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Original Article

Efficacy of the digital textbook for the autonomous work of physical therapy students

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ABSTRACT

The evolution of technologies and the health context have favored the development of distance education and autonomous learning. The digital textbook (DTB) is a flexible and accessible teaching resource that favors autonomous work and equity in learning. To evaluate the perception of quality and efficacy of the DTB for the achievement of learning outcomes (LO) in the autonomous work of physical therapy students. A non-experimental, cross-sectional study. A DTB was designed for the Intervention in Kinesiology of the Musculoskeletal System (IKMES) course. The study was conducted in five stages: design, revision, digitization, implementation, and LO evaluation and perception of quality. The DTB was implemented after peer validation in two-course units for which LO was assessed. Median differences before and after DTB use were compared (Wilcoxon test). A performance improvement of 42% was observed after the use of the electronic resource, which was statistically significant ($p < 0.05$). In addition, 50% of the students showed median values equal to or above the passing score for the two evaluations after using the DTB. The DTB had a favorable assessment by students, with a 98.14% recommendation. The DTB favors autonomous work, contributing to the achievement of the LO. The resource was highly valued by teachers and students, who recognized the importance of digital resources in their professional development.

Keywords: Teaching, Textbook, Students, Distance education, Physical therapy, Education

Introduction

Physical therapy is currently recognized as a health profession whose purpose is the development, maintenance, and restoration of functioning and movement in people with different health conditions due to aging, diseases, injuries, or environmental factors [1]. Physical therapist practice is based on transversal elements of a professional, jurisdictional, and personal nature [1-3].

The training of health professionals, including physical therapists, is a challenge for higher education due to the diversity of skills that they must acquire in accordance with the growing health demands of society [4]. These skills include aspects such as communication, collaboration and teamwork, management, empathy, and self-training [5]. Self-training is recognized as one of the central axes of higher education [6]. This ability is associated with autonomous, active, and reflective learning, which is acquired and strengthened during the training process and is a necessity due to the speed with which knowledge and technologies evolve [7, 8].

Autonomous learning is a process in which the individual is responsible for obtaining different knowledge and skills at their own pace, taking responsibility for their learning through a process of planning, development, and evaluation [9]. Some of its advantages include the incentive of curiosity, discipline, time freedom, problem-solving ability, independence, and the construction of knowledge [9, 10]. This conceptualization invites academics to develop pedagogical practices that favor active strategies and reflective capacity in the search for learning [10]. Due to the foregoing, the use of active methodologies focused on learning is required that combine face-to-face class strategies

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with interactive elements and autonomous work together with evaluations that demonstrate the achievement of learning outcomes (LOs), that is, the knowledge or actions that the student demonstrates in the development of the course [11, 12]. In this line, autonomous learning has become even more relevant given the transition from the face-to-face modality to b-learning modalities (blended learning) or e-learning (electronic learning) in several higher education and postgraduate programs [13]. This transition has been driven by the evolution of information and communication technologies (ICTs), although global circumstances such as the SARS-CoV2 (COVID-19) pandemic have also influenced, forcing a change in the paradigms of education in a few years in favor of distance education [14-16]. These contexts have made distance education and ICTs models accepted for their ability to adapt to different disciplines, demonstrating the development of autonomous learning and promoting key professional skills such as permanent updating, innovation, and creation [17-19]. The foregoing is also relieved by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) because of advancing the sustainable development goal 4 (SDG4) and where ICTs play a capital role in the transformation of education by reducing learning gaps, facilitating universal access to knowledge, supporting teacher development, and improving management and administration in education [20]. These characteristics would foster a participatory role for students with a focus on their learning outcomes in accordance with the constructivist model, reducing gender gaps, geographic location, or socioeconomic levels [21, 22].

The textbook is a teaching resource for autonomous work widely used by students and teachers at different levels of training [23, 24]. It is a structured and organized instrument with activities or problems that guide the study and that have the knowledge that is required for a certain discipline. This resource is sometimes questioned for its lack of depth or loss of the role of the teacher. It has other virtues, such as equal opportunities in learning by making common educational materials available, feedback on their activities, and the possibility of monitoring the activities of the students, recognizing those with greater difficulties [23, 24]. Textbooks have traditionally been conceived in printed format, although in recent years they have been moving to electronic formats [25].

Digital reading favors the combination of various multimedia resources adapted to all kinds of technological devices, thereby facilitating universal access to knowledge. The integration of the textbook and ICTs has favored digital materials that incorporate the benefits of multimedia and the Internet, as well as the benefits of the printed textbook [24, 25]. These materials have advantages over printed resources because of their flexibility (individual study pace), accessibility, adaptability to different devices (mobile phones, tablets, or computers), interactivity through different multimedia elements, the relationship between teacher and students, and the possibility of permanent update [26, 27].

Considering autonomous learning as one of the fundamental competencies in higher education and healthcare, the incorporation of new didactic alternatives such as digital texts becomes relevant to favoring a guided study that facilitates autonomous learning and the achievement of LO. Thus, the objective of this research is to evaluate the perception of quality and the effectiveness of the digital textbook (LTD) in the learning outcomes when used as a support resource in the autonomous work of physical therapy students.

Materials and Methods

Study type

A non-experimental, cross-sectional study was conducted.

Participants

The study population consisted of 189 4-year physical therapy students (107 men, 82 women; average age: 21.3 ± 1.5 years) of the Andrés Bello University (UNAB), Santiago campus (Santiago, Chile), who were enrolled in the first academic semester of 2022 in the Intervention in Kinesiology of the Musculoskeletal System (IKMES) course. IKMES is a mandatory course offered in the seventh semester of the Kinesiology program at UNAB; it consists of 114 hours (3 face-to-face work hours and 5 autonomous work hours per week), for a total of 5-semester credits. The objective of the course is to train students to be able to design and implement a musculoskeletal system intervention plan for individual patients or communities.

Students who did not sign the informed consent form (i.e., they did not consent to the use of their data), those who did not consent to the use of the scores obtained in the exams taken before (pre) and after (post) the use of the digital textbook (DTB) in their autonomous work activities, those who, due to non-attendance, did not take any of these two exams (pre or post) in the two thematic units considered for data analysis in the present study (more details on this aspect will be provided in the following paragraphs), and those who withdraw from the course using an official request were excluded, thus the final sample consisted of 166 and 154 students for evaluation 1 (pre and post exams in the first thematic unit considered for analysis) and evaluation 2 (pre and post exams in the second thematic unit considered for analysis), respectively.

Digital textbook (DTB)

A digital textbook was designed and implemented as an autonomous work resource aimed at reinforcing the learning of the contents of the IKSME course in 4-year kinesiology students through the development of self-learning activities.

The design and implementation of the LTD were conducted in five stages: 1) material design; 2) material review; 3) book digitization and availability in the electronic resources database of the university; 4) implementation of the resource in the course as an autonomous work resource; and 5) evaluation of the efficacy of the DTB as an autonomous work resource in the achievement of learning outcomes (LO) and the student's perception of the quality of this resource.

The textbook was designed in 2021 by one of the professors of the IKSME course (H-DBO). It consists of 9 thematic chapters that were created in accordance with the course study plan and LOs, namely: LO1: Development of a comprehensive intervention plan related to people's and/or communities' health, with a focus on human rights and an emphasis on the musculoskeletal system and its association with all body systems; (LO2) Implementation of a comprehensive intervention plan related to the health condition of people and/or communities, with an emphasis on the musculoskeletal system and based on a biopsychosocial model; (LO3) Evaluation of the results of the intervention concerning the health condition of people and/or communities in which it was implemented based on a physical therapy diagnosis and a biopsychosocial model. **Table 1** shows the nine thematic units of the textbook, as well as their objectives and the IKSME course LOs addressed in each unit.

Table 1. Association of the learning outcomes of the course with the chapters and objectives of the digital textbook

Chapter number	Chapter Name	Chapter Objectives	LO
1	Physiological and biomechanical bases of muscle contraction	1.1 To understand the fundamental concepts and physiology of muscle contraction. 1.2 To understand the fundamental concepts and physiology of muscle contraction. 1.3 To apply the chapter's contents addressed to a variety several of health problems and clinical settings.	LO 1 LO 2
2	Exercises in kinematic chains (kinetics)	2.1 To understand the fundamentals of kinematic chain exercises. 2.2 To understand the basics of kinematic chain exercises. 2.3 To use the contents of the chapter in different problems and clinical settings.	LO 1 LO 2
3	Isotonic resistance training methods	3.1 To know and understand the existing isotonic resistance training methods. 3.2 To understand how isotonic training methods work to choose appropriate workloads and muscle-building exercise sets and repetitions. 3.3 Dose isotonic training against resistance from the contents of the chapter.	LO 1 LO 2 LO 3
4	Isometric Resistance Training Methods	4.1 Know the existing isometric training resistance methods. 4.2 Understand how isometric training methods work to choose appropriate workloads and muscle-building exercise sets and repetitions. 4.3 Dose isometric training against resistance from the contents of the chapter.	LO 1 LO 2 LO 3
5	The physical and physiological foundations of neuromuscular electrical stimulation (NMES) training	5.1 To understand the biophysical mechanisms of action of common electrical currents used for neuromuscular electrical stimulation (NMES). 5.2 Propose therapeutic objectives associated with the use of neuromuscular electrical stimulation (NMES) in different clinical settings. 5.3 Solve clinical problems related to the contents of the chapter.	LO 1 LO 2
6	The therapeutic exercise model of H. de la Barra and the dosage method of exercise I and II: adaptation to clinical practice	6.1 Know the methodology of prescription of therapeutic exercise of H. de la Barra in different contexts. 6.2 Understand the adaptation of isotonic and isometric methods. 6.3 Dose therapeutic exercise through the methods described in the chapter.	LO 1 LO 2 LO 3
7	H. de la Barra's therapeutic exercise model for neuromuscular electrical stimulation (NMES); dosage adapted to clinical practice	7.1 Understand the applications of neuromuscular electrical stimulation (NMES) in various clinical settings. 7.2 Understand different dosage forms of neuromuscular electrical stimulation (NMES) based on the model of therapeutic exercise developed by H. de la Barra. 7.3 Apply different forms of neuromuscular electrical stimulation (NMES) based on the model of therapeutic exercise.	LO 1 LO 2 LO 3
8	Comprehension of the activity (y-axis) for the therapeutic exercise models of H. de la Barra	8.1 Know the activities associated with therapeutic exercise. 8.2 Recognize therapeutic exercise activities. 8.3 Adjust therapeutic exercise dosage based on activity and clinical context.	LO 1 LO 2 LO 3
9	Problem-solving	Solutions of the activities and problems presented in chapters 1 through 8.	LO 1 LO 2 LO 3

LO: Learning outcome.

In addition, each chapter was divided into two sections: a content section and a self-learning activity section with activities such as the definition of concepts, single-choice questions, short-answer questions, and case method-related activities [28]. The content section consisted of a detailed explanation of key concepts and their integration in different clinical settings, while the self-learning section included several problem-solving activities of increasing complexity. A problem-solving chapter with the solutions to all the problems and activities presented in each unit was also included (chapter 9), thus providing students with the possibility of feedback. Finally, at the end of the textbook, there was an appendix section, where tables and complementary information for each chapter were available.

The review stage of the textbook was divided into three phases: expert validation, proofreading, and review by the Editorial Committee of the UNAB. The expert validation phase, which included a peer evaluation of the self-learning resource by three-course professors, allowed ensuring that the contents and self-learning activities of all chapters of the textbook aligned with the IKSME course LOs. The peer evaluation was carried out using the Learning Object Review Instrument (LORI) model, which was designed for the assessment of digital educational resources according to the following criteria: 1) content quality; 2) alignment of learning outcomes; 3) feedback and adaptability; 4) motivation; 5) design and presentation; 6) usability; 7) accessibility; 8) reusability; and 9) standards compliance. Each criterion was evaluated using a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = indifferent, 4 = agree, and 5 = strongly agree) [29, 30].

The proofreading of the textbook was carried out by a journalist (P-RN) with ten years of experience in editing and correcting academic papers and books, who was asked to correct any spelling, punctuation, or formal writing mistakes. Finally, in the third phase, the Editorial Committee of the Library of the University reviewed the textbook to ensure the quality of its contents and that they were in line with the editorial policies of the UNAB for the publication of digital learning resources [31].

The library at the university was in charge of the digitalization of the textbook. Then, once digitalized, the DTB was uploaded to the electronic resources database of the library system of the university so that any student or professor of the UNAB could have access to it using their institutional credentials [31].

Also, the intellectual property rights of the textbook were registered during the digitalization process [32]. **Figure 1** shows the presentation of the digitized book in the electronic databases.The implementation stage was carried out at the beginning of the course through an introductory session in which students enrolled in the IKSME course were informed about the DTB, its objective, its contents, and how to use it.

Figure 1. Digital textbooks available in the electronic resources database of the library system of the UNAB.

Evaluation of the efficacy of the DTB in the achievement of LOs

Although the DTB was used in different thematic units of the IKSME course, only two units were considered for data analysis in the present study, namely "Prognosis and general aspects of interventions in Physical Therapy" and "Strength and muscle resistance training," which were addressed in the course during four weeks (both face-to-face and autonomous work). Therefore, the efficacy of the DTB as an autonomous work resource for the achievement of LOs in these two thematic units was assessed by comparing the scores obtained by students in two face-to-face written exams taken before (pre1 and pre2 depending on the thematic unit) and after (post1 and post2 depending on the thematic unit) completing their autonomous work activities in each unit using the DTB (chapters 3 and 8 of the DTB, respectively); the exams consisted of activities similar to those available in the DTB.

It is worth noting that, according to the institutional policies of UNAB and in line with the grading criteria of the IKSME course, obtaining a passing score (>70%) on the test was considered a LO achievement.

Students' perception of the DTB quality

The student's perception of the quality of the DBT was evaluated using a questionnaire that included questions about several aspects of the DTB such as its versatility, language, its ability to encourage the study of the subject, the alignment of its contents with the LO of the course, and the sequence in which the contents are presented, and in which students were asked to give a response to each question using a 5-point Likert-type scale (1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly agree) were asked [33, 34]. In addition, two questions about the importance of using digital resources in the learning process and how much would the student recommend the use of the DTB were also included.

The questionnaire was sent via e-mail to all students enrolled in the course once it was finished, informing them that completing this questionnaire was voluntary and that anonymity of their data would be always ensured.

Statistical analysis

The results obtained in the peer validation process and the quality perception questionnaire, as well as the scores obtained by the students in each of the exams (pre1, pre2, post1, and post2), were tabulated and coded for data processing and analysis using the Microsoft Excel 2016 software.

The descriptive analysis of data was performed as follows: categorical variables were summarized using relative and absolute frequencies, and continuous variables were summarized using measures of central tendency and dispersion. In the case of the scores obtained in the four tests (pretests 1 and 2 and posttests 1 and 2), these were summarized using measures of central tendency (means and medians), measures of dispersion (standard deviations (SD), minimum and maximum), and

percentile values (25th percentile and 75th percentile). In addition, since these data showed a non-normal distribution (as determined using the Kolmogorov-Smirnov normality test) [35], bivariate analysis was performed using the Wilcoxon signed-rank test was used to determine the differences between the mean scores obtained in the pre-and post-tests taken in the two thematic units considered for analysis (pre 1 vs. post 2 and pre2 vs. post 2) [36]. The significance level was set at $p<0.05$.

In the case of the peer validation of the DTB, expert evaluation was carried out by analyzing the distribution of the scores in the dimensions of the LORI instrument together with the assessment of agreement between the experts. The agreement between pairs was evaluated with the Fleiss kappa statistic (kappa coefficient) with a significance of $\alpha = 0.05$ [34, 35]. In addition, the qualitative interpretation of the kappa coefficient value, that is, the strength of agreement was conducted according to the Landis and Koch classification: poor agreement (0), slight agreement (0.1-0.2), fair agreement (0.21-0.4), moderate agreement (0.41-0.60), substantial agreement (0.61-0.80), and almost perfect agreement (0.81-1.0) [36, 37]. All statistical analysis was performed in the SPSS.v26 software(Software for Sociologists: Statistical Analysis on the IBM PC).

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The scores for four evaluations (two before and two after the autonomous work with the digital material) were analyzed through Kolmogorov-Smirnov normality tests to determine the distribution [35]. Because the scores for evaluations 1 and 2 (pre1, post1, pre2, and post2) had a non-normal distribution, the non-parametric Wilcoxon test with a significance level of 0.05 was chosen to compare the differences between the scores before and after each test [36]. Test scores were described using means and medians as measures of central tendency, and the 25th (p25) and 75th (p75) percentiles as measures of dispersion.

Results and Discussion

Table 2 shows the results of the peer evaluation for the nine dimensions of the LORI instrument. A good general evaluation of the digital material is observed with 74.08% of responses for the category "strongly agree" and 25.92% for the category "agree", with an average score of 42.6 out of a total of 45. The concordance between the evaluators was based on the agreements for each dimension of the instrument, obtaining a Fleiss kappa value of 0.61 ($p<0.01$), which was qualitatively assessed as substantial [37]. Although the general assessment is positive, the main discrepancies are observed for dimensions 3 and 4, associated with adaptability and motivation. In addition, the concordance coefficient was analyzed by pairs of evaluators, showing a greater concordance between evaluators 1 and 3, obtaining a kappa value of 0.99 and an almost perfect concordance strength [37].

A statistically significant difference ($p<0.01$) is observed in both evaluations for the units evaluated before and after the use of the DTB. **Figure 2** shows that the resulting medians for both evaluations after the use of the resource are of the order of 8 points, which indicates that 50% of the students achieved the passing score and the RAs associated with these units. In addition, a median difference (meddiff) of 4 points for evaluation 1 and 5 points for evaluation 2 can be seen, which indicates a performance improvement of 33.33% and 41.66%, respectively. In addition, **Table 2** shows a total of 153 positive rankings for evaluation 1, and 117 for evaluation 2, which indicates an improvement of the scores of 92.17% and 75.97%, respectively. It should be noted that the 25th percentile (p25) for the subsequent assessments shows scores of 7 and 5, indicating that 25% of the students were 1 or 3 points below the passing score. On the other hand, for the 75th percentile (p75) a value of 9 points was obtained for evaluation 1, and 10 points for evaluation 2, so that 25% of the students reached at least a performance level of 75% or higher.

In addition, an analysis of the differences in the scores grouped by sex was performed **(Figure 2)**. A statistically significant improvement ($p < 0.01$) in their results in the evaluations after autonomous work with DTB was observed for both men and women. For the post1 evaluations, medians of 8 were obtained for both sexes, while for the post2 evaluations, the medians for both sexes, while for the post2 evaluations, the medians resulted in 9 points for women and 7 points for men.

Table 2. Peer assessment of digital material quality and concordance for the LORI (Learning Object Review Instrument).

LORI criteria	ev1+	ev2+	ev3+	Overall agreement kappa (p-value) Strength	ev1-ev2 concordance kappa (p-value) Strength	ev1-ev3 concordance kappa (p-value) Strength	ev2-ev3 concordance kappa (p-value) Strength
1. Content quality	5	5	5				
2. Adequacy with learning outcomes	5	5	5	0.61 (p<0.01*)	0.36 (p=0.28)	0.35 (p = 0.28)	0.99 (p=0.03*)
3. Feedback and adaptability	5	4	4	Substantial	Fair	Fair	Almost perfect
4. Motivation	5	4	4				

5. Design and presentation	4	4	4
6. Usability	5	5	5
7. Accessibility	5	5	5
8. Reusability	5	5	5
9. Compliance with standards	5	5	5
Total score	44	42	42

LORI score: 1 = very poor, 2 = poor, 3 = fair, 4 = good, and 5 = very good.
Evaluators[+]
significance: $p < 0.05$*
Source: own elaboration.

Table 3. Summative assessment scores before and after asynchronous work with the digital textbook.

Evaluation	Students	mean ± SD	median	p25	p75	min	max	Total score	Distribution	Difference evaluation (post-pre)	Rankings***
pre1	166	4.5 ± 1.3	4	4	5	2	9	12	no normal*	p < 0,01**	positives = 153 negatives = 7 ties = 6
post1		8.0 ± 1.9	8	7	9	3	12	12	no normal*		
pre2	154	4.1 ± 2.5	3	2	5	0	10	12	no normal*	p < 0,01**	positives = 117 negatives = 9 ties = 28
post2		7.4 ± 2.9	8	5	10	0	11	12	no normal*		

Kolmogorov-Sminorv test $p < 0.01$*
Wilcoxon test $p < 0.01$**
Rankings obtained for the differences between the pre and post-evaluations with the Wilcoxon test
Source: own elaboration

The foregoing indicates that at least 50% of the women and men reached the passing score and the LOs associated with the study units in the book. However, differences were observed for evaluation 2, in which the performance of 50% of women was better than that of 50% of men. The meddiff for evaluation 1 according to gender shows a value of 3 points for women and 4 points for men, which indicates an improvement in their performance of 33.33% and 41.66%, respectively. The meddiff for evaluation 2 according to gender shows a value of 4 points for women and 3.5 points for men, which translates into an improvement of 41.66% and 29.16%. In addition, when comparing the results between men and women after autonomous work (post1 and post2), statistically significant differences are only observed in favor of women for the second evaluation ($p < 0.05$), but not in the first, where the results were similar. The foregoing indicates that at least 50% of the women and men reached the passing score and the RA associated with the study units in the book. However, differences were observed for evaluation 2, in which the performance of 50% of women was better than that of 50% of men. The meddiff for evaluation 1 according to gender shows a value of 3 points for women and 4 points for men, which indicates an improvement in their performance of 33.33% and 41.66%, respectively. The meddiff for evaluation 2 according to gender shows a value of 4 points for women and 3.5 points for men, which translates into an improvement of 41.66% and 29.16%. In addition, when comparing the results between men and women after autonomous work (post1 and post2), statistically significant differences are only observed in favor of women for the second evaluation ($p < 0.05$), but not in the first, where the results were similar.

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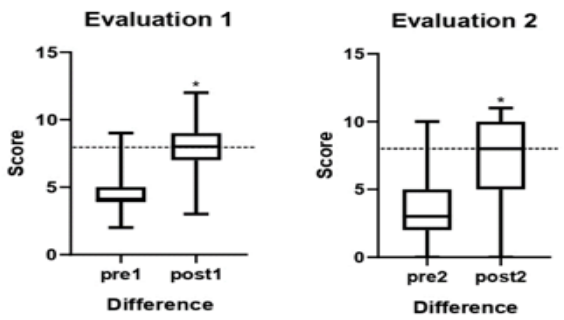

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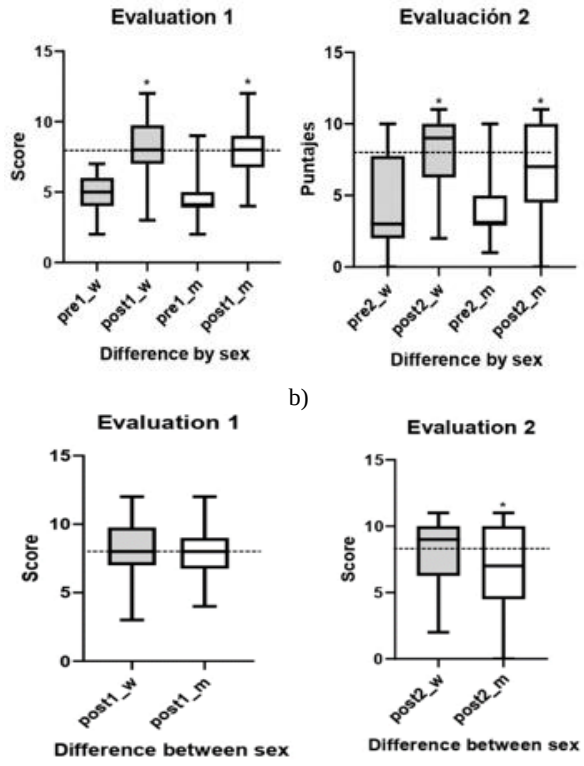

Figure 2. Differences between the scores obtained for the evaluations linked to the digital textbook. (a) Comparison of Assessment 1 and Assessment 2 scores for all IKSME course students. (b) Comparison of Test 1 and 2 scores for students grouped by gender. The comparison of the scores before and after the asynchronous work with the digital resource was carried out with the Wilcoxon test. $p < 0.05$* (c) Comparison of the scores between sex for the evaluations after the use of the digital resource. The comparison of the scores was made with the U-Mann Whitney test. $p < 0.05$** Source: own elaboration.

Initial training in higher education requires more support and guidance from the teacher. However, at higher levels, students have skills that allow them more autonomy [37]. Autonomous work involves procedural strategies (decisions about the organization of the study), metacognition processes (reflection of the learning process itself), and support strategies (regulation of work and promotion of conditions that effectively facilitate the study) [7, 37, 38]. In addition, this autonomous work must be motivating, provide students with the possibility of feedback, and integrate the contents of the face-to-face classes [10, 11, 39, 40].

The development of ICTs has allowed the incorporation of different technological elements that favor autonomous work [15, 16]. This development has been driven by globalization and other recent contexts such as the SARS-CoV-2 (COVID-19) pandemic or the transition from face-to-face education programs to distance education, highlighting the use of multimedia and the Internet [13-15]. These elements have favored autonomous and cooperative learning by promoting spaces for participation between teachers and students, along with greater stimulation of the senses by offering various channels of interaction [10, 13, 15, 27, 41].

The value of textbooks at various levels of training is undeniable, given characteristics such as the sequence of their contents (increasing complexity) and activities that encourage autonomous work, though their greatest virtue is probably equity of learning [24, 26, 27].

Being digitally literate implies having skills and abilities in a number of domains, including the ability to use technology. The era of digital reading has led to accessible, interactive, transportable, and lower-cost resources, expanding the scope of knowledge (universality) [25]. Probably, another of its main advantages is the permanent update according to the evolution of knowledge [26, 27]. In addition, many of these resources incorporate accessibility aids that promote the learning of people with disabilities. These characteristics make the DTB valuable educational materials in accordance with the international guidelines in education [20, 42].

This study made it possible to evaluate the perception of the quality and efficacy of the DTB when using it as a support resource in the autonomous work of Physical Therapy students. The DTB was chosen to standardize and systematize students' autonomous work through an innovative didactic strategy for some units of the IKSME course. The initiative was also promoted by the academic experience gained during the first years of the pandemic, in which remote emergency activities were incurred that made it difficult to develop autonomous work.

Table 4. Students' perception of the quality of the digital textbook (n = 54)

QUESTIONS	1 = strongly disagree	2 = disagree	3 = neither agree nor disagree	4 = agree	5 = strongly agree
Q1. The digital textbook educational resource is versatile and flexible.	n = 0 0%	n = 0 0%	n = 5 9.27%	n = 10 18.52%	n = 39 72.22%
Q2. The digital resource presents correct and clear language.	n = 0 0%	n = 2 3.70%	n = 3 5.56%	n = 12 22.22%	n = 37 68.52%
Q3. The digital resource favors motivation and interest in the subject.	n = 0 0%	n = 2 3.70%	n = 0 0%	n = 14 25.92%	n = 38 70.37%
Q4. The digital resource clearly shows the learning outcomes of the subject.	n = 0 0%	n = 0 0%	n = 1 1.86%	n = 15 27.77%	n = 38 70.37%
Q5. The digital resource presents an adequate amount of activity time.	n = 0 0%	n = 0 0%	n = 4 7.41%	n = 15 27.77%	n = 35 64.80%

Q6. The digital resource presents an adequate sequence of contents.	n = 0 0%	n = 0 0%	n = 1 1.86%	n = 11 20.37%	n = 42 77.77%
Q7. Rate on a scale of 1 to 5 the importance that digital resources have for you in your learning process.	n = 0 0%	n = 0 0%	n = 1 1.86%	n = 12 22.22%	n = 41 75.92%
Q8. Rate on a scale of 1 to 5 how much would you recommend the use of the DTB.	n = 0 0%	n = 0 0%	n = 1 1.86%	n = 9 16.66%	n = 44 81.48%

The results are favorable, showing an improvement in the performance of the students on the evaluations after using the book. Approval of more than half of the students in the evaluations associated with the DTB is observed, demonstrating the achievement of the LO. In addition, the gap in achieving the passing score was 1 or 2 points for most of the students with the lowest scores. Likewise, it should be noted that the same LO was not only dependent on the DTB but was reinforced with other didactics during the development of the course and, in most significant instances, ensured their consolidation. On the other hand, the better results of women are consistent with the evidence that suggests a greater sense of responsibility and better performance than their male counterparts, facing autonomous work in a more strategic way, a globally growing phenomenon in higher education [22, 43, 44].

Additionally, the students value the DTB satisfactorily, especially concerning the organization of its contents and its relationship with the LO of the course. The foregoing is complemented by the high recommendation of the resource and the good assessment they give to the incorporation of digital strategies for their learning. This is not uncommon considering that these are digital natives who have grown up with technologies and social networks, making them more competent in the use of digital resources and developing other forms of learning that require teachers to have digital skills [45]. On the other hand, studying with the DTB improves digital skills, which have a direct relationship with stress management and burn-out, as well as with the perceived well-being of students [46-48].

Study limitations

It is recognized as a limitation not to have made more evaluations associated with the use of the book. We wanted to introduce the resource gradually and evaluate the results associated with its use in a preliminary approach. On the other hand, this research is improved by surveying the hours of autonomous work of the students and evaluating their relationship with the hours of autonomous work declared for the course.

Conclusion

The DTB is a valuable resource introduced in higher education to guide the autonomous work of students, offering flexibility in the study, accessibility, and portability, although its greatest virtue is equity of learning. The DTB is highly valued by professors and students and allows students to account for the LOs for a course. The design of these materials must be done considering the LO and the professional needs of the students according to their level of training.

The next steps include updating the digital resource and maintaining its use in the autonomous work of the new cohorts of students, involving it in other units of the course, although always bearing in mind that it is another of many teaching strategies.

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