúde foi o item mais frágil em ambos os grupos. Conclusão: a formação acadêmica contribui para o desenvolvimento do letramento digital em saúde, mas lacunas persistem.

Descritores: Alfabetização Digital. Estudantes de Enfermagem. Uso da Internet. Letramento em Saúde. Estudantes.

Objetivo: evaluar el nivel de alfabetización digital en salud entre estudiantes de enfermería, ingresantes y graduados, de una universidad federal del sur de Brasil. Método: estudio transversal con 139 estudiantes (81 ingresantes, 58 graduados). Se utilizó un formulario digital para la recopilación de datos sociodemográficos y académicos y la escala eHealth Literacy Scale para evaluar la alfabetización digital en salud. Los análisis estadísticos incluyeron pruebas de Mann-Whitney y Kruskal-Wallis (p<0,05). Resultados: el nivel medio de alfabetización digital en salud fue alto, siendo significativamente mayor entre los estudiantes que terminaban la carrera en comparación con los que ingresaban (p<0,001), especialmente en habilidades de evaluación crítica de la información en línea. La participación en proyectos de extensión se asoció con mayores niveles de alfabetización digital en salud (p=0,001). La confianza en el uso de la información digital para la toma de decisiones en materia de salud fue el aspecto más débil en ambos grupos. Conclusión: la formación académica contribuye al desarrollo de la alfabetización digital en salud, aunque persisten algunas lagunas.

Descriptores: Alfabetización Digital. Estudiantes de Enfermería. Uso de Internet. Alfabetización en Salud. Estudiantes.

Introduction

The rapid evolution of a digitalized and interconnected world through the internet has exponentially expanded the availability of services and information, both in terms of opportunities and challenges, driven mainly by constant technological innovations and by increasingly simple ways to access services and information, especially those related to digital health[1-3].

To benefit from what digital health offers through the internet, users need to develop specific competencies and skills so they can use these technologies safely when applying them to address health problems(1,3). Mastery of the competencies and skills required to use digital health resources are features that determine a person's level of Digital Health Literacy (DHL)[4].

DHL consists in the ability to search for and find, as well as to understand and evaluate, health information from the Internet and to apply the knowledge acquired through these actions in order to solve a health problem[5]. Its origin stems from the concept of Health Literacy (HL), which emphasizes the importance of strengthening actions in education and communication fields, with the aim of achieving better health indicators and quality of life in the population[6].

With the increased use of Information and Communication Technologies (ICTs) in health, it is essential that Nursing students, as future nurses, develop digital competencies to promote educational actions for patients and their families, who also access health information online[7], since evidence already shows that higher DHL levels are associated with better quality of delivered care and professional performance[8]. This premise increases the likelihood that Nursing students with high DHL levels will become professionals who feel confident to manage their own health effectively, as well as to provide qualified care and support the population in greater therapeutic adherence to address health problems[9].

Thus, identifying DHL levels of Nursing students throughout the program enables targeted interventions to foster DHL among future nurses, which must be implemented over the training process with topics incorporated into course curricula[10]. Findings from a study with European university students in health

sciences showed a significant gap between their willingness to become protagonists in the digitalization of care and their development of competencies and skills needed to achieve this goal[11], which reinforces the importance of promoting DHL during nurse training.

In the national context, Resolution 573/2018, approved by the National Health Council, which issued recommendations for the draft of the new National Curriculum Guidelines (NCG) for undergraduate Nursing programs, briefly addresses the encouragement of DHL development; it focuses mainly on use of ICTs to be developed as a cross-cutting theme and does not specify clear guidelines regarding Digital Health or the use of the Internet in health[12]. However, international Nursing curricula have incorporated DHL development models, promoting the integration of digital competencies into Nursing curricula[13].

In parallel, the Digital Health Strategy for Brazil (DHSB) 2020-2028 aims to expand the Unified Health System (SUS) by incorporating the National Health Data Network (RNDS), but its success depends on population DHL[14]. Achieving this goal may be compromised, since the population needs adequate DHL; without it, engagement will be limited and the benefits of this innovation may fail to meet their intended purpose[15].

Therefore, the following question emerges: What is DHL level of Nursing students? As Nursing undergraduates will be future professionals working in a context of digital health transformation, identifying DHL level is essential as a form of monitoring and support to design pedagogical strategies to be implemented during undergraduate education. Thus, this study aims to assess Digital Health Literacy level of first-year and graduating Nursing students from a federal university in southern Brazil.

Method

This analytical cross-sectional study, conducted with undergraduate Nursing students from a Federal University in southern Brazil, followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline[16].

A non-probability convenience sampling technique was used, and participants met the following inclusion criteria: first-year students (1st and 2nd semesters) or graduating students (9th and 10th semesters), aged 18 years or older, and formally enrolled in the undergraduate Nursing program. Students in academic mobility programs and those on medical leave during data collection were excluded. A total of 143 students were contacted and 139 returned the instruments, forming the final sample, with 81 first-year and 58 graduating students. Sample size was calculated from the target population size, with a 10% margin of error and 95% confidence level.

Data collection used a digital form with three sections: socioeconomic data (gender, age, self-declared race or skin color, family income, and type of high school attended); academic data (enrollment semester, participation in research and community outreach projects, proficiency in another language, and previous higher education degree); and the eHealth Literacy Scale (eHEALS), validated in Brazil for use with undergraduate students. This scale obtained Cronbach's alpha = 0.88 and intraclass correlation coefficient (ICC) stability = 0.71, 95% confidence interval: 0.49-0.84. It comprises eight items on a 5-point Likert scale, with responses ranging from "Strongly disagree" (1 point) to "Strongly agree" (5 points). Total scores range from 8 to 40 points[17], which allows classification of DHL levels as low (up to 24), mean (25 to 32), and high (33 to 40)[4]. High DHL levels indicate greater competencies and skills to search for, understand, evaluate, and apply health information obtained online.

Data were collected between July and August 2023 using a digital form hosted on the Google Forms platform. The invitation to participate was delivered in person within the educational institution facilities. A QR code was provided at the time of the invitation, directing students to the form link, which included the Informed Consent Form. Participation was voluntary, and

data were stored in a secure environment to ensure confidentiality.

Form responses were exported to an Excel® spreadsheet and then to the Statistical Package of Social Sciences® (SPSS), version 25. Normality of continuous variables was tested with the Shapiro-Wilk test. Frequency distributions were produced for categorical variables, and mean, standard deviation (SD), median, and interquartile range were calculated for numerical variables. Mann-Whitney and Kruskal-Wallis tests were applied. The significance level adopted was 0.05.

The researchers responsible for the validation of the instrument into Portuguese authorized its use, and the study was approved by the Research Ethics Committee of the Federal University of Rio Grande do Sul (UFRGS), under opinion n. 6.067.883, in accordance with ethical principles.

Results

A total of 139 students participated, most identified as female (85%; n=119), with mean age of 23.2 years (SD 4.97) and higher concentration (43.9%; n=61) in the 21–25-year age range. Most students, 78.4% (n=109), self-identified as having White skin color, followed by Black 10.8% (n=15) and Brown 9.4% (n=13). In terms of income, 39.6% (n=55) reported income between 2 and 5 minimum wages and 21% (n=30) between 1 and 2 minimum wages. Most participants (58.3%; n=81) were first-year students, 67.6% (n=94) had attended public high school, 38.8% (n=54) reported proficiency in another language, and 1.4% (n=2) reported having another higher education degree. Student participation in research and community outreach projects was frequent in 41.7% (n=58) and 57.6% (n=80) of cases, respectively. Slightly more than half of the students (55.5%) had high DHL level (Table 1).

Table 1 – Description of the sample of nursing students participating in the study. Porto Alegre, Rio Grande do Sul, Brazil, 2023. (N=139)

Socioeconomic variables	n (%)
Gender	
Female	119 (85.6)
Male	20 (14.4)
Mean age (SD) 23.2 (4.97)	
Age group	
Up to 20 years	51 (36.7)
21 to 25 years	61 (43.9)
26 to 35 years	25 (18.0)
Over 35 years	2 (1.4)
Self-declared race or skin color	
White	109 (78.4)
Black	15 (10.8)
Brown	13 (9.4)
Indigenous	1 (0.7)
Other	1 (0.7)
Income (in minimum wages, R$)	
<=1	12 (8.6)
>1 to 2	30 (21.6)
>2 to 5	55 (39.6)
>5 to 10	24 (17.3)
>10 to 20	5 (3.6)
>20	1 (0.7)

Table 1 – Description of the sample of nursing students participating in the study. Porto Alegre, Rio Grande do Sul, Brazil, 2023. (N=139)

Prefer not to answer	12 (8.6)
Academic variables	
Enrollment status	
First-year	81 (58.3)
Graduating	58 (41.7)
Type of School	
Public	94 (67.6)
Private	45 (32.4)
Other higher education degree	
Yes	2 (1.4)
No	137 (98.6)
Proficiency in another language	
Yes	54 (38.8)
No	85 (61.2)
Participation in research	
Yes	58 (41.7)
No	81 (58.3)
Participation in community outreach	
Yes	80 (57.6)
No	59 (42.4)
Internet access conditions	
Room with internet access	
Yes	70 (50.4)
No	69 (49.6)
Furniture for internet use	
Yes	115 (82.7)
No	24 (17.3)
Sharing of devices	
Yes	58 (41.7)
No	81 (58.3)
Types of devices	
Mobile phone + computer	104 (74.8)
Mobile phone + computer + tablet	21 (15.3)
Mobile phone	7 (5.0)
Mobile phone + computer + other	2 (1.4)
Mobile phone + other	2 (1.4)
Mobile phone + computer + tablet + other	2 (1.4)
Mobile phone + tablet	1 (0.7)
Digital Health Literacy level*	
Low (up to 24)	17 (12.2)
Moderate (25 to 32)	45 (32.4)
High (33 to 40)	77 (55.5)

Source: authors' own work.

Note: *Classification considering schooling level = completed lower secondary education to higher education.

In the association analysis, higher DHL level was significantly associated with students aged 26–35 years (35.44; SD 4.22), those at graduating enrollment stages (35.96; SD 4.6), those who had participated in community outreach projects (3.48; SD 6.63), and those who did not share internet access devices (33.75; SD 5.77) (Table 2).

Table 2 – Variables associated with eHealth Literacy Scale scores of study participants. Porto Alegre, Rio Grande do Sul, Brazil, 2023. (N=139)

Socioeconomic variables	Mean	Median	Minimum	Maximum	Standard deviation	p value*
Gender						
Female	32.26	34	9	40	6.55	0.911
Male	32.45	33	21	40	6.32	
Race or skin color						
White	32.54	33	14	40	5.82	0.539
Black	29.47	34	9	40	10.05	
Brown	32.69	35	13	40	6.91	
Indigenous	34	34	34	34	0.0	
Other	40	40	40	40	0.0	
Age group (years)						
Up to 20	30.7	32	14	40	5.68	**0.001**
21 to 25	32.54	34	9	40	7.41	
26 to 35	35.44	36	27	40	4.22	
Over 35	34	34	29	39	7.07	
Income (in minimum wages, R$)						
≤ 1	29.08	31	21	35	5.37	0.180
> 1 to 2	32.43	34	9	40	7.70	
> 2 to 5	33.05	34	14	40	5.95	
> 5 to 10	32.62	32	24	39	4.03	
> 10 to 20	31.60	34	24	38	5.86	
> 20	40	40	40	40	0.0	
Prefer not to answer	30.58	33.5	12	40	10.09	
Academic variables						
Enrollment status						
First-year	29.65	31.0	9	0	6.39	**0.000**
Graduating	35.96	37.5	4	0	+-4.61	
Type of School						
Public	32.14	34.0	9	0	+-6.97	0.766
Private	32.57	32.0	16	40	+-5.43	
Other higher education degree						
Yes	32.50	2.5	1	4	+-2.12	0.738
No	32.28	33.0	9	0	+-6.54	
Proficiency in another language						
Yes	31.64	32.5	3	0	+-6.44	0.262
No	32.69	34.0	9	0	+-6.54	
Participation in research						
Yes	32.91	34.5	2	0	+-7.25	0.060
No	31.83	32.0	9	40	+-5.91	
Participation in community outreach						

Table 2 – Variables associated with eHealth Literacy Scale scores of study participants. Porto Alegre, Rio Grande do Sul, Brazil, 2023. (N=139)

Yes	3.48	35	9	0	+-6.63	**0.001**
No	0.66	32	2	0	+-5.99	
Internet access conditions						
Room with internet access						
Yes	31.80	34	9	40	+-7.41	0.844
No	32.78	33	14	40	+-5.43	
Furniture for internet use						
Yes	32.54	33	12	40	+-6.16	0.617
No	31.08	33	9	40	+-7.97	
Sharing of devices						
Yes	30.24	32	9	40	+-6.94	**0.001**
No	33.75	35	13	40	+-5.77	
Types of devices						
Mobile phone + computer	32.73	33	12	40	+-6.06	0.201
Mobile phone + computer + tablet	32.90	35	16	40	+-6.70	
Mobile phone + computer + other	33	33	29	37	+-5.65	
Mobile phone	24	21	9	37	+-9.32	
Mobile phone + other	32	32	32	32	0.0	
Mobile phone + computer + tablet + other	34	34	29	39	+-7.07	

Source: authors' own work.
Notes: *significant (p<0.05); Kruskal-Wallis and Mann-Whitney tests.

Mean total eHEALS score, which classifies participant DHL level, was 32.8. In the stratified analysis of eHEALS items, all scores were significantly higher among graduating students compared to first-year students (p values between 0.000 and 0.001) (Table 3).

Table 3 – Academic level associated with item scores on the eHealth Literacy Scale among study participants. Porto Alegre, Rio Grande do Sul, Brazil, 2023. (N=139)

Questions	Enrollment status	Mean	Median	Minimum	Maximum	Standard deviation	p value*
Q1 I know how to find useful health information or resources on the internet	First-year	4.07	4	1	5	0.93	0.000
	Graduating	4.63	5	2	5	0.61	
Q2 I know how to use the internet to answer my questions about health	First-year	4.12	4	1	5	0.97	0.001
	Graduating	4.60	5	2	5	0.59	
Q3 I know which health resources are available on the internet	First-year	3.50	4	1	5	0.96	0.000
	Graduating	4.34	4	2	5	0.76	
Q4 I know where to find useful health resources on the internet	First-year	3.79	4	1	5	1.02	0.000
	Graduating	4.51	5	2	5	0.68	

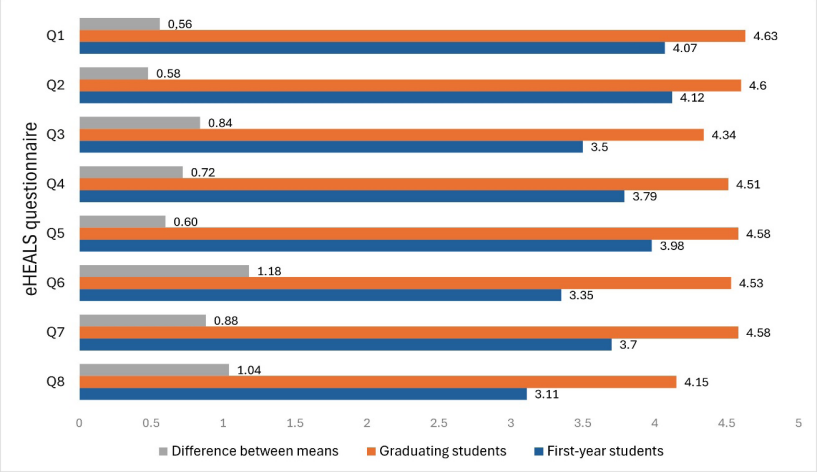
Table 3 – Academic level associated with item scores on the eHealth Literacy Scale among study participants. Porto Alegre, Rio Grande do Sul, Brazil, 2023. (N=139)							
Q5 I know how to use the health information I find on the internet to help myself	First-year	3.98	4	1	5	0.99	0.000
	Graduating	4.58	5	1	5	0.75	
Q6 I have the skills needed to evaluate the health resources I find on the internet	First-year	3.35	4	1	5	1.18	0.000
	Graduating	4.53	5	1	5	0.86	
Q7 I can distinguish between high-quality and low-quality health resources available on the internet	First-year	3.70	4	1	5	1.20	0.000
	Graduating	4.58	5	2	5	0.77	
Q8 I feel confident using information from the internet to make decisions about my health	First-year	3.11	3	1	5	1.29	0.000
	Graduating	4.15	4	2	5	0.95	
Total		32.8					

Source: authors' own work.
Notes: *significant (p<0.05); Mann-Whitney test.

The items with the highest scores were Q2 (4.60 points), Q5 (4.58 points), and Q7 (4.58 points), all among graduating students. In this group, scores for all items were above four points. Among first-year students, only Q1 (4.07 points) and Q2 (4.12 points) scored above four.

The lowest score was observed for Q8 in both groups (3.11 points among first-year students and 4.15 points among graduating students), and the largest differences between mean scores of first-year and graduating students were found in Q6 (difference of 1.18 points), Q8 (difference of 1.04 points), and Q7 (difference of 0.88 points) (Figure 1).

Figure 1 – Differences between mean item scores of the eHealth Literacy Scale according to enrollment status. Porto Alegre, Rio Grande do Sul, Brazil, 2023. (N=139)



Source: authors' own work.

Discussion

Digital Health Literacy (DHL) has been studied in various higher education institutions, including Nursing programs(10,18-19). In this study conducted at a public university, student profiles were predominantly aged 21 to 25 years (43.9%), had family income between 2 and 5 minimum wages (39.6%), and were mostly from public schools (67.6%). Higher DHL levels were found among students aged 26 to 35 years. A study with nursing students from two public universities in Turkey, with mean age 21.14 (SD=1.62), found moderate DHL levels[19], corroborating literature that youth alone does not guarantee effective technological appropriation, indicating the need to reinforce digital health competencies[20].

This study showed nursing students had, on mean, a high DHL level, with differences between first-year and graduating students. Graduating students showed higher DHL levels, especially in critical evaluation of internet-sourced information. These findings reaffirm a positive association between academic experience and development of competencies that raise DHL levels among health students(7,18-19,21-22), as well as in other fields of knowledge[23]. Time spent in contact with courses like Health Information Systems and participation in practical activities helps explain these differences and highlights the importance of curricular integration to develop high DHL levels.

A study in Ethiopia supports this inference, showing increased internet use needs and availability of computer-related courses improve student DHL[21], paralleling this study's findings that graduating students had better critical information evaluation skills (Q6-Q8), strengthening the idea that longer academic engagement is key to high DHL levels.

A positive association was observed between participation in community outreach projects and higher DHL level (p=0.001), emphasizing the importance of integrated pedagogical activities combining theory and practice in professional training. This evidence aligns with international studies highlighting extracurricular and extension activities' role in developing and strengthening digital competencies(7,21). However, unlike other studies[18-19], variables such as language proficiency and possession of another degree were not significantly associated, suggesting contextual factors may influence this relationship.

An important concern was students' low scores on Q8, which relates to confidence in using internet information for health decision-making. Both first-year and graduating students showed weakness here, revealing a critical gap in nursing education. These results match findings from other countries(22,24), suggesting that while students gain technical skills during their degree, internalizing criteria for evaluating health information remains a challenge. The difficulty in discerning digital content quality is somewhat mitigated by critical evaluation skills, but this is not sufficient to fully address the deficiency. Despite high DHL scores, low self-confidence levels have been noted elsewhere(18,25).

Another factor significantly associated with higher DHL levels was not sharing access devices (e.g., computers, tablets, smartphones) used for internet access. The greatest differences between first-year and graduating students appeared in abilities to evaluate online health resources, confidence in using information for health decisions, and capacity to distinguish quality of digital resources.

While academic training facilitates DHL development, some significant gaps remain, particularly in critical information evaluation skills in digital environments. The Brazilian Digital Health Strategy [2020-2028] demands professionals capable of overcoming challenges posed by healthcare digitalization and increased availability of information and misinformation online(2,14).

This study's limitations include its cross-sectional design, which prevents causal inference, data collection from a single institution, and focus on two student groups (first-year and graduating), which hinder tracking DHL evolution over time. Although a validated and

robust instrument was used, it relies on self-report and self-perception, which may introduce subjectivity. DHL level may also involve more complex dimensions not explored here due to current technological advances and contexts excluded from the research.

Future research should explore pedagogical interventions in nursing curricula and their impacts, conduct interinstitutional comparisons, and examine factors influencing development of DHL in nursing students. This study contributes to the debate on how future nurses are prepared for the growing technological demands in digital health, emphasizing critical development and competencies for evaluating and confidently using digital health information.

Conclusion

This study demonstrated that, on mean, the Digital Health Literacy (DHL) level among Nursing undergraduates was considered high, with significant variation according to the stage of academic training. Graduating students presented a high DHL level, while first-year students reached a moderate level. The main distinction was observed in critical evaluation skills regarding online health information, suggesting that academic experience contributes to the development of such competencies.

Factors such as participation in community outreach projects were positively associated with higher DHL levels. However, low confidence in using digital information for health decision-making stood out in both groups, indicating a weakness in the Nursing undergraduate training process. Given the advancement of digitalization in health, the results reinforce the importance of integrating DHL development into curricula, ensuring that future nurses are prepared to critically use digital technologies in professional practice.

Contributions:

1 – project conception and planning: Evelyn de Castro Roballo and Ana Luísa Petersen Cogo;

2 – fata analysis and interpretation: Evelyn de Castro Roballo, Luciano Fiorentin and Ana Luísa Petersen Cogo;

3 – writing and/or critical review: Evelyn de Castro Roballo, Luciano Fiorentin, Edlamar Kátia Adamy and Ana Luísa Petersen Cogo;

4 – final version approval: Evelyn de Castro Roballo, Luciano Fiorentin, Edlamar Kátia Adamy and Ana Luísa Petersen Cogo.

Conflicts of interest

There are no conflicts of interest.

Data Availability Statement

The participants in this study did not provide written consent for their data to be shared publicly due to the sensitive nature of the research.

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Received: May 1, 2025
Approved: November 16, 2025
Published: May 19, 2026