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Learning Strategies and Academic Difficulty in Physical and Occupational Therapy Online Education

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1 **Learning Strategies and Academic Difficulty in Occupational and Physical Therapy**
2 **Online Education**

3
4 **Abstract**

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6 The purpose of this study was to explore the Learning and Study Strategies Inventory (LASSI)
7 in relation to hybrid-online clinical neuroscience course outcomes in occupational therapy (OT)
8 and physical therapy (PT) students. OT and PT students self-administered the LASSI during
9 the Spring of 2019. N=34 students (14 OT; 20 PT) completed the LASSI. The scales of
10 Information Processing ($r = -0.43$; $p < 0.01$), Self-Testing ($r = -0.36$; $p < 0.05$), and Test Strategies
11 ($r = 0.32$; $p < 0.05$) displayed modest statistically significant relationships to final neuroscience
12 grade; and cumulative professional GPA ($r = -0.43$; $p < 0.01$), ($r = -0.30$; $p < 0.05$), ($r = 0.29$;
13 $p < 0.05$), respectively. Some scales of the LASSI appear to be modestly related to academic
14 difficulty in this sample. Students who rely on certain learning strategies may be at risk for
15 academic difficulty in hybrid-online coursework.

16
17 **Keywords**

18
19 *Academic difficulty, learning strategies, study strategies, academic performance, LASSI*

20
21 **Highlights**

- 22
- 23 • Scales of the LASSI demonstrated modest relationships to academic difficulty.
 - 24 • In large part, the LASSI was not significantly related academic achievement.
 - 25 • Students who scored highly on the LASSI scales of Information Processing and Self-
26 testing tended to have lower course performance compared to their peers.
 - 27 • Students who scored highly on the LASSI scale of Test Strategies tended to have higher
28 course performance compared to their peers.
 - 29 • The LASSI may yield valuable information for OT and PT students and educators.
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1 **Learning Strategies and Academic Difficulty in Occupational and Physical Therapy** 2 **Online Education**

3 4 **Introduction**

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6 Entry-level occupational therapy (OT) and physical therapy (PT) education programs are
7 witnessing explosive growth rates as the demand for qualified health care providers increases
8 (Landry et al., 2016). To address this growing need the number of accredited OT and PT
9 education programs has increased by 24% and 21%, respectively, in the last decade
10 (Commission on Accreditation in Physical Therapy Education [CAPTE], 2019; Harvison, 2018).
11 Concomitantly, there has been a shift in the curricular models of many health professions
12 education programs. The American Occupational Therapy Association (AOTA) reports that
13 nearly 90% of OT programs are offered with at least half of their curriculum delivered online
14 (Harvison, 2018). According to aggregate program data from CAPTE (2019) and the AOTA
15 (Harvison, 2018), curricula have moved from mostly traditional face-to-face to online and hybrid-
16 online instruction. Additionally, across the U.S., entry-level PT curricula now include up to 75%
17 hybrid-online instruction (CAPTE, 2019). As such, OT and PT educational programs appear to
18 be increasingly turning to online instruction to help meet the growing needs of expanding
19 professional education.
20

21 As online and hybrid-online education become more widely integrated into these professions
22 there exists a need to better understand the learning and study strategies associated with
23 academic outcomes for this mode of instruction (Griffin et al, 2012; Liu et al., 2016; Zhou,
24 Graham, & West, 2016). A deeper understanding of learning strategies in OT and PT education
25 can be beneficial for many reasons (Kuo, 2015; Lee, 2018; Waite et al., 2019). For example,
26 strategies related to outcomes can be advantageous in making programmatic decisions or
27 diagnosing and prognosticating student success to mitigate academic difficulty (Slaybaugh,
28 2012; West & Sadoski, 2011). A sound knowledge of learning strategies may help educators
29 promote specific strategies most closely associated with success (Griffin, et al., 2012; West &
30 Sadoski, 2011; Zhou et al., 2016). As such, learning and study strategies may be used to
31 promote academic progression and retention and help struggling students avoid increased
32 financial burden from added tuition costs (Crede & Kuncel, 2008; Wolden, 2018). Therefore, a
33 better understanding of the learning and study strategies linked to academic outcomes may
34 provide educators with many areas to target for student support (Alkhateeb & Nasser, 2014;
35 Villareal & Martinez, 2018).
36

37 The Learning and Study Strategies Inventory (LASSI) is a valid and reliable tool that has been
38 shown to identify scales of learning and study strategies associated with positive learning
39 outcomes (Cano, 2006; Flowers, 2003; Melancon, Sanders, & Smith, 2002; Moak, 2002;
40 Weinstein, Palmer, & Acee, 2016). The LASSI measures ten scales of learning and study
41 strategies, including: Anxiety, Attitude, Concentration, Information Processing, Motivation,
42 Selecting Main Ideas, Self-testing, Test Strategies, Time Management, and Using Academic
43 Resources (Weinstein et al., 2016). The LASSI is normative referenced, has demonstrated
44 sound psychometric properties across many educational levels, and has been widely adopted at
45 thousands of universities across the U.S. (Cano, 2006; Melancon et al., 2002; Weinstein et al.,
46 2016). For these reasons, the LASSI has become a trusted tool that generates actionable data
47 from which to drive educational support for students (Norouzinia et al., 2016).
48

49 A review of the literature reveals a vast array of studies that have investigated learning and
50 study strategies using the LASSI measurement. These studies have uncovered some important
51 relationships. For example, in prior investigations of a select few health professions the LASSI

1 scales of motivation, concentration, time management, and self-testing strategies have been
2 positively and significantly associated with academic performance; whereas, anxiety has shown
3 a significant negative association (Wolden, 2018). More broadly, prior investigations have led to
4 an improved understanding of the important relationship between learning strategies and
5 academic success for college students (Broadbent & Poon, 2015; Ning & Downing, 2010;
6 Orsini, Binnie, & Wilson, 2016; Simons, Dewitte, & Lens, 2004; Skinner et al., 2015). There is a
7 growing body of evidence highlighting the link between the scales measured by the LASSI and
8 academic performance. Currently, however, an understanding of the LASSI in OT and PT
9 education is severely lacking (Kuo, 2015; Lee, 2018, Waite et al., 2019), especially when
10 considering online or hybrid-online education. Therefore, it is possible that the LASSI may have
11 practical utility in this population.

12
13 To date, there is a dearth of published investigations examining the relationships between the
14 LASSI and learning outcomes in OT and PT students (Kuo, 2015; Lee, 2018; Waite et al.,
15 2019). As a result, a knowledge of the learning and study strategies associated with academic
16 outcomes in online education for this population remains largely unknown. Therefore, the
17 purpose of this study was to characterize a sample of entry-level OT and PT students, and to
18 identify and describe any relationships that may exist between the scales of the LASSI and
19 measures of academic performance within an online neuroscience course. It was hypothesized
20 that the LASSI scales of Time Management, Motivation, and Self-testing scales would be
21 positively associated with academic performance, while Anxiety would be positively associated
22 with academic difficulty.

23 24 **Materials and methods**

25
26 A cross-sectional and correlational study design was utilized. A convenience sample of OT and
27 PT students was solicited for participation in this study. The study was approved by IRB and
28 conducted during the Spring term of 2019. All participants completed a written informed
29 consent. Participants were included in this study if they were actively enrolled in an
30 interprofessional Clinical Neuroscience for MOT, OTD, and DPT programs, had not previously
31 failed or withdrew from the course, or had a history of remediating the course. Participants were
32 excluded from this study if they declined participation on the written informed consent procedure
33 or had not completed the LASSI prior to the first course examination. No financial incentives
34 were provided for participants.

35
36 The LASSI 3rd edition measurement was self-administered online by each participant using an
37 individual access code according to the test procedures (Weinstein et al., 2016). The LASSI-3
38 contains a total of 60-items, six question items for each of the ten scales of strategic learning.
39 The ten scales measured include Anxiety, Attitude, Concentration, Information Processing,
40 Motivation, Selecting Main Ideas, Self-testing, Test Strategies, Time Management, and Using
41 Academic Resources (Weinstein et al., 2016). The LASSI also measures three main
42 components of Skill, Will, and Self-regulation (Weinstein et al., 2016). The Skill component is
43 comprised of Information Processing, Selecting Main Ideas, and Test Strategies scales. The
44 Will component is comprised of Anxiety, Attitude, and Motivation scales. The Self-regulation
45 component is comprised of Concentration, Self-testing, Time Management, and Using
46 Academic Resources scales. There is no time limit associated with the test; however, it is
47 typically completed in under 15 minutes.

48
49 The LASSI was self-administered within the first three weeks of the USAHS Spring 2019 term,
50 and prior to the first written examination of the course to avoid a confounding influence on
51 results. At the conclusion of the term, academic performance was collected for the outcome

1 variables of cumulative professional GPA, final neuroscience grade, and averages across four
 2 written course examinations. Undergraduate GPA and undergraduate core science GPA were
 3 collected for each participant from record of admission to the university.

4 5 **Data Analysis**

6
7 Data was analyzed using IBM SPSS version 25 for Windows (IBM Corp, Armonk, NY, 2018).
 8 Descriptive, comparative, and inferential statistics were performed in accordance with Green
 9 and Salkind (2014) and Warner (2008), and assumptions tests were performed across all
 10 variables of interest (Portney & Watkins, 2015). All levels of statistical significance were set at
 11 0.05. The data set met the assumptions of homogeneity of variance, however, the sample was
 12 not normally distributed. As such, non-parametric Spearman's rho was chosen to test for all
 13 correlation analyses. Independent samples t-tests were performed to compare differences
 14 across means scores for scales of the LASSI and academic outcomes by profession and
 15 gender, as it is robust to violations in assumptions of normality (Portney & Watkins, 2016).

16 17 **Results**

18
19 A total of 34 students met the inclusion criteria and completed this study [N=9(26.5%) male;
 20 N=25(73.5%) female]. This number represented 40% of the total number of students enrolled in
 21 this cohort. Of this sample, 14(41%) were OT students and 20(59%) were PT students and
 22 were equally proportionate to the OT/PT class size. A description of the participants,
 23 demographic information, and academic outcomes can be found in Table 1. Significant
 24 differences were found between examination averages for OT and PT students ($p < 0.01$), but
 25 not between final course grade, or professional GPA.

26
27 **Table 1. Participant Demographics**

Category	OT	PT	OT/PT Combined	P value
Total N (%)	14 (41%)	20 (59%)	34 (100%)	n/a
Gender N(%)	3 (21%) Male 11 (79%) Female	6 (30%) Male 14 (70%) Female	9 (26%) Male 25 (74%) Female	n/a
Final Course Grade Mean (SD)	83.1(5.9)	83.1(4.7)	83.1(5.1)	n/s
Exam Average Mean (SD)	67.6(6.2)	79.7(5.4)	74.7(8.3)	$p < 0.01$
Professional GPA* Mean (SD)	3.40 (.33)	3.28 (.28)	3.33 (.30)	n/s

28 *Table 1. Key. OT = occupational therapy; PT = physical therapy; n/s = not significant; *GPA reported on a*
 29 *4.0 scale.*

30
31 Descriptive statistics were performed for the LASSI scale scores as an aggregate and by
 32 professional affiliation (OT/PT) and can be found in Table 2. Results on the performance of the
 33 LASSI measurement by profession and gender can also be found in Table 2. The highest mean
 34 (SD) percentile scores on the scales of the LASSI for this sample were noted in Attitude
 35 62.9(23.1) and Information Processing 58.8(23.3) scales. The lowest LASSI scale scores for
 36 this sample were noted in Selecting Main Ideas 36.2(23.6) and Concentration 39.7(23.1) scales.
 37 A comparison of the mean percentile scores by profession and gender for the LASSI can be
 38 found in Table 2. Females scored significantly lower on the scale of Anxiety when compared to
 39 males ($p < 0.01$), indicating decreased ability to manage levels of anxiety. Males scored
 40 significantly higher on the LASSI scales of Attitude, Concentration, Motivation, Time

1 Management, and Using Academic Resources. Significant differences were noted between the
2 professions across the LASSI scales of Concentration and Selecting Main Ideas.

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Table 2. Descriptive statistics for LASSI scale scores by gender and profession

LASSI scale	OT	PT	OT/PT p value	Male	Female	M/F p value	Combined
ANX	50.7(27.4)	55.7(30.5)	n/s	69.9(24.1)	47.8(28.8)	P<0.01	53.7(28.9)
ATT	60.4(24.8)	64.8(22.3)	n/s	52.2(17.5)	66.8(23.9)	P<0.05	62.9(23.1)
CON	43.6(26.3)	37.0(22.6)	P<0.05	31.1(19.3)	42.8(25.1)	P<0.05	39.7(23.1)
INP	56.4(22.4)	60.5(24.3)	n/s	67.8(20.6)	55.6(23.7)	P<0.05	58.8(23.3)
MOT	51.4(23.8)	51.0(23.7)	n/s	35.0(21.1)	56.9(21.7)	P<0.01	51.2(23.4)
SMI	32.6(22.8)	38.8(24.4)	P<0.05	34.6(30.5)	36.8(21.4)	n/s	36.2(23.6)
SFT	44.0(23.7)	45.8(25.5)	n/s	41.7(27.5)	46.2(23.7)	n/s	45.0(24.4)
TST	52.1(17.3)	55.0(16.8)	n/s	47.2(16.2)	56.2(16.7)	n/s	53.8(16.8)
TMT	46.1(29.6)	47.8(26.1)	n/s	27.2(20.6)	54.2(25.9)	P<0.01	47.1(27.2)
UAR	49.6(26.2)	50.0(27.3)	n/s	34.4(26.9)	55.4(24.5)	P<0.05	49.9(26.4)

5 *Table 2. Key. ANX – anxiety; ATT – attitude; CON – concentration; INP – information processing; MOT –*
6 *motivation; SMI – selecting main ideas; SFT – self-testing; TST – test strategies; TMT – time*
7 *management; UAR – using academic resources. OT = occupational therapy; PT = physical therapy; n/s =*
8 *not significant*

9

10 Relationships were identified between LASSI scale scores and academic performance using
11 Spearman's rho and can be found in Table 3. Significant relationships were detected between
12 academic performance and the LASSI scales of Information Processing ($r = -0.43$; $p < 0.01$),
13 Self-Testing ($r = -0.36$; $p < 0.05$), and Test Strategies ($r = 0.32$; $p < 0.05$). The LASSI scale of Test
14 Strategies was the only scale to show a significant positive relationship to final grade.
15 Significant relationships were identified between undergraduate science GPA and final grade ($r =$
16 0.36 ; $p < 0.05$), and undergraduate cumulative GPA and final grade ($r = 0.33$; $p < 0.05$).
17 Interestingly, the scales of Information Processing and Selecting Main Ideas were significantly
18 and negatively correlated to undergraduate science ($r = -0.36$; $r = -0.30$) and undergraduate
19 cumulative GPA ($r = -0.29$; $r = -0.54$). The results of the correlation analysis between the scale
20 of Information Processing and final grade, and cumulative professional GPA can be found in
21 Figure 1.

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23

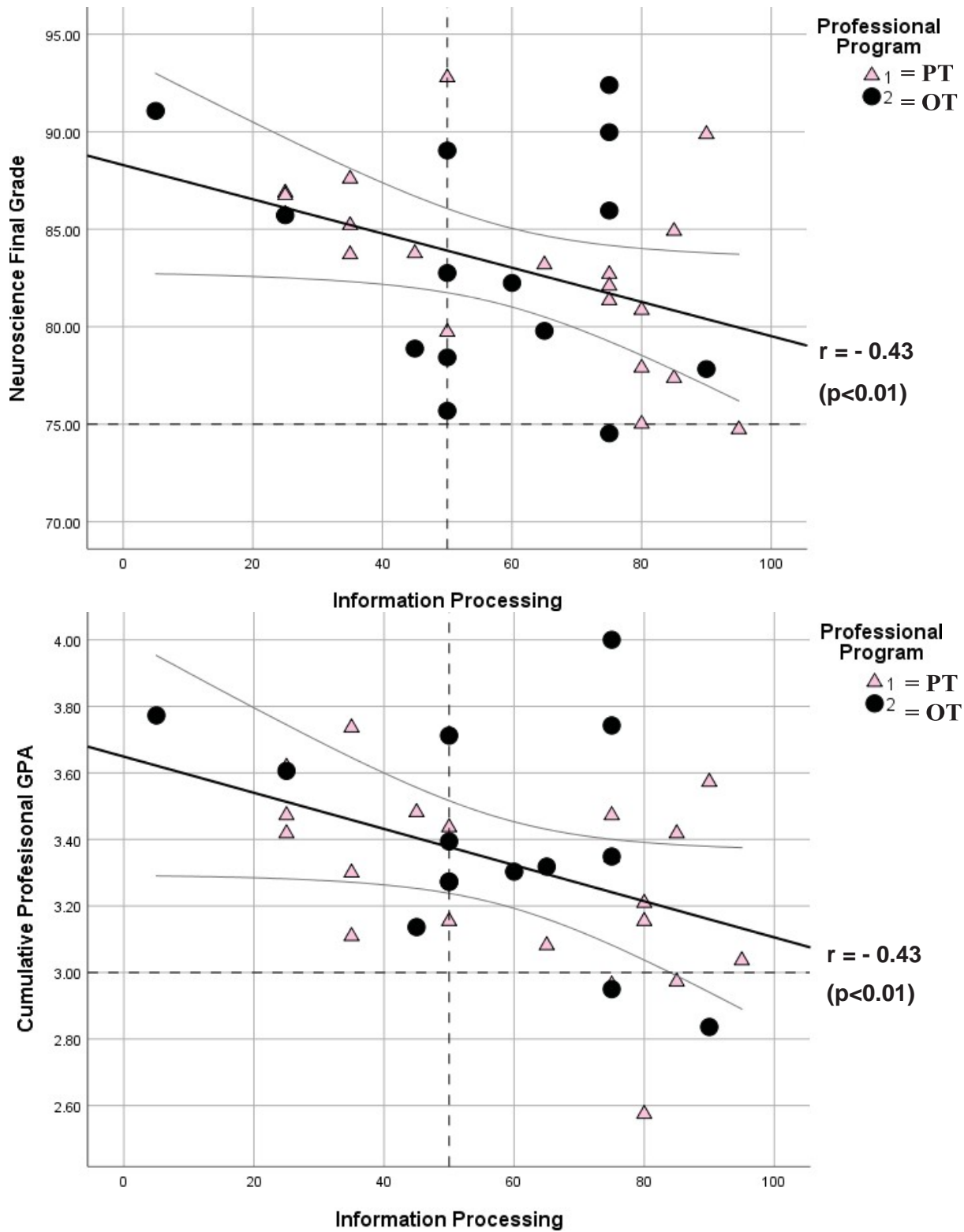
Table 3. Spearman correlations of LASSI scale scores and academic performance

LASSI Scale	Final course grade	Exam average	profGPA	uGPAcum	uGPAsci
ANX	-0.03	0.09	0.09	-0.11	0.02
ATT	0.06	0.09	0.02	0.08	0.04
CON	0.05	-0.11	0.05	-0.18	-0.13
INP	-0.43**	-0.14	-0.43**	-0.29*	-0.36*
MOT	0.29	0.13	0.25	0.08	-0.18
SMI	-0.07	0.08	-0.10	-0.54**	-0.30*
SFT	-0.36*	-0.21	-0.30*	-0.28	-0.31
TST	0.32*	0.21	0.29*	-0.06	0.05
TMT	0.14	0.02	0.05	-0.15	-0.16*
UAR	-0.25	-0.26	-0.21	-0.02	-0.11

24 * $p < 0.05$; ** $p < 0.01$

25 *Table 3. Key. ANX – anxiety; ATT – attitude; CON – concentration; INP – information processing; MOT –*
26 *motivation; SMI – selecting main ideas; SFT – self-testing; TST – test strategies; TMT – time*
27 *management; UAR – using academic resources; profGPA = professional cumulative GPA; uGPAcum =*
28 *undergraduate cumulative GPA; uGPAsci = undergraduate science GPA*

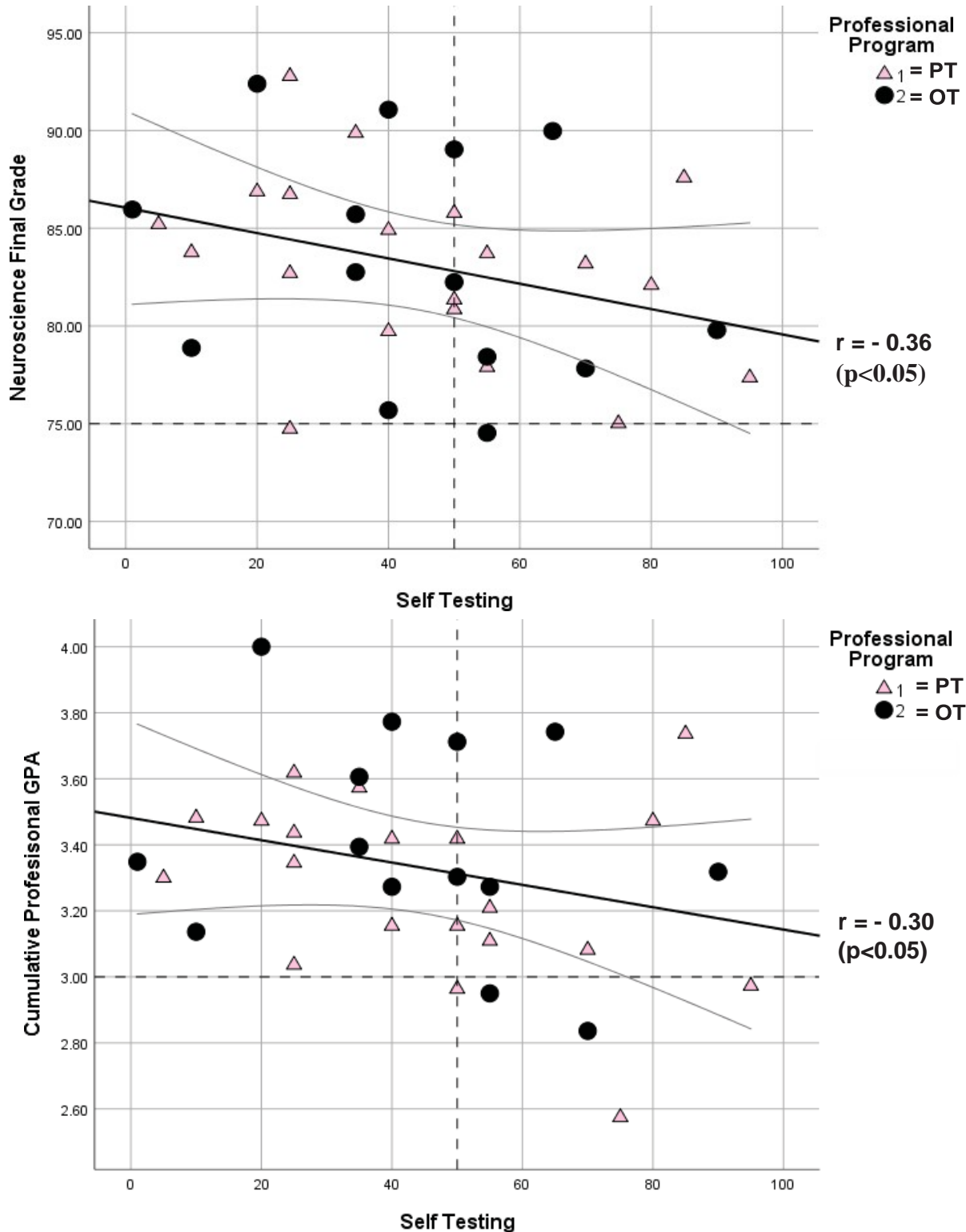
1 **Figure 1. Relationships to the LASSI scale of Information Processing.**



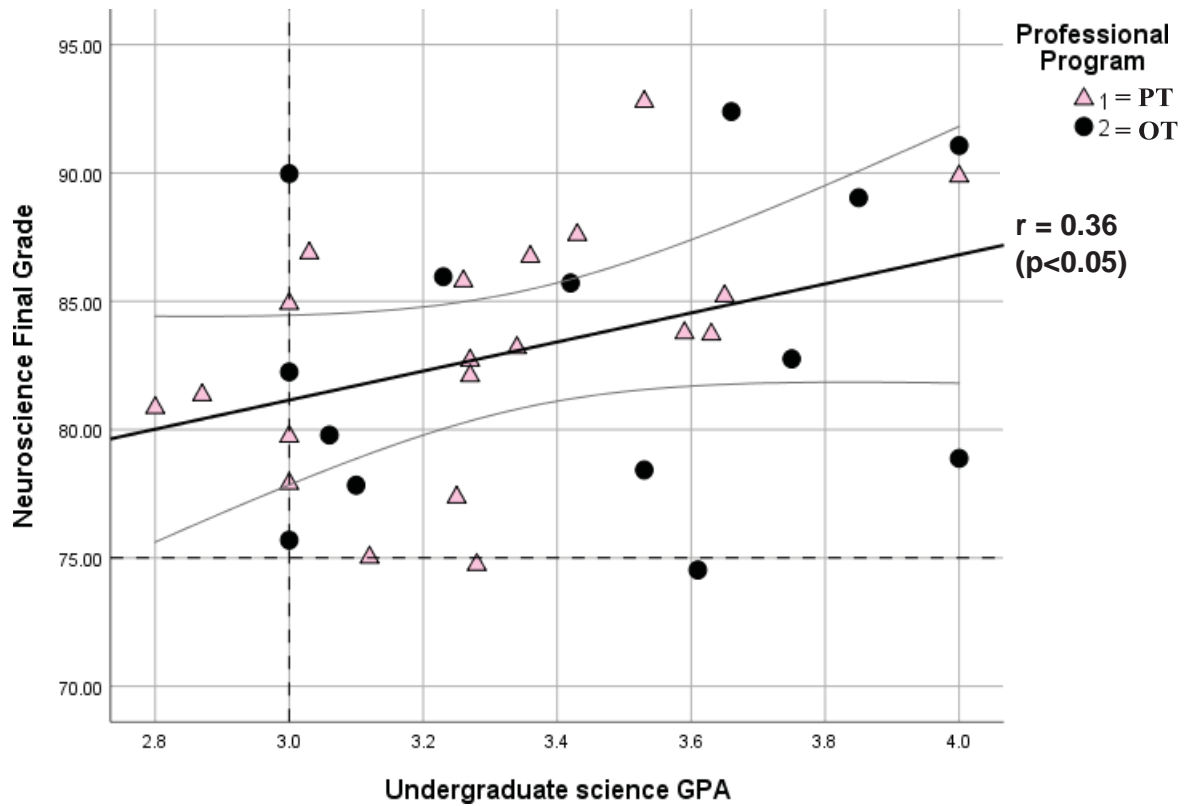
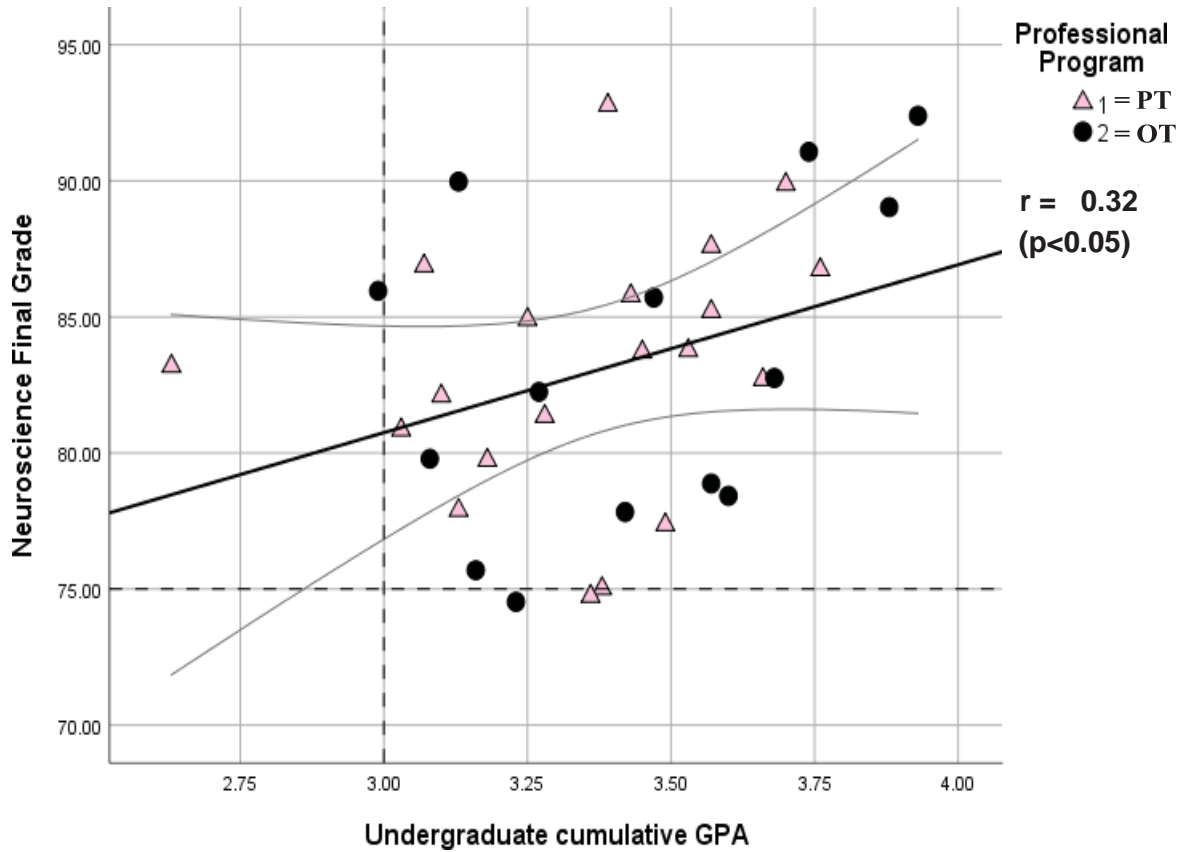
2
 3 Figure 2 represents the relationship between the LASSI scale of Self-testing and final grade,
 4 and cumulative professional GPA. The results in Figure 3 demonstrate the relationship that was

1 detected between undergraduate admissions variables and academic performance in this
 2 interdisciplinary cohort of OT and PT students. Figure 3 illustrates the historical relationship that
 3 exists between performance in undergraduate core science coursework and success in future
 4 sciences.

5 **Figure 2. Relationships to the LASSI scale of Self-Testing.**



1 **Figure 3. Relationship to undergraduate academic performance**
 2



1 Discussion

2
3 Prior investigations in health professions education have demonstrated positive relationships
4 between the LASSI and student outcomes, chiefly the scales of Time Management, Motivation,
5 Concentration, and Self-testing strategies (Haghani & Sadeghizdeh, 2011; Jouhari et al., 2016;
6 Khalil et al., 2018; Wolden, 2018). It was originally hypothesized that the LASSI scales of
7 Motivation, Time Management, and Self-testing would be positively related to academic
8 performance in this course, while Anxiety would be negatively related. However, the
9 hypotheses were not supported in the findings. Interestingly, males and females differed
10 significantly across several scales of the LASSI, particularly Anxiety, Motivation, and Time
11 Management. This may indicate that gender played a role in influencing outcomes, however,
12 lay outside the scope of this study. Although no significant positive findings were identified for
13 the hypothesized outcomes, valuable results were uncovered. In this study, only one of the ten
14 LASSI scales were positively related to academic performance, Test Strategies. The Test
15 Strategies scale measures a student's actions and behaviors that influence performance and
16 execution on examinations (Hicks, 2010; Weinstein et al., 2016). However, the relationship of
17 Test Strategies to academic performance was found to be modest, at best, and should be
18 interpreted cautiously. In large part, results from this study conflict with prior findings from many
19 studies using the LASSI with similar designs across fields of education (Wolden, 2018).

20
21 Overall, the findings from this study demonstrate that a modest negative relationship exists
22 between some scales of the LASSI and academic performance in a hybrid-online neuroscience
23 course for OT and PT students. This study found that the scales of Information Processing and
24 Self-testing were modestly and negatively related to academic success. Interestingly,
25 significant findings were detected in the Skill component of the LASSI, although the skill
26 component itself was not found to be significantly related to academic outcomes. This suggests
27 that these scales may be more valuable in measuring academic difficulty, and those who may
28 struggle, instead of success. The scale of Information Processing measures how a student
29 chooses to absorb, make meaning of, and accommodate new information into existing
30 structures and evaluates one's cognitive skill (Hicks, 2010; Weinstein et al., 2016). On the other
31 hand, the scale of Self-testing measures how a student continually evaluates their
32 understanding as they learn new information and the ability to perform progressive self-
33 assessment. In this sample, it appears that these strategies were more highly utilized by less
34 successful students, and perhaps should have been avoided for OT and PT students in online
35 coursework. As such, Information Processing and Self-testing may be inferior sets of learning
36 and study strategies that are more indicative of struggling students in graduate health
37 professions. Unfortunately, the exact mechanisms by which these strategies impact academic
38 performance are not fully understood and lay outside the scope of this investigation. However,
39 this information can be helpful to both students and educators as there is equal value in
40 understanding which strategies to encourage, and those to evade.

41
42 Not surprisingly, prior academic performance in undergraduate science and undergraduate
43 cumulative GPA were significantly related to academic outcomes in this graduate clinical
44 neuroscience course. This was an important component of the study as it anchored the results
45 of each participant to their historical academic performance. The results from this study indicate
46 that undergraduate admissions variables are related to future performance in a graduate-level
47 science course and is well supported by prior literature (Riddle et al., 2009; Utzman, Riddle, &
48 Jewell, 2007). One may expect students with a history of academic difficulty in undergraduate
49 core sciences to have a greater propensity to struggle in more challenging graduate-level
50 sciences. However, it appears that this was not the case for the subjects included in this study,
51 suggesting performance may have been linked to other factors such as learning strategies. As

1 a result, these findings establish consistency in performance for science coursework, thereby
2 lending credibility to the data collected from participants.

3
4 This study has limitations and the results should be interpreted with caution when considering
5 its external validity. This sample consisted of second-term OT and third-term PT students
6 enrolled in a hybrid-online clinical neuroscience course and may not be representative of the
7 broader population of these learners. Therefore, these results may not be applicable to other
8 institutions that harbor more traditional instructional methods. This study was also limited by a
9 small sample size and larger than expected variation in LASSI scores. Given the results of this
10 study, it may be more beneficial to examine the LASSI in relation to measures of academic
11 difficulty instead of success. Future studies should seek to enroll larger samples of students
12 and prospectively examine the prognostic and diagnostic utility of the LASSI across a
13 curriculum. Furthermore, although psychometric properties for the LASSI have been well-
14 established, studies should interrogate the reliability and validity of the LASSI measurement in
15 this population of learners and educational setting. Lastly, future studies should consider
16 examining the use of the LASSI in relation to other measures of future performance, such as
17 cumulative professional GPA at graduation or national licensure examination passing rates.

18 19 **Conclusion and Implications for Occupational Therapy Education**

20
21 Although relationships appear to be modest as best, some scales of the LASSI are significantly
22 related to academic difficulty in this sample of OT and PT student. OT students who rely on
23 certain learning strategies may be at risk for academic difficulty in hybrid-online coursework.
24 For example, students who prefer to endorse the elements measured in the LASSI scales of
25 information processing, self-testing, and test strategies compared to other learning strategies
26 may result in lower academic performance in online or hybrid-online learning. OT educators
27 should consider utilizing the LASSI measurement in programs with online coursework as a way
28 to screen for learning strategies that may support learning outcomes.

29 30 **Acknowledgements**

31
32 The authors would like to thank the OT and PT students for their enthusiasm and participation in
33 this research study. We would also like to thank our departmental leadership for supporting and
34 encouraging such an inquiry to better our understanding of the students for whom we serve.

35 36 **Declaration of Interests**

37
38 The authors report no declarations of interest. This research did not receive any specific grant
39 monies from funding agencies in the public, commercial, or not-for-profit sectors.

40 41 **Ethical Reporting Statement**

42
43 The primary investigator has unrestricted access to the data that is presented in this work. He
44 takes full responsibility for the integrity of the data and the accuracy of the analysis contained in
45 this report. We attest that we have read the Journal's position on issues involving the ethical
46 reporting and affirm that this scientific report is consistent with those guidelines.

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