PTJ: Physical Therapy & Rehabilitation Journal | *Physical Therapy*, 2025;105:pzaf108
https://doi.org/10.1093/ptj/pzaf108
Advance access publication date September 3, 2025
Original Research

Validation of the Learning and Study Strategies Inventory (LASSI) in Doctor of Physical Therapy Learners: A Retrospective Observational Study

Jessica T. Feda, PT, DPT, DSc[1,*]; Evan M. Pucillo, PT, DPT, EdD[2]; Laura E. Wenger, PT, DPT, DSc[3]; Melissa H. Scales, PT, DPT, PhD[4]; Kyle R. Adams, PT, DPT, DSc[5]; Carrie A. Minahan, PT, DPT, EdD[6]; Jennifer G. Martin, PT, DPT, MS[7]; Nancy S. Smith, PT, DPT, PhD[7]

[1]Department of Physical Therapy, Baylor University, Waco, TX 76798, United States
[2]College of Rehabilitation Sciences, University of St. Augustine for Health Sciences, St. Augustine, FL 32086, United States
[3]Department of Physical Therapy and Athletic Training, University of Utah, Salt Lake City, UT 84108, United States
[4]Department of Physical Therapy Education, Elon University, Elon, NC 27244, United States
[5]Department of Physical Therapy, Baylor University, Waco, TX 76798, United States
[6]Department of Physical Therapy, DPT Program, New England Institute of Technology, E. Greenwich, RI 02818, United States
[7]Department of Physical Therapy, Winston-Salem State University, Winston-Salem, NC 27110, United States

*Corresponding author: Jessica Feda, PT, DPT, DSc, Department of Physical Therapy, One Bear Place #97193, Waco, TX 76798, United States (Jessica_Feda@baylor.edu)

ABSTRACT

Importance: The Learning and Study Strategies Inventory (LASSI) is an instrument that measures self-regulated learning. However, it has not been validated for use in entry-level Doctor of Physical Therapy (DPT) learners.
Objective: The objective of this study was to investigate the validity and reliability of the LASSI in DPT learners.
Design: This was a retrospective observational cohort study.
Setting/Participants/Intervention: Demographic and LASSI data were retrospectively analyzed from 1541 learners enrolled in 5 entry-level DPT programs across the United States.
Main Outcomes and Measures: A confirmatory factor analysis (CFA) was conducted to evaluate whether the 60-item LASSI (3rd Edition) demonstrated a valid and reliable factor structure. An exploratory factor analysis (EFA) was used to identify a more succinct set of LASSI scales. Goodness-of-fit indices and reliability coefficients were computed to assess model fit and measurement consistency.
Results: CFA revealed that the 60-item LASSI accounted for 46.7% of total score variance. In contrast, EFA identified a revised 47-item version (termed LASSI-DPT) that accounted for 58.1%, indicating improved construct validity. χ^2 goodness-of-fit supported the adequacy of the EFA model ($\chi^2 = 3964.1$). The revised 47-item LASSI demonstrated excellent internal consistency, with an overall Cronbach alpha of 0.92, compared to 0.78 for the 60-item version.
Conclusion: The revised 47-item LASSI-DPT provides a more reliable, concise, and valid assessment compared to the 60-item LASSI, tailored to learning strategies in physical therapist education programs.
Relevance: Factor analysis demonstrated improved construct validity and excellent reliability in a newly developed 47-item version of the LASSI tailored for DPT learners. This shorter instrument may result in decreased survey fatigue and improved measurement accuracy. With its enhanced psychometric properties, the LASSI-DPT may enable DPT programs to better identify learners who need additional support related to self-regulation of learning.

Key words: Education; LASSI; Physical Therapy; Reliability; Self-regulation of Learning; Validity.

Received: August 21, 2024; **Revised:** July 10, 2025; **Accepted:** July 17, 2025

INTRODUCTION

Effectively identifying strengths and weaknesses in strategic learning—key factors in supporting individual learner success—requires a measurement tool that is both reliable and valid.[1,2] One widely used self-report tool that measures learning and study strategies across various educational settings and demographics is the Learning and Studies Strategies Inventory (LASSI).[2] The LASSI is based on Weinstein's Model of Strategic Learning, which focuses on the student as an active participant in their learning, and encompasses metacognitive, behavioral, and motivational constructs.[3] The LASSI provides information regarding strengths and weaknesses related to students' strategic and self-regulated learning (SRL) strategies.[2] Students can use the LASSI to assess their learning and study strategies, focused on 10 different aspects of learning.[2] At the same time, educators can employ LASSI scores to prospectively identify the need for additional student support and prescribe instruction to those at risk of academic difficulty.[4,5] Research on the psychometric properties of the LASSI has focused on reliability, concurrent validity, and expert validation of the assessment, yielding acceptable to good reliability as reported for the 60-item LASSI (3rd edition) across various samples and settings.[2,6] However, despite the LASSI's long-standing use in educational research, first published in 1987, there is little consensus on categorizing the learning and self-regulation constructs represented by the scales or the overarching concepts of skill, will, and self-regulation assessed within the LASSI.[6–9]

The LASSI has been previously described in Doctor of Physical Therapist (DPT) education to report on constructs of self-regulation of learning.[10–16] In physical therapist education, the LASSI has been used to predict academic success,[10,14] discuss influences of strategic learning and academic performance,[11,17,18] determine the effectiveness of a strategic learning intervention program,[11] and explore how self-regulation and learner demographics relate to LASSI scores.[15,19] Despite reported and emerging research on the use of this tool, the LASSI has yet to be validated in any graduate-level educational setting, including physical therapist education.

As physical therapist education navigates the evolving demands of a complex society through multiple educational delivery models, there is a great need to better understand the learning and study strategies that support and potentiate DPT learner success. The ability of a learner to self-regulate has been positively correlated to their academic achievement in higher education; more specifically, research demonstrates that SRL is linked to academic outcomes in both medical and physical therapist education.[10,11,13,14,20–29] There are multiple SRL conceptual frameworks, yet all possess 3 main areas of exploration: metacognition, motivation, and emotion.[30] SRL encompasses a learner's intrinsic ability to engage in an active, constructive, and self-directed cyclic process, thereby assuming responsibility for learning by setting goals, monitoring progress, reflecting on outcomes, and adapting learning strategies as needed.[31,32] Unfortunately, identifying potential learning deficiencies early within physical therapist educational programs is challenging, and many learners fail to adopt effective strategic learning skills in time to avoid programmatic failure or psychological distress.[33–36] Refining a DPT learner's SRL skills may foster the growth of adaptive expertise and critical thinking necessary in contemporary clinical practice.[37–39] Though DPT learners have completed undergraduate education prior to their graduate training, their incoming learning strategies to support SRL are unknown. Implementing a validated instrument to evaluate learning and study strategies could facilitate the early identification of learners in need of guidance and assistance with SRL, thereby reducing the prevalence of academic struggles and enhancing program retention.

Across entry-level physical therapist education, there is a growing emphasis on standardizing performance-based outcomes to evaluate progress toward and attainment of professional competencies.[40] The call for clear competencies and standardization of performance outcomes aligns with other health care professions, and there are multiple proposed integral domains of professional competency, one being lifelong learning.[41] Developing and refining lifelong learning skills occurs throughout physical therapist education as a necessary skill for clinical practice and professional growth. Evaluating the influence of SRL requires instruments with established construct validity and internal consistency to successfully identify gaps in learning strategies using established methods of interpreting results via percentile cutoff values.[2] To determine if DPT learners have the essential skills of self-regulation and strategic learning, there must be validated instruments, like the LASSI, for measuring SRL within the DPT learner population. Assessing the validity of the LASSI in physical therapist learners may provide educators with reliable insight to develop targeted strategies for self-regulatory training. These strategies can address specific deficits in study strategies and behaviors while building techniques reflective of master adaptive learning concepts. Such concepts include metacognition, affective tendencies, and motivational patterns, all aimed at enhancing academic achievement. When derived from a valid and reliable tool, such insight may enhance both DPT learner and programmatic success through reduced attrition rates and academic difficulties. However, the LASSI has not undergone confirmatory or exploratory factor analysis (EFA) to assess its construct validity and internal consistency within DPT learners—a necessary step to determine whether the instrument's factor structure is appropriate for evaluating SRL and study strategies in this population. Therefore, this research aimed to determine if the LASSI is a reliable (internally consistent) and valid (construct validity) instrument for measuring learning and study strategies in DPT learners. It was hypothesized that the LASSI instrument would demonstrate acceptable internal consistency and construct validity in this sample of physical therapist learners.

METHODS

Researchers conducted a retrospective observational cohort study using institutional data from a geographically diverse sample of participants ($n = 1541$). These data included learner's demographic characteristics and LASSI scores. This study was deemed exempt as non-human research by the Baylor University Institutional Review Board (#2040466).

Participants

The sample included learners within 5 entry-level DPT programs across the United States. The DPT programs were located in Texas, Tennessee, North Carolina (2), and Florida, representing 2 geographic regions (South Atlantic and West South Central) which together contain approximately

one-third of all accredited DPT programs.[42] Four of the participating programs were private institutions, and 1 was housed within a public university. The instructional delivery models included 2 hybrid (non-residential) and 3 residential (face-to-face) programs. Currently, the Commission on Accreditation in Physical Therapy Education (CAPTE) does not distinguish between hybrid and residential DPT program formats when reporting enrollment data. Accordingly, the power analysis was based on the estimated total number of DPT learners in the United States. The study sample represented approximately 14% of the national DPT learner population, as reported by CAPTE, which provided sufficient statistical power for factor analysis and enhanced the generalizability of the findings.[42]

Each program administered the LASSI at 1 of 2 time points: (1) prior to matriculation or (2) within 2 weeks of orientation. Consequently, the sample consisted of DPT learners who had not yet completed any summative assessments within the curriculum. LASSI data were collected as a required onboarding process at each institution during routine programmatic assessment between 2017 and 2023. LASSI data were collected using the LASSI online survey, 3rd edition (H&H Publishing, Inc., https://www.collegelassi.com/lassi/index.html). Each program collected data from the time their program instituted the LASSI, comprising a total of 22 learner cohorts within the sample. Records were excluded if there were missing data involving any of the 10 LASSI scales. All records were de-identified and kept confidential.

Instrumentation

The LASSI is a 60-item self-reported instrument (Supplemental Table 1) comprising 10 scales and requiring approximately 9 to 11 minutes to complete.[2] Each question is answered based on a 5-point Likert response (ranging from 1 = "not at all like me" to 5 = "very much like me") to produce a standardized score with percentile score equivalents for each scale.[7] A score above the 75th percentile indicates a low priority for improving strategies. A score between the 50th and 75th percentile indicates room for improvement and suggests that learners consider improving strategies within this area. A score below the 50th percentile indicates a need to improve skills to avoid academic difficulty.[2,7] The scales assess a learner's covert and overt thoughts, behaviors, attitudes, motivations, and beliefs toward learning.[8] The 10 factorable scales of the LASSI include Anxiety (ANX), Attitude (ATT), Concentration (CON), Information Processing (INP), Motivation (MOT), Selecting Main Ideas (SMI), Self-Testing (SFT), Test Strategies (TST), Time Management (TMT), and Using Academic Resources (UAR).[8]

The 60-item LASSI was initially validated by analyzing a dataset of over 30,000 undergraduate participants who had previously taken the LASSI 2nd edition.[2] Balancing both conceptual and psychometric analyses, the LASSI was shortened to 60 questions by using exploratory and confirmatory factor analysis for the 3rd edition, consisting of 10 scales demonstrating moderate to good internal consistency (Cronbach $\alpha = .76–.87$) and acceptable construct validity within each of the scales.[2] The LASSI has since demonstrated acceptable predictive validity for undergraduate,[43,44] chiropractic,[45] and medical[27] learners. Studies examining the internal consistency of the LASSI scales have found Cronbach α values ranging from 0.72 to 0.89 across various sample populations.[2,27,46–50]

Data Analysis

Data were analyzed using SPSS v.29 (IBM Corp, Armonk, NY, US). The data set was coded and screened for errors, and $n = 3$ records were removed before analysis due to missing or incomplete data. An a priori statistical power calculation was performed using G*Power to determine the minimum required sample size.[51] The estimated population size was based on the average number of DPT learners enrolled in all physical therapist education programs within the United States.[52,53] Descriptive statistics were used to summarize demographic characteristics, which were comparable across curricular models and aligned with national CAPTE data.[52]

Normality was assessed using the Shapiro-Wilk test to confirm that parametric assumptions were met. Histograms were visually inspected for skewness and kurtosis to confirm a normal distribution. Prior to factor analysis, Bartlett's test of Sphericity and the Kaiser-Meyer-Olkin (KMO) Test of Sampling Adequacy were performed to confirm that the dataset was factorable and non-collinear. Confirmatory factor analysis (CFA) was then used to evaluate whether the hypothesized structure of the LASSI measured the intended constructs based on item alignment. When CFA results indicated suboptimal model fit or suggested potential for improved parsimony, researchers proceeded with EFA.

Confirmatory Factor Analysis

One way to assess reliability and validity of the instrument is to conduct a CFA, which assesses whether the observed data from a population fits the underlying theoretical structure of the instrument. Within the original LASSI structure, there are 10 factors or scales that are operationalized constructs that measure the 10 dimensions of SRL. Since the overall validity and reliability of the 60-item LASSI have not previously been established in physical therapist education, a CFA was conducted. Specifically, CFA was used to evaluate the construct validity of the instrument's 10 predefined scales, examine the alignment of individual items with their intended scales, and determine the strength of association between each item and its associated construct. Construct validity within this population was evaluated using acceptable variance standards.[54]

The CFA was conducted using the item-to-scale assignments as defined by the developers of the 60-item LASSI. Model fit was assessed using χ^2 goodness-of-fit analysis to evaluate the proportion of variance accounted for by the factor structure. Cronbach α was calculated for each scale and the overall instrument to evaluate internal consistency and determine whether items within each scale reliably measured the same underlying construct.[55] Following CFA, a principal component analysis (PCA) was conducted to identify the most informative grouping of items associated with each scale, maximizing the retention of variance related to the underlying constructs while minimizing measurement redundancy, reducing scale covariance, and supporting the independence of distinct constructs.[56,57] Eigenvalues were analyzed to assess the proportion of variance accounted for by each component, including the variance explained at the item and scale levels. Additionally, the rotated component matrix was evaluated using the sum of squares to better understand how strongly individual items contributed to each retained scale. The researchers analyzed factor loading coefficients (>.5) to determine if each item was sufficiently loaded to each scale.[56] Items with factor loadings below this threshold were individually examined by the researchers to evaluate whether

their eigenvalues, loading coefficients, and explained variance meaningfully contributed to the overall model.

Exploratory Factor Analysis

After conducting CFA and PCA, the LASSI instrument was found to have "acceptable" reliability (Cronbach $\alpha < .79$).[58] To further explore the latent structure of the LASSI and improve item-to-scale alignment, the research team conducted an EFA. EFA was chosen for its utility in identifying alternative item groupings and eliminating items that did not meaningfully contribute to construct validity, thereby enhancing the instrument's interpretability and psychometric performance. The decision to conduct an EFA was based on 3 key considerations. First, following CFA, 2 of the 10 LASSI scales demonstrated internal consistency below the acceptable threshold (Cronbach $\alpha = .7$).[55,57] Second, α coefficients differed from those reported in prior studies.[2,27,46–50] Third, concerns about potential survey fatigue were raised, as prior research suggests that instruments with 60 items or more may be associated with reduced response quality.[57,59] Accordingly, EFA was performed on the LASSI using PCA with orthogonal Varimax rotation to derive a more consistent, psychometrically sound, and parsimonious factor structure.[57]

The Kaiser Normalization Criterion typically recommends retaining factors with eigenvalues >1. However, this approach assumes that the retained factors explain 70% to 80% of the total variance.[57] If this threshold is not met, a Cattell scree plot may be used to determine the appropriate number of factors to retain.[56,57] For the purposes of this study, a Cattell scree plot was used to determine the number of factors to retain in the final model. Factors corresponding to the "elbow" of the plot, typically those with eigenvalues values <2, were considered to have diminished explanatory power.[56,57] The researchers identified the factors that accounted for the greatest proportion of variance. Orthogonal Varimax rotation was employed to minimize correlation between factors and reduce item redundancy and collinearity.[60] After calculating Cronbach α coefficients for each scale and the overall instrument, χ^2 goodness-of-fit analyses were conducted to assess the proportion of variance explained by the factor solution. PCA was used to examine eigenvalues, the variance explained by each item and scale, and the rotation sum of squares. Items with factor loadings <0.5 were individually reviewed. If an item's eigenvalue, factor loading, and explained variance did not meaningfully contribute to the overall model, the item was removed.[56] Items that loaded on multiple factors were assigned, based on which factor demonstrated the strongest explanatory relationship, as determined by comparative analysis of their eigenvalues and factor loading coefficients.[56]

Reliability

Cronbach α coefficients were calculated for each LASSI scale during both CFA and EFA procedures. α values were interpreted using established criteria: .7 to .79 as "acceptable," .8 to .89 as "good," and .9 to .99 as "excellent."[58,61]

RESULTS

Participants

This study analyzed a total of $n = 1541$ ($n = 573$ [37%] male, $n = 968$ [63%] female) DPT learner records from institutional databases. The sample mean (SD) age was 25.1 (4.3) years and consisted of the following n (%) races and ethnicities: 1125 (73%) White, 145 (9%) Black, 109 (7%) Hispanic, 54 (3.5%) 2 or more, 75 (4.9%) Not specified, and less than 1% each of Filipino, American Indian or Alaskan Native, Chinese, Indian, and Pacific Islander. Results are reported as an aggregate representative of DPT learners from residential face-to-face ($n = 494$ [32%]) and hybrid ($n = 1047$ [68%]) education programs. A complete list of demographic characteristics can be found in Table 1.

Table 1. Demographic Characteristics of the Sample[a]

Variable	Value
Total sample n (%)	1541 (100%)
Legal sex	
Male	573 (37.2%)
Female	968 (62.8%)
Age in y mean (SD)	
Overall	25.1 (4.3)
Range	19–55
Male	25.6 (3.6)
Female	24.7 (4.4)
Race and ethnicity n (%)	
White	1125 (73.0%)
Black	145 (9.4%)
Hispanic	109 (7.1%)
Filipino, American Indian or Alaskan Native, Chinese, Asian Indian, or Pacific Islander	22 (1.4%)
Two or more	54 (3.5%)
Not specified	75 (4.9%)
Program type n (%)	
Residential face-to-face	494 (32.1%)
Hybrid[b]	1047 (67.9%)
LASSI 60-item scale scores mean (SD)	
Anxiety (ANX)	52.1 (27.9)
Attitude (ATT)	62.6 (23.7)
Concentration (CON)	58.7 (24.8)
Information Processing (INP)	63.1 (25.3)
Motivation (MOT)	63.5 (23.8)
Selecting Main Ideas (SMI)	47.9 (26.5)
Self-Testing (SFT)	57.7 (26.8)
Test Strategies (TST)	62.9 (23.6)
Time Management (TMT)	64.8 (26.5)
Using Academic Resources (UAR)	50.6 (27.2)

[a]Abbreviation: SD = standard deviation. [b]Indicates a physical therapist education program using a combination of online and face-to-face instructional delivery.[71,72]

The following mean (SD) percentile scores were observed for the 10 LASSI scales in the sample: Anxiety 52.1 (27.9), Attitude 62.6 (23.7), Concentration 58.7 (24.8), Information Processing 63.1 (25.3), Motivation 63.5 (23.8), Selecting Main Ideas 47.9 (26.5), Self-Testing 57.7 (26.8), Test Strategies 62.9 (23.6), Time Management 64.8 (26.5), and Using Academic Resources 50.6 (27.2).

Power Analysis and Tests for Statistical Normality

The power analysis revealed that a minimum sample of $n = 375$ participants was required, based on a 95% confidence interval, a β of 0.8, k of 10 factors, a significance level of $P < .05$, a population proportion of 50%, a moderate effect size (0.5), and an estimated population size of 15,000 DPT learners. This analysis confirmed that the study was adequately powered. The Shapiro–Wilk test was significant at the $P < .01$ level. However, visual inspection of histograms revealed no skewness or kurtosis. Skew values across all scales ranged from −0.5 to 0.5, supporting an acceptable normal distribution. Although the Shapiro-Wilk test indicated

Table 2. LASSI 60-Item CFA Results of Variance Explained by Each Factor, Eigenvalues, and Rotation Sums of Squares[a]

60-Item LASSI	Eigenvalue	% of Variance	Extraction Sum of Squared	% of Variance[b]
Selecting Main Ideas (SMI)	10.7	19.11	4.80	8.02
Anxiety (ANX)	4.61	7.95	4.04	6.73
Time Management (TMT)	2.65	4.41	3.38	5.64
Information Processing (INP)	1.78	2.92	3.30	5.50
Concentration (CON)	1.59	2.65	2.43	4.05
Using Academic Resources (UAR)	1.41	2.28	2.38	3.97
Attitude (ATT)	1.38	1.89	2.22	3.70
Motivation (MOT)	1.29	1.85	2.07	3.45
Self-Testing (SFT)	1.11	1.70	1.74	2.90
Test Strategies (TST)	1.02	1.46	1.65	2.75

[a]Abbreviations: CFA = confirmatory factor analysis; LASSI = Learning and Study Strategies Inventory. [b]Results of a principal component analysis (PCA). Total variance explained = 46.7%.

statistical significance, the large and representative sample size, combined with symmetric visual distribution of the histograms, supported the assumption of normality; therefore, parametric statistical procedures were deemed appropriate for subsequent analyses.[58]

Confirmatory Factor Analysis

Prior to performing the factor analysis, Bartlett's Test of Sphericity was determined to be significant ($\chi^2 = 5317.01$, df = 45, $P < .001$), indicating that these data were factorable and non-collinear. The KMO Test of Sampling Adequacy ($n = 0.85$) revealed that the sample size was adequate for factor analysis.

An initial CFA reliability analysis revealed an overall Cronbach $\alpha = .73$ for the 60-item LASSI across its 10 scales. Factor loadings for the LASSI ranged from 0.17 to 0.82 and χ^2 goodness-of-fit results (2454.6; $P < .001$) demonstrated a factor solution model explaining 46.7% of the variance. Eigenvalues, explained variance, and rotation sum of squares are located in Table 2 for the CFA. PCA values for each scale can be found in Table 3. Internal consistency results for the 60-item scale, reported as Cronbach α, can be found in Supplemental Table 2.

In evaluating the CFA results, researchers found that the overall internal consistency of the 60-item LASSI was acceptable (Cronbach $\alpha = .73$), supporting the viability of the proposed factor structure. However, this value was notably lower than those reported in prior studies (up to 0.87), prompting further investigation of individual scale reliabilities. Cronbach α coefficients for the 10 scales ranged from .64 to .81, with 2 scales falling below the generally accepted threshold of 0.70: the Motivation (MOT) Scale (Cronbach $\alpha = .64$) and the Attitude (ATT) Scale (Cronbach $\alpha = .67$).[55,57] When compared with values reported in the LASSI user manual, most scales demonstrated lower internal consistency in the present sample (original ANX = 0.87, ATT = 0.76, CON = 0.85, INP = 0.81, MOT = 0.77, SMI = 0.86, SFT = 0.80, TST = 0.77, TMT = 0.80, UAR = 0.76), with only 2 scales (TST and TMT) showing slightly higher reliability.[2] These discrepancies, coupled with concerns about survey fatigue associated with the length of the LASSI, led researchers to conduct an EFA to examine a more parsimonious and psychometrically sound factor structure.

Exploratory Factor Analysis

To enhance the reliability of the LASSI, EFA results led to a reallocation of items onto 10 scales to ultimately form a 47-item LASSI with improved internal consistency. A PCA with Varimax orthogonal rotation initially revealed a 12-factor model, explaining 54.7% of the variance (EFA $\chi^2 = 3281.2$; $P < .001$). However, based on the scree plot and the Kaiser Normalization Criterion, 10 factors were ultimately retained (Table 3). Factors 11 and 12 had eigenvalues of 1.07 and 1.00, accounting for only 1.8% and 1.7% of the variance, respectively. Because these values fell to the left of the bend on the Scree Plot (Suppl. Material 1), they were excluded from the model.

Following EFA, factor loadings for the truncated 47-item LASSI ranged from 0.38 to 0.85, indicating stronger loadings across factors. The final 10-factor model of the 47-item LASSI with recombination of items can be found in Table 4. This 10-factor model explained 58.1% of the variance indicating improved construct validity. χ^2 goodness of fit demonstrated an acceptable model (3964.1; $P < .001$). Contributions to the variance are noted for factors 1 to 10 in Table 4 with their rotation sums of squares. On the "Perseverance" scale, two items demonstrated loadings below the 0.5 threshold: MOT17 (0.38) and TMT51 (0.45). Despite these lower loadings, the items were retained in the final 10-factor model given their contribution to the overall explained variance of the scale.

Forty-seven items from the LASSI significantly contributed to the model with factor loadings of 0.38 or greater and P values of $< .001$. The EFA components' factor loadings are noted in Table 5. Numbers of the items are noted next to the category. For example, 47 represents item 47 on the LASSI scale. A total of 13 question items were dropped from the 60-item LASSI (Questions 1, 5, 8, 14, 21, 30, 33, 36, 43, 55, 57, and 58). A complete representation of the 47-item LASSI model solution can be found in Figure 1.

An iterative review process was used to revise the scale composition and rename the resulting 10 scales based on updated thematic content. Three nascent scales were developed and named based on researcher consensus of their themes: "Mindset," "Perseverance," and "Self-Review," in lieu of "Attitude," "Motivation," and "Testing Strategies," respectively. Finally, 2 scales were renamed to better describe the scale's measurement intent: "Anxiety" was renamed "Anxiety Management," and "Using Academic Resources" was renamed "Academic Resourcefulness." Supplemental Table 3 displays the 47-item truncated LASSI with items organized by each new scale.

Following EFA, Cronbach α was calculated for the original 60-item LASSI and for the revised 47-item version, designated as the LASSI-DPT. The LASSI-DPT demonstrated an overall interclass correlation of 0.92, compared to the 60-item LASSI

Table 3. CFA Results of Principal Component Analysis by Factor Loading for 60-Item LASSI[a]

LASSI Scales	Items Represented on the LASSI Scale[b]	Factor Loading for Each Item	Communalities
Selecting Main Ideas (SMI)	SMI 9	0.74	0.63
	SMI 16	0.75	0.65
	SMI 19	0.69	0.61
	SMI 44	0.63	0.60
	SMI 48	0.78	0.67
	SMI 55	0.50	0.61
Anxiety (ANX)	ANX 28	0.82	0.73
	ANX 34	0.79	0.70
	ANX 37	0.63	0.51
	ANX 50	0.82	0.72
	ANX 53	0.65	0.48
	ANX 56	0.77	0.70
Time Management (TMT)	TMT 4	0.65	0.59
	TMT 8	0.30	0.43
	TMT 11	0.78	0.72
	TMT 23	0.77	0.74
	TMT 51	0.45	0.44
	TMT 54	0.76	0.67
Information Processing (INP)	INP 3	0.72	0.55
	INP 10	0.60	0.54
	INP 18	0.77	0.61
	INP 22	0.49	0.35
	INP 35	0.74	0.59
	INP 41	0.81	0.69
Concentration (CON)	CON 6	0.64	0.60
	CON 13	0.71	0.69
	CON 25	0.73	0.74
	CON 40	0.52	0.53
	CON 47	0.64	0.70
	CON 58	0.32	0.51
Using Academic Resources (UAR)	UAR 2	0.75	0.59
	UAR 7	0.62	0.54
	UAR 12	0.57	0.49
	UAR 27	0.67	0.55
	UAR 46	0.72	0.62
	UAR 60	0.53	0.42
Attitude (ATT)	ATT 14	0.26	0.53
	ATT 29	0.41	0.50
	ATT 32	0.70	0.57
	ATT 39	0.66	0.53
	ATT 42	0.66	0.54
	ATT 59	0.69	0.52
Motivation (MOT)	MOT 1	0.51	0.42
	MOT 17	0.38	0.50
	MOT 24	0.68	0.58
	MOT 31	0.71	0.59
	MOT 33	0.18	0.54
	MOT 45	0.17	0.48
Self-Testing (SFT)	SFT 15	0.76	0.82
	SFT 20	0.74	0.77
	SFT 26	0.26	0.58
	SFT 38	0.85	0.78
	SFT 49	0.82	0.83
	SFT 52	0.37	0.52
Test Strategies (TST)	TST 5	0.35	0.42
	TST 21	0.35	0.42
	TST 30	0.53	0.57
	TST 36	0.44	0.53
	TST 43	0.25	0.45
	TST 57	0.39	0.46

[a]Abbreviations: CFA = confirmatory factor analysis; LASSI = Learning and Study Strategies Inventory. [b]The number following the abbreviation is the item number on the LASSI.

value of 0.73. A comparison of the LASSI scale reliability values can be found in Supplemental Table 2. A comparison of the median and interquartile range scale scores for the 60-item LASSI and the revised LASSI-DPT can be found in Supplemental Table 4. Definitions for the LASSI-DPT are located in Supplemental Table 5 and a summary of domains can be found in Supplemental Table 6.

DISCUSSION

This study tested the reliability and validity of the LASSI 3rd edition in a large and geographically diverse sample of DPT learners to determine if the LASSI was a psychometrically sound instrument for assessing self-regulation and strategic learning skills.

Demonstration of Reliability and Validity

The findings of this study indicate that the 60-item LASSI demonstrated moderate reliability (Cronbach $\alpha = .73$) and acceptable validity in this sample.[54,62,63] While the 60-item LASSI was shown to be a reliable and valid measure of learners' attitudes, self-regulatory habits, and metacognitive skills, the revised LASSI-DPT demonstrated superior psychometric strength across reliability and validity indices. The EFA results outline a revised and truncated LASSI-DPT version of the LASSI, which possesses excellent reliability (Cronbach $\alpha = .92$) with enhanced construct validity (58.1% explained variance).[56,64] While some may question the adequacy of a model that explains 58.1% of the total variance, this value is not uncommon in behavioral science research. A systematic review by Peterson reported that the average variance explained by EFA models in behavioral studies was 56.6%, with average factor loadings of 0.32.[64] The EFA model for the LASSI-DPT is consistent with findings commonly reported in the behavioral sciences, demonstrating comparable variance explained and factor loadings that exceed average thresholds. Importantly, the revised 47-item LASSI-DPT reduces the number of items by approximately 22% ($n = 13$), potentially decreasing assessment time and minimizing response fatigue compared to the 60-item version.[59,65]

Currently, CAPTE does not differentiate between learners enrolled in hybrid and residential face-to-face DPT programs. Accordingly, the power analysis was based on the estimated total number of DPT learners in the U.S. The study sample represented approximately 14% of the national DPT learner population, as reported by CAPTE, providing sufficient power for factor analysis and supporting generalizability. Learner demographics were comparable across curricular models and aligned with CAPTE aggregate data.[52] All participants were assessed within 2 weeks of their program start date. Findings indicate that incoming DPT learners, regardless of program format, demonstrate comparable demographic characteristics and LASSI (3rd edition) scores, supporting the broader applicability of results across the national DPT learner population. However, future research analyzing differences between hybrid and residential face-to-face programs using factor analysis would help reinforce the applicability of these results across the broader DPT learner population.

Nascent Scale Development

With the construction of the LASSI-DPT, the 10-scale structure was retained, along with 7 of the 60-item LASSI scales, which can be found in Table 5. Researchers created 3 nascent scales, replacing ATT, TST, and MOT. The new scales of Mindset, Perseverance, and Self-Review more accurately reflect the behaviors and habits assessed by their respective items and may better capture the attitudes, beliefs, perceptions, or habits specific to the physical therapist learner population. More accurate scales may enable physical therapist educators to provide more targeted instructional strategies, interventions, and resources. For example, the Self-Testing scale on the original 60-item LASSI has been separated into 2 distinct scales on the LASSI-DPT: Self-Review and Self-Testing. These refined scales may allow for more accurate assessment of learners and support the prescription of more focused interventions.

The first nascent scale, Mindset, is constructed of 6 items derived from the 60-item LASSI's ATT and CON scales. Mindset assesses learners' attitudes toward class attendance and engagement, as well as their interest in and perceived value of coursework. The 6 items grouped together support the concepts of growth and fixed mindsets as they relate to learning and study strategies. The grouping may more accurately reflect fixed and growth mindset constructs and their influence on developing adaptive and lifelong learning skills.[66]

The second scale, Perseverance, is constructed of 4 items adapted from the MOT and TMT scales in the 60-item LASSI and reflects the ability to persist in a task regardless of its difficulty, personal preference, or likelihood of success. An expanding body of literature highlights the significance of grit in physical therapist education, noting its relevance in learner success and professional development.[67–69] Grit, characterized by sustained effort and resilience, encompasses behaviors of perseverance.

The final nascent scale, Self-Review, is derived from 3 items from the 60-item LASSI SFT scale. This scale assesses learners' use of strategies to independently assess learning needs through habitual review of notes and materials for classroom learning, in contrast to the SFT scale, which assesses goal-directed actions to prepare specifically for examinations and assessments. Self-Review includes self-monitoring, an essential self-regulatory behavior/habit of SRL, and requires the metacognitive processes of self-awareness and self-assessment. Deficits in metacognitive awareness, especially in concert with poor self-regulatory behaviors, have a negative influence on academic performance.[11] Self-assessment is essential for learning and plays a crucial role in developing decision-making and critical thinking skills for clinical practice.[70]

Given the importance and relevance of these habits, attitudes, and perspectives on the learning experience and academic outcomes, the revised LASSI scales may better capture processes and experiences most relevant to physical therapist education. Future research may demonstrate the LASSI-DPT to be a more relevant and accurate measurement of strategic learning in DPT learners.

Relevance of Findings in Physical Therapist Education

Educators may assume that learners enter graduate physical therapist education as fully developed adult learners equipped to meet academic demands. However, research utilizing the LASSI suggests that newly matriculated physical therapist learners, on average, lack well-established learning and study

Table 4. LASSI-DPT (47-Item) EFA Results of Variance Explained by Each Factor, Eigenvalues, and Rotation Sums of Squares[a]

New 47-Item LASSI-DPT	Eigenvalue	% of Variance	Rotation Sum of Squared	% of Variance
Selecting Main Ideas	12.46	20.77	4.73	7.88
Anxiety Management	5.33	8.88	4.67	7.79
Time Management	3.31	5.51	3.75	6.25
Information Processing	2.29	3.81	3.56	5.92
Concentration	2.13	3.55	3.14	5.23
Academic Resourcefulness	1.78	2.96	2.88	4.80
Mindset[b]	1.57	2.62	2.60	4.34
Perseverance[b]	1.39	2.31	2.31	3.86
Self-Testing	1.36	2.26	2.16	3.60
Self-Review[b]	1.02	2.02	2.14	3.56

[a]Abbreviations: EFA = exploratory factor analysis; LASSI-DPT = Learning and Study Strategies Inventory for Doctor of Physical Therapist education. [b]Indicates a new revised subscale based on the results of exploratory factor analysis (EFA). Total variance explained = 58.1%.

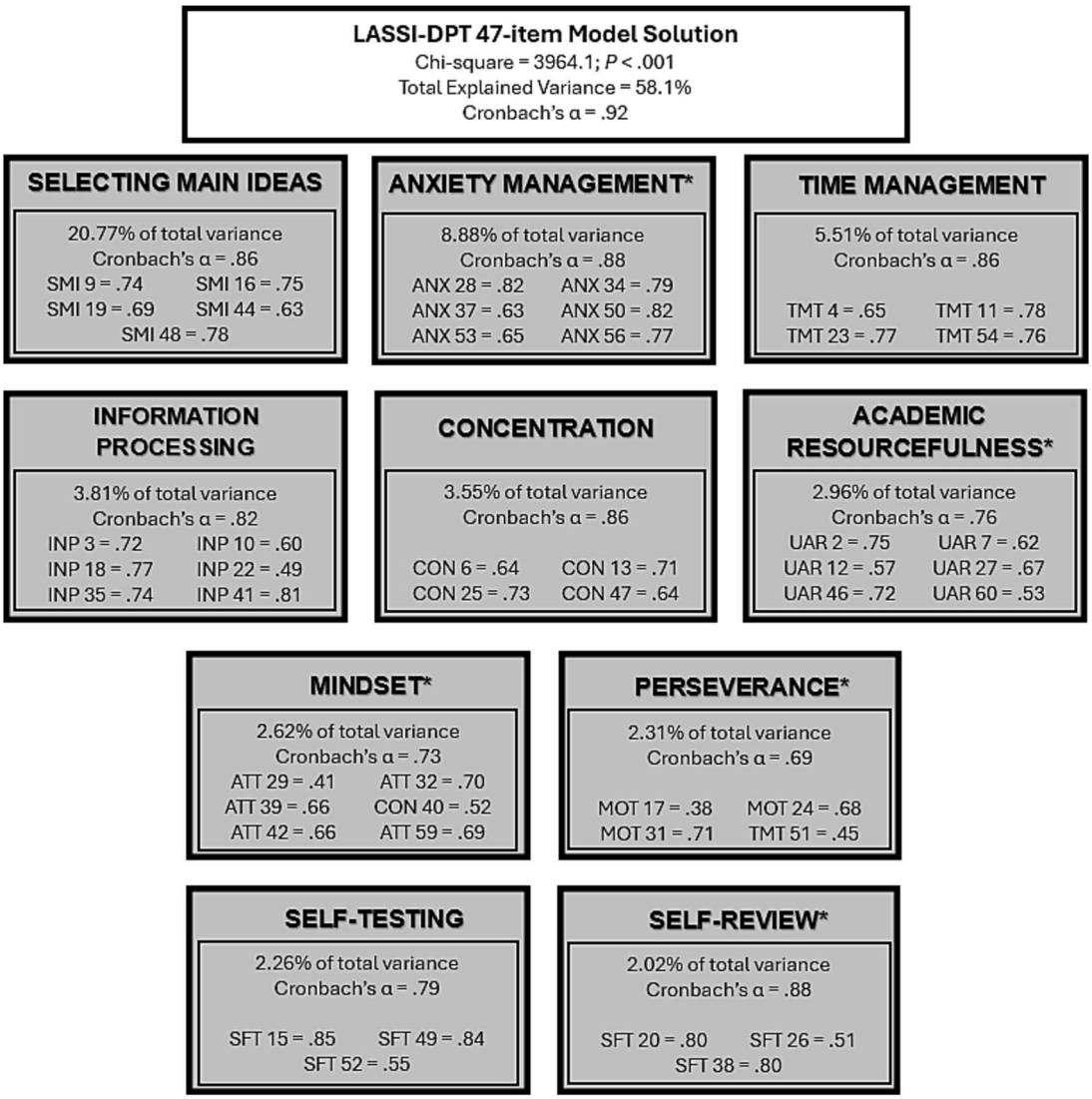

Figure 1. Exploratory Factor Analysis Model Solution for the LASSI-DPT Measurement by Scale, Item and Factor Loading, Cronbach α Value, and % of Variance Explained. * = Indicates a new revised subscale based on the results of exploratory factor analysis (EFA). Abbreviations: ANX = anxiety; ATT = attitude; CON = concentration; INP = information processing; LASSI-DPT = Learning and Study Strategies Inventory for Doctor of Physical Therapist education; MOT = motivation; SFT = self-test; SMI = selecting main ideas; TMT = time management; UAR = using academic resources.

Table 5. Factors Contributing to 47-Item LASSI-DPT with Rotated Component Loadings[a]

New LASSI Scale	Items Represented on the LASSI Scale[b]	Factor Loading for Each Item	Communalities
Selecting Main Ideas	SMI 9	0.74	0.68
	SMI 16	0.75	0.66
	SMI 19	0.69	0.62
	SMI 44	0.63	0.61
	SMI 48	0.78	0.68
Anxiety Management[c]	ANX 28	0.82	0.73
	ANX 34	0.79	0.71
	ANX 37	0.63	0.52
	ANX 50	0.82	0.76
	ANX 53	0.65	0.53
	ANX 56	0.77	0.72
Time Management	TMT 4	0.65	0.64
	TMT 11	0.78	0.71
	TMT 23	0.77	0.78
	TMT 54	0.76	0.69
Information Processing	INP 3	0.72	0.60
	INP 10	0.60	0.47
	INP 18	0.77	0.70
	INP 22	0.49	0.65
	INP 35	0.74	0.61
	INP 41	0.81	0.69
Concentration	CON 6	0.64	0.60
	CON 13	0.71	0.69
	CON 25	0.73	0.65
	CON 47	0.64	0.58
Academic Resourcefulness[c]	UAR 2	0.75	0.62
	UAR 7	0.62	0.55
	UAR 12	0.57	0.49
	UAR 27	0.67	0.62
	UAR 46	0.72	0.7
	UAR 60	0.53	0.49
Mindset[d] *(composed of former ATT and CON questions)*	ATT 29	0.41	0.51
	ATT 32	0.70	0.63
	ATT 39	0.66	0.58
	CON 40	0.52	0.47
	ATT 42	0.66	0.55
	ATT 59	0.69	0.53
Perseverance[d] *(composed of former MOT and TMT questions)*	MOT 17	0.38	0.44
	MOT 24	0.68	0.53
	MOT 31	0.71	0.67
	TMT 51	0.45	0.40
Self-Testing	SFT 15	0.85	0.82
	SFT 49	0.84	0.78
	SFT 52	0.55	0.61
Self-Review[d] *(composed of former SFT questions)*	SFT 20	0.80	0.77
	SFT 26	0.51	0.58
	SFT 38	0.80	0.78

[a]Abbreviations: ANX = anxiety; ATT = attitude; CON = concentration; INP = information processing; LASSI = Learning and Study Strategies Inventory; LASSI-DPT = Learning and Study Strategies Inventory for Doctor of Physical Therapist education; MOT = motivation; SFT = self-test; SMI = selecting main ideas; TMT = time management; UAR = using academic resources. [b]The number following the abbreviation is the item number on the LASSI. [c]Renamed scale for the LASSI-DPT. [d]New scale for the LASSI-DPT.

habits.[15,16] There are numerous benefits in confirming the validity and reliability of the LASSI instrument and developing a validated version tailored specifically for physical therapist learners.

First, a growing body of research in physical therapist education has utilized the LASSI in descriptive, predictive, correlative, and investigative studies. Our findings do not negate any previous scholarly products. On the contrary, we have established that the 60-item LASSI has adequate reliability in the physical therapist learner population.

Second, the LASSI-DPT provides physical therapist educators with a shorter, psychometrically sound, and conceptually relevant instrument to efficiently measure strategic learning in the DPT learner population. Further, development of this population-specific instrument may provide timely, valuable, and accurate insight into specific learning deficits to inform

targeted educational interventions, reducing the risk of programmatic failure or psychological distress.[10,11,13,14,20–29] A population-specific instrument could enable individual physical therapist learners to more effectively assess their SRL skills, enhancing metacognition for active and self-directed monitoring of their evolving learning strategies.[16,30,31,32] Learners who develop a deeper understanding of their SRL skills may further cultivate the critical thinking and adaptive expertise essential in clinical practice.[37–39]

Analysis and interpretation of LASSI-DPT results may enable programs and learners to mitigate academic difficulty, failure, and attrition, particularly through early identification and timely application of targeted supportive resources. The LASSI-DPT may provide physical therapist educators with a more relevant and targeted instrument assessing physical therapist learners' attitudes, beliefs, and behaviors related to strategic learning. Future research should assess the diagnostic accuracy of the new scales developed in this study for identifying potential academic difficulties and predicting key performance outcomes, including National Physical Therapy Examination (NPTE) pass rates.

Limitations

One limitation of this study is the potential for sampling bias due to the use of convenience sampling. This concern is mitigated by a large, adequately powered sample with a representative mix of program types and learner demographics. The demographic characteristics of the sample of learners included for analysis (age, legal sex, and race and ethnicity) were consistent with averages for the same time period as reported by aggregate CAPTE program data.[52] While hybrid program learners comprised a larger proportion of the sample, both program groups were adequately sized to support generalizability. However, the disproportionate representation of private ($n = 4$) versus public ($n = 1$) programs may have introduced bias, given that only 55.2% of physical therapist programs nationally are private, compared to 80% in this study. Future research may aim to include a more balanced representation of public institutions to better align with national CAPTE data.

CONCLUSION

This study is the first to evaluate the reliability and validity of the 60-item LASSI 3rd edition in graduate health care education, specifically among physical therapist learners. The LASSI 3rd edition, originally developed and validated within a population of undergraduate students from 23 postsecondary institutions, did not include graduate-level learners or those within health care education programs.[2] Given the content, instructional delivery methods, and curricular framework within physical therapist education, DPT learners may require different learning strategies and sophisticated skills in SRL greater than those required for undergraduate education. A more concise and reliable instrument, such as the LASSI-DPT, may enable programs to efficiently identify learning strategy deficits and deliver targeted support for learner development, particularly in the early stages of the program.

ACKNOWLEDGMENTS

The authors acknowledge the many physical therapist learner participants, faculty, and staff who made this research possible.

CRediT—CONTRIBUTOR ROLES

Jessica Feda (Conceptualization, Data curation, Resources, Methodology, Writing—original draft, Writing—review & editing [equal], Formal analysis, Validation [supporting], Project administration, Supervision [lead]), Evan Pucillo (Conceptualization, Data curation, Methodology, Resources, Writing—original draft, Writing—review & editing [equal], Formal analysis, Validation [lead], Project administration, Supervision [supporting]), Laura E. Wenger (Conceptualization, Investigation, Resources, Writing—original draft, Writing—review & editing [equal], Data curation, Formal analysis, Methodology, Project administration, Supervision, Validation [supporting]), Melissa Scales (Conceptualization, Data curation, Investigation, Resources, Writing—original draft, Writing—review & editing [equal], Formal analysis, Methodology, Project administration, Supervision, Validation [supporting]), Kyle R. Adams (Conceptualization, Data curation, Investigation, Resources [equal], Formal analysis, Methodology, Project administration, Supervision, Validation, Writing—original draft [supporting], Writing—review & editing [lead]), Carrie Minahan (Conceptualization, Data curation, Resources, Writing—original draft, Writing—review & editing [equal], Formal analysis, Methodology, Project administration, Software, Supervision, Validation, Visualization [supporting]), Jennifer G. Martin (Conceptualization, Data curation, Formal analysis, Methodology, Project administration, Supervision, Validation [supporting], Investigation, Resources, Writing—original draft, Writing—review & editing [equal]), and Nancy S. Smith (Conceptualization, Data curation, Investigation, Methodology, Resources, Writing—original draft, Writing—review & editing [equal], Formal analysis, Validation [lead], Project administration, Supervision [supporting]).

SUPPLEMENTARY MATERIAL

Supplementary material is available online.

FUNDING

None declared.

ETHICS

This study was deemed exempt as non-human research by the Baylor University Institutional Review Board (#2040466).

DISCLOSURES AND PRESENTATIONS

The authors completed the ICMJE Form for Disclosure of Potential Conflicts of Interest and reported no conflicts of interest.

Portions of this research were presented at the Education Leadership Conference (ELC) in October 2024 in Oakland, CA, United States. The abstract from the platform presentation was published in JOPTE in the March 2025 issue (Volume 39 -S1).

DATA AVAILABILITY

The dataset generated and analyzed during the current study is not publicly available due to institution agreements but is available from the corresponding author upon reasonable request.

REFERENCES

1. Wolters CA, Won S. Validity and the use of self-report questionnaires to assess self-regulated learning. In: Schunk JAG DH, ed., *Handbook of Self-Regulation of Learning and Performance*. 2nd ed. Routledge; 2018: 307–322.
2. Weinstein CE, Palmer DR, Acee TW. In: Hackworth R, Ealy M, Trimmier P, Hackworth K, eds., *LASSI User's Manual, Learning and Study Strategies Inventory* 3rd Edition. H&H Publishing Company, Inc, Clearwater, FL; 2016. Accessed May 2024. https://www.hhpublishing.com/LASSImanual.pdf

3. Krause JM, Fong CJ. Considerations for learner learning: a qualitative analysis of college calculus instruction. *Int J Univ Teach Fac Dev*. 2011;2(3):181.
4. Fong CJ, Krou MR, Johnston-Ashton K, Hoff MA, Gonzales C. LASSI's great adventure: a meta-analytic review of the learning and study strategies inventory and academic outcomes. *Educ Res Rev*. 2021;34(5). https://doi.org/10.1016/j.edurev.2021.100407
5. Weinstein CE, Acee TW, Jung J. Self-regulation and learning strategies. *New Dir Teach Learn*. 2011;2011(128):45–53. https://doi.org/10.1002/tl.443
6. Fong CJ, Lee J, Krou MR, et al. Meta-analyzing the factor structure of the learning and study strategies inventory. *J Exp Educ*. 2023;91(2):380–400. https://doi.org/10.1080/00220973.2021.2021842
7. Weinstein CE, Palmer DR. In: Claire E. Weinstein, David R Palmer, eds. *LASSI-HS user's Manual*. H&H Publishing Company, Inc, Dunedin, FL; 1990. Accessed December 29, 2022. https://www.hhpublishing.com/ap/_assessments/LASSI-HS_Manual.pdf
8. Weinstein CE, Acee TW. Study and learning strategies. In: Flippo RF, Bean TW, eds., *Handbook of College Reading and Study Strategy Research*. 3rd ed. Rutledge; 2018;227–240. https://doi.org/10.4324/9781315629810-17
9. Nist SL, Mealey DL, Simpson ML, Kroc R. Measuring the affective and cognitive growth of regularly admitted and developmental studies learners using the learning and study strategies inventory (LASSI). *Read Res Instr*. 1990;30(1):44–49. https://doi.org/10.1080/19388079009558032
10. Pucillo EM, Black EL. Do learning and study strategies predict success in hybrid-online physical and occupational therapist education? *Internet J Allied Health Sci Pract*. 2021;19(3):1.
11. Pucillo EM, Perez G. Metacognition and self-regulation influence academic performance in occupational and physical therapy learners. *J Occup Ther Educ*. 2023;7(1):1–8.
12. Pucillo EM, Perez G. Training and instruction of learning and study strategies improve academic performance in rehabilitation learners. *Internet J Allied Health Sci Pract*. 2023;21(4):13.
13. Pucillo EM, Kiernan E, Shotwell MP, Crossen-Sills J. Learning strategies and academic difficulty in occupational and physical therapy online education. *J Occup Ther Educ*. 2020;4(2):5.
14. Harmon DJ, Attardi SM, Waite JG, Topp KS, Smoot BJ, Farkas GJ. Predictive factors of academic success in neuromusculoskeletal anatomy among doctor of physical therapy learners. *Anat Sci Educ*. 2023;16(2):323–333. https://doi.org/10.1002/ase.2202
15. Martin JG, Smith NS, Wendt C. Self-regulated learning on program entry in doctor of physical therapy learners: a pilot study. *J Phys Ther Educ*. 2021;35(1):55. https://doi.org/10.1097/JTE.0000000000000171
16. Scales MH, Vallabhajosula S. Learning and study strategies of learners in the first year of an entry-level physical therapist program. *J Phys Ther Educ*. 2023;37(2):132–137. https://doi.org/10.1097/JTE.0000000000000275
17. Reynolds B, Minahan C. Strategic learning principles are related to academic scores for doctor of physical therapy learners. *Med Sci Educ Published online November*. 2024;34(4):1–10. https://doi.org/10.1007/s40670-024-02215-5
18. Feda J, Adams K, Wenger L, et al. Exploration of predictive relationships between learning and study strategies and student success in hybrid physical therapy education. *J Allied Health*. 2025;54(2):e175–e181.
19. Minahan CA, Reynolds B, Martin JG, Seale J. Strategic learning strategies of doctor of physical therapy learners. *J Phys Ther Educ*. 2024;38(4):311–321. https://doi.org/10.1097/JTE.0000000000000345
20. Zhou Y, Graham L, West C. The relationship between study strategies and academic performance. *J Int Assoc Med Sci Educ*. 2016;7:324–332. https://doi.org/10.5116/ijme.57dc.fe0f
21. Jouhari Z, Haghani F, Changiz T. Assessment of medical learners' learning and study strategies in self-regulated learning. *J Adv Med Educ Prof*. 2016;4(2):72–79.
22. West C, Kurz T, Smith S, Graham L. Are study strategies related to medical licensing exam performance? *J Int Assoc Med Sci Educ*. 2014;5(1):199–204. https://doi.org/10.5116/ijme.5439.6491
23. Waite JG, Farkas GJ, Topp KS, Smoot B, Harmon D. Assessing determinants of musculoskeletal anatomy success in first-year physical therapy learners. *FASEB J*. 2019;33(S1). https://doi.org/10.1096/fasebj.2019.33.1_supplement.442.1
24. Pucillo EM, Marinas R, Salmon C, Agrawal V. Admission variables predict success in a hybrid-online physical therapist education program. *Internet J Allied Health Sci Pract*. 2022;20(1):Article 18.
25. Foong CC, Bashir Ghouse NL, Lye AJ, et al. A qualitative study on self-regulated learning among high performing medical learners. *BMC Med Educ*. 2021;21(1):320. https://doi.org/10.1186/s12909-021-02712-w
26. Khalil MK, Hawkins HG, Crespo LM, Buggy J. The relationship between learning and study strategies inventory (LASSI) and academic performance in medical schools. *Med Sci Educ*. 2017;27(2):315–320. https://doi.org/10.1007/s40670-017-0400-x
27. Khalil MK, Williams SE, Hawkins HG. The use of learning and study strategies inventory (LASSI) to investigate differences between low vs high academically performing medical learners. *Med Sci Educ*. 2020;30(1):287–292. https://doi.org/10.1007/s40670-019-00897-w
28. Norouzinia R, Seidabadi M, Mohammadi R, Ghadimi M, Aghabarari M. The relationship between learning and study strategies with learners' academic performance. *Educ res Med Sci* 2016;5(1):16–23. Accessed February 23, 2024. https://brieflands.com/articles/erms-79179.htmlhttps://brieflands.com/articles/erms-79179#abstract
29. Mohammadi I, Thaghinejad H, Suhrabi Z, Tavan H. The correlation of learning and study strategies with academic achievement of nursing learners. *J Basic Res Med Sci*. 2017;4(3):8–13.
30. Panadero E. A review of self-regulated learning: six models and four directions for research. *Front Psychol*. 2017;8(442):1–28. https://doi.org/10.3389/fpsyg.2017.00422
31. Puustinen M, Pulkkinen L. Models of self-regulated learning: a review. *Scand J Educ Res*. 2001;45(3):269–286. https://doi.org/10.1080/00313830120074206
32. Winne PH. Cognition, metacognition, and self-regulated learning. In: Noblit GW, ed., *Oxford Research Encyclopedia of Education*. Oxford University Press; 2021. https://doi.org/10.1093/acrefore/9780190264093.013.1528
33. Blackinton M, Calendrillo M, Gobert D, Myers K. The pandemic's current impact on DPT education. *APTA Magazine*. 2021 June 1. Accessed May 16, 2022. https://www.apta.org/apta-magazine/2021/06/01/the-pandemics-current-impact-on-dpt-education
34. Chitra E, Hidayah N, Chandratilake M, Nadarajah VD. Self-regulated learning practice of undergraduate learners in health professions programs. *Front Med*. 2022;9:803069. https://doi.org/10.3389/fmed.2022.803069
35. Plack MM, Healey WE, Huhn K, Costello E, Maring J, Hilliard MJ. Navigating learner challenges: from the lens of first-year doctor of physical therapy learners. *J Phys Ther Educ* 2021;22. https://doi.org/10.1097/JTE.0000000000000212
36. Kume J, Reddin V, Horbacewicz J. Predictors of physical therapy academic and NPTE licensure performance. *Health Prof Educ*. 2019;5(3):185–193. https://doi.org/10.1016/j.hpe.2018.06.004
37. Abraham K, Green-Wilson J, Hartley GW, et al. Master adaptive learning as a framework for physical therapist professional education: a call to action. *Phys Ther*. 2022;102(9):1–5. https://doi.org/10.1093/ptj/pzac064
38. Cupido N, Ross S, Lawrence K, et al. Making sense of adaptive expertise for frontline clinical educators: a scoping review of definitions and strategies. *Adv Health Sci Educ Theory Pract*. 2022;27(5):1213–1243. https://doi.org/10.1007/s10459-022-10176-w
39. Lajoie SP, Gube M. Adaptive expertise in medical education: accelerating learning trajectories by fostering self-regulated

learning. *Med Teach*. 2018;40(8):809–812. https://doi.org/10.1080/0142159X.2018.1485886
40. Timmerberg JF, Chesbro SB, Jensen GM, Dole RL, Jette DU. Competency-based education and practice in physical therapy: It's time to act! *Phys Ther*. 2022;102(5):1–8. https://doi.org/10.1093/ptj/pzac018
41. Englander R, Cameron T, Ballard AJ, Dodge J, Bull J, Aschenbrener CA. Toward a common taxonomy of competency domains for the health professions and competencies for physicians. *Acad Med*. 2013;88(8):1088–1094. https://doi.org/10.1097/ACM.0b013e31829a3b2b
42. Commission on Accreditation in Physical Therapy Education. *2023 Physical Therapist Education Programs Fact Sheet*. Aggregate Program Data; 2024: https://www.capteonline.org/faculty-and-program-resources/data-and-research/aggregate-program-data/archive
43. Marrs H, Sigler E, Hayes K. Study strategy predictors of performance in introductory psychology. *J Instr Psychol*. 36(2):125–133.
44. Carson AD. Predicting learner success from the LASSI for learning online (LLO). *J Educ Comput Res*. 2011;45(4):399–414. https://doi.org/10.2190/EC.45.4.b
45. Schutz CM, Dalton L, Tepe RE. Learning and study strategies inventory subtests and factors as predictors of National Board of chiropractic examiners part 1 examination performance. *J Chiropr Educ*. 2013;27(1):5–10. https://doi.org/10.7899/JCE-D-12-012
46. Marland JGT. LASSI: an Australian evaluation of an enduring study skills assessment tool. *J Acad Lang Learn*. 2015;9(2):A32–A45.
47. Flowers LA. Test-retest reliability of the learning and study strategies inventory (LASSI): new evidence. *Read Res Instr*. 2003;43(1):31–46.
48. Albaili MA. Differences among low-, average- and high-achieving college learners on learning and study strategies. *Educ Psychol Rev*. 1997;17(1–2):171–177.
49. Deming MP, Valeri-Gold M, Idleman LS. The reliability and validity of learning and study strategies inventory (LASSI) with college developmental learners. *Read Res Instr*. 1994;33(4):309–318.
50. Weinstein CE, Palmer DR, Schultz AC. LASSI: user's manual for those administering the learning and study strategies inventory. H&H Publishing Company; 2002. Accessed February, 2024. https://www.hhpublishing.com/LASSImanual.pdf
51. Faul F, Erdfelder E, Lang AG, Buchner A. G*power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behav Res Methods*. 2007;39(2):175–191. https://doi.org/10.3758/BF03193146
52. Commission on Accreditation in Physical Therapy Education. *2021 Physical Therapist Education Programs Fact Sheet*. Aggregate Program Data; 2023. Accessed October. https://www.capteonline.org/faculty-and-program-resources/data-and-research/aggregate-program-data/archive
53. Warner RM. *Applied Statistics: From Bivariate through Multivariate Techniques*. 2nd ed. SAGE Publications; 2013.
54. Hair JF, Black WC, Babin BJ, Anderson RE. *Multivariate Data Analysis*. Pearson Education; 2014.
55. Zafrullah Z, Ramadhani AM, Ayuni RT, Fadhilla NT, Safitri R. The using confirmatory factor analysis as construct validity in education research: a analysis with biblioshiny. *Dirosat* 2024;2(3):206–220.
56. Kahn JH. Factor analysis in counseling psychology research, training, and practice. *Couns Psychol*. 2006;34(5):684–718. https://doi.org/10.1177/0011000006286347
57. Beavers AS, Lounsbury JW, Richards JK, Huck SW, Skolits GJ, Esquivel SL. Practical considerations for using exploratory factor analysis in educational research. *Pract Assess Res Eval*. 2013;18(1):1–13. https://doi.org/10.7275/qv2q-rk76
58. Laerd Statistics. *Principal Component Analysis (PCA) Using SPSS Statistics*. Laerd Statistics. Accessed May, 2024. https://statistics.laerd.com/spss-tutorials/principal-components-analysis-pca-using-spss-statistics.php
59. Nguyen HLT. *Tired of Survey Fatigue? Insufficient Effort Responding Due to Survey Fatigue [master's Thesis]*. Murfreesboro, TN: Middle Tennessee State University; 2017. Accessed May, 2024. https://jewlscholar.mtsu.edu/handle/mtsu/5302
60. Rennie KM. Exploratory and confirmatory rotation strategies in exploratory factor analysis. *Paper Presented at: Annual Meeting of the Southwest Educational Research Association*; 1997; Austin, TX. Accessed May, 2024. https://files.eric.ed.gov/fulltext/ED406446.pdf
61. Warner RM. *Applied Statistics: From Bivariate through Multivariate Techniques*. 3rd ed. SAGE Publications; 2019.
62. Cheung GW, Cooper-Thomas HD, Lau RS, Wang LC. Reporting reliability, convergent and discriminant validity with structural equation modeling: a review and best-practice recommendations. *Asia Pac J Manag*. 2024;41(2):745–783. https://doi.org/10.1007/s10490-023-09871-y
63. Tavakol M, Dennick R. Making sense of Cronbach's alpha. *J Int Assoc Med Sci Educ*. 2011;2(2):53–55. https://doi.org/10.5116/ijme.4dfb.8dfd
64. Peterson RA. Meta-analysis variance accounted factor loadings exploratory factor analysis. *Mark Lett*. 2000;11(3):261–275. https://doi.org/10.1023/A:1008191211004
65. Ben-Nun P. Respondent fatigue. In: Lavrakas PJ, ed. *Encyclopedia of Survey Research Methods*. Vol 2. SAGE Publications; 2008:743.
66. Williams CA, Lewis L. Mindsets in health professions education: a scoping review. *Nurse Educ Today*. 2021;100(104863):104863. https://doi.org/10.1016/j.nedt.2021.104863
67. Calo M, Judd B, Chipchase L, Blackstock F, Peiris CL. Grit, resilience, mindset, and academic success in physical therapist learners: a cross-sectional, multicenter study. *Phys Ther*. 2022;102(6). https://doi.org/10.1093/ptj/pzac038
68. Carp S, Fry K, Gumerman B, Pressley K, Whitman A. Relationship between grit scale score and academic performance in a doctor of physical therapy program: a case study. *J Allied Health*. 2020;49(1):29–35.
69. Rindflesch A, Barnes S, Craig H, Zebelian C, Hollman J. Do learner physical therapists have grit? The self-perceived effortful persistence of learners in doctor of physical therapy programs. *J Allied Health*. 2023;52(1):44–50.
70. Mould MR, Bray KK, Gadbury-Amyot CC. Learner self-assessment in dental hygiene education: a cornerstone of critical thinking and problem-solving. *J Dent Educ*. 2011;75(8):1061–1072. https://doi.org/10.1002/j.0022-0337.2011.75.8.tb05151.x
71. Swisher D, Marcoux B, Blackinton M et al. Implementing distance education in physical therapist/physical therapist assistant programs. Commission on the accreditation in Physical Therapy Education; 2019. Accessed May 26, 2024. https://www.capteonline.org/globalassets/capte-docs/capte-position-papers.pdf
72. Gagnon K, Young B, Bachman T, Longbottom T, Severin R, Walker MJ. Doctor of physical therapy education in a hybrid learning environment: reimagining the possibilities and navigating a "new normal". *Phys Ther*. 2020;100(8):1268–1127. https://doi.org/10.1093/ptj/pzaa096

Physical Therapy, 2025, 105, pzaf108
https://doi.org/10.1093/ptj/pzaf108
Original Research