International Journal for Educational Media and Technology
2025, Vol.19, No. 1, pp.81-89

Grit, Self-Efficacy, and Study Habits in Mobile Learning Among Physical Therapy Students

Hisaya Sudo
The United Graduate School of Education, Tokyo Gakugei University, Japan
sudoh6381@gmail.com

Yoko Noborimoto
Graduate School of Teacher Education, Tokyo Gakugei University, Japan
noborimt@u-gakugei.ac.jp

Jun Takahashi
Faculty of Education, Tokyo Gakugei University, Japan
jun@takalab.jp

This study investigated the relationship between grit, self-efficacy, and study habits operationalized through engagement with a mobile learning app among Japanese physical therapy students. The findings revealed that students with more consistent app-based study habits demonstrated significantly higher levels of both grit and self-efficacy. Logistic regression analysis revealed that grit was a stronger positive predictor of consistent app usage than self-efficacy. Furthermore, a positive correlation was observed between consistent app usage and academic test scores. This research significantly contributes by clarifying the relationship between psychological traits and study habits within a mobile learning environment through objective measurement via learning logs.

Keywords: Grit, Mobile Learning, Physical Therapy Education, Self-efficacy, Study Habits

Introduction

Effective study habits are widely recognized as key predictors of academic success in higher education (Nonis & Hudson, 2010; Stinebrickner & Stinebrickner, 2004). Moreover, cultivating continuous study habits during college years is crucial for promoting lifelong learning after graduation. Identifying psychological factors that foster consistent study habits is important to provide effective learning support. While prior research has examined various factors influencing study habits, such as emotional intelligence dimensions among health science students (Iqbal et al., 2022), the role of other psychological characteristics related to these habits has not been fully explored, particularly within mobile learning environments. To address this gap, the current study investigates the relationship between two psychological factors, grit (Duckworth et al., 2007) and self-efficacy (Bandura, 1977), and students' study habits as recorded by a learning app.

To assess study habits, Nonis and Hudson (2010) measured study time by asking students to allocate the time spent on various activities during a typical day and a week. They also noted a limitation of this method, which is its reliance on student memory. The current study offers a significant contribution to the existing literature by visualizing study habits through learning logs collected via a learning app. This approach provides an objective evaluation of study habits, contrasting with the subjective assessments common in prior survey-based studies. Additionally, this study examines the relationship between these visualized study habits and psychological traits in higher education.

Literature Review

Mobile Learning in Physical Therapy Education

Mobile learning refers to a form of learning that utilizes mobile devices such as smartphones and tablets, excluding laptops, netbooks, and gaming consoles (Crompton & Burke, 2018). Mobile learning promotes autonomous learning experiences because it enables learners to easily access educational resources from anywhere and at any time (Motiwalla, 2007). In well-designed mobile learning settings, learners can enhance their autonomy over the learning content by managing the location, speed, and timing of their learning (Kearney et al., 2012). In comparison to traditional analog

self-study methods using paper and pencil, mobile learning offers the significant advantage of flexibility, enabling students to be free from limitations related to time and space.

In physical therapy education, students are required to memorize numerous terms within basic medical science subjects. For example, even within the subject of anatomy alone, students need to memorize the names of approximately 206 bones and over 600 muscles. As they should learn not only the names of anatomical terms but also their functions, the number of things to be memorized is countless. Kojima et al. (2011) explored the effectiveness of mobile learning to support the memorization-heavy curriculum of physical therapy. They developed a mobile e-learning resource for musculoskeletal anatomy, a subject requiring extensive memorization. Their pilot study with physical and occupational therapy students utilized a text-based app with quizzes. Results showed that around 70% of students with mobile devices used it, and over 80% were satisfied. The resource was accessed in various locations, highlighting its flexibility. The authors concluded that mobile e-learning could effectively support the acquisition of anatomical knowledge in physical therapy education. At the physical therapy college in the current research, a similar mobile learning approach has been introduced to facilitate the acquisition of foundational medical knowledge using a learning app designed to enhance memory retention.

The Role of Grit in Health Sciences Education

Grit, defined as perseverance and passion for achieving long-term goals (Duckworth et al., 2007), is known to positively correlate with academic success (Duckworth & Quinn, 2009; Lam & Zhou, 2022; Wolters & Hussain, 2015). This psychological trait encompasses two primary dimensions: perseverance of effort and consistency of interest. Perseverance of effort refers to the ability to continue working hard and maintain effort toward challenges. Consistency of interest involves sustaining one's interests over an extended period despite encountering setbacks and failures. (Duckworth et al., 2007). While grit has similarities with other psychological traits such as self-control, as both involve acting in line with one's intentions and predict success, grit possesses distinct characteristics emphasizing sustained passion and perseverance towards a single, main long-term goal over extended periods, often years or even decades (Duckworth & Gross, 2014).

Calo et al. (2022) explored the relationship between grit and academic success in physical therapy students across four Australian universities. Their cross-sectional study, including 266 final-year students, found a positive association between grit and academic success. The authors suggested that fostering grit may be beneficial for enhancing academic outcomes in physical therapy education. Research indicates that students with higher grit demonstrate higher academic performance, not only in physical therapy but also in medicine (Miller-Matero et al., 2018), pharmacy (Pate et al., 2017), and dentistry (Montas et al., 2021).

Wolters and Hussain (2015) investigated the relationship between grit, students' Self-Regulated Learning (SRL), and academic outcomes and reported a significant association between grit and procrastination, indicating that students with low grit tend to delay necessary tasks or decisions. Their findings also suggested that SRL might mediate the relationship between grit and academic performance. Specifically, students' ability to self-regulate their time and environment and to avoid procrastination in academic tasks is a critical pathway between psychological traits and students' academic achievement.

To further explore the role of grit in technology-enhanced learning environments, the present study aims to investigate the hypothesis that in a mobile learning environment utilizing a learning app, students with higher grit will demonstrate better management of their study time, avoid procrastination in completing daily assignments, and consequently achieve higher scores on academic tests.

Academic Self-efficacy and Its Impact on Learning

Self-efficacy is the confidence in one's ability to successfully perform the actions required to achieve desired outcomes. This confidence determines how much effort people put in and how long they will persevere in the face of obstacles or difficulties. The stronger their self-efficacy, the more actively they engage in effort (Bandura, 1977). Perceived self-efficacy is domain-specific, meaning that high self-efficacy in one domain does not necessarily mean high efficacy in another (Artino, 2012).

Research has consistently highlighted the key role of academic self-efficacy in students' learning and achievement (Elias & MacDonald, 2007; Honicke & Broadbent, 2016). Pintrich and De Groot (1990) demonstrated that students with a strong belief in their academic capabilities exhibit greater cognitive engagement and achieve higher levels of performance. These students are more inclined to utilize effective cognitive and metacognitive strategies and display

increased persistence when faced with more challenging academic tasks, regardless of their prior academic history, intrinsic motivation, or test anxiety levels. Furthermore, Zimmerman et al. (1992) found that students with higher perceived self-efficacy tend to set higher academic goals for themselves and are more likely to successfully achieve these goals. Bandura et al. (1996) also emphasized that children who believe they can control their learning and master academic material are more likely to succeed academically, as a strong sense of academic efficacy is a significant motivator.

Building on this prior research, our study hypothesized that within a mobile learning environment utilizing a learning app, college students with higher self-efficacy would demonstrate greater engagement with daily learning assignments, consequently achieving higher scores on academic tests. The verification of the hypotheses is expected to contribute to clarifying the psychological characteristics of students who exhibit consistent study habits and provide a valuable theoretical foundation for supporting students experiencing learning difficulties.

Research Objectives

"Consistent study habits" are a key indicator of students' learning behavior. In this study, this term is defined as consistently engaging in their daily learning assignments using a learning app, as opposed to cramming. We hypothesize that these scientifically effective study habits are strongly associated with psychological traits related to perseverance and self-belief, as well as academic performance. Specifically, the current study proposes the following two hypotheses:

- Hypothesis 1: Students with higher levels of grit and self-efficacy will demonstrate more consistent study habits as recorded by a learning app.
- Hypothesis 2: More consistent study habits will be associated with higher academic test performance.

Methods

Participants

The participants were recruited from a cohort of third-year students at a four-year physical therapy college in Japan. As part of the curriculum prior to their clinical practicum, a total of 40 students in the grade were assigned a self-study task using a mobile learning app over the winter break. 37 out of 40 students provided informed consent for their learning logs to be used in this research. Consequently, the final study population consisted of these 37 third-year students (23 males, 14 females; mean age 21.1 $\pm$ 0.5 years). The participants received a thorough explanation of the study's aims and procedures and signed a consent form aligning with the ethical principles of the Declaration of Helsinki.

Learning App

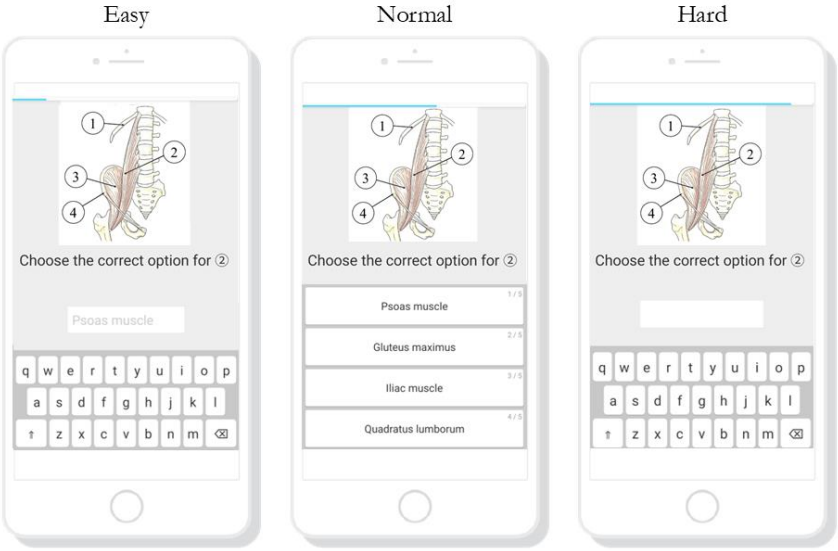
This study incorporated Monoxer, a learning application developed by Monoxer Inc. This app is designed to enhance long-term memory retention based on the principles of spaced repetition, retrieval practice (Weinstein et al., 2018), and the testing effect (Rowland, 2014). Learners can access the app on their smartphones or tablets and repeatedly complete 20 quizzes per session, with each session lasting only a few minutes. The short duration of each session promotes a flexible learning experience and motivates students to study during their spare time. The participants had been using Monoxer for approximately one and a half years when this study started. Specifically, they used Monoxer for out-of-class self-study as part of a flipped classroom approach in the required courses such as "Physical Therapy Assessment and Measurement" and "National Physical Therapist Examination Preparation".

Monoxer includes an adaptive learning function that integrates artificial intelligence (AI) to adjust the frequency and difficulty of quizzes according to each student's learning history, thereby optimizing memory retention. Figure 1 displays screenshots of Monoxer and illustrates examples of the adaptive learning function. The easiest difficulty level presents the quiz answer faintly on the screen, allowing for direct input to achieve a correct response. Upon consistent correct answers, the AI automatically increases the difficulty level. At the normal difficulty level, questions are presented in a multiple-choice format. The most challenging difficulty level requires users to provide answers through text input, as shown in the figure on the right.

In addition, Monoxer features a study planning function. For this function, teachers create the assignment quizzes and set the overall duration of the study plan. Following this setup, the app then automatically determines the number of quizzes to be memorized each day to enhance effective memorization over the specified period. As a learning log, the completion rate of assignments (CRA) is automatically recorded. The CRA reflects the daily achievement rate of

assigned tasks, indicating consistent study habits. For instance, if a student completes all the assignments of a 10-day study plan over ten consecutive days, their CRA will be 1.0. If these assignments were completed only five of those ten days, the CRA will be 0.5.

Figure 1.
Screenshots of Monoxer and example of the adaptive learning function



Procedure

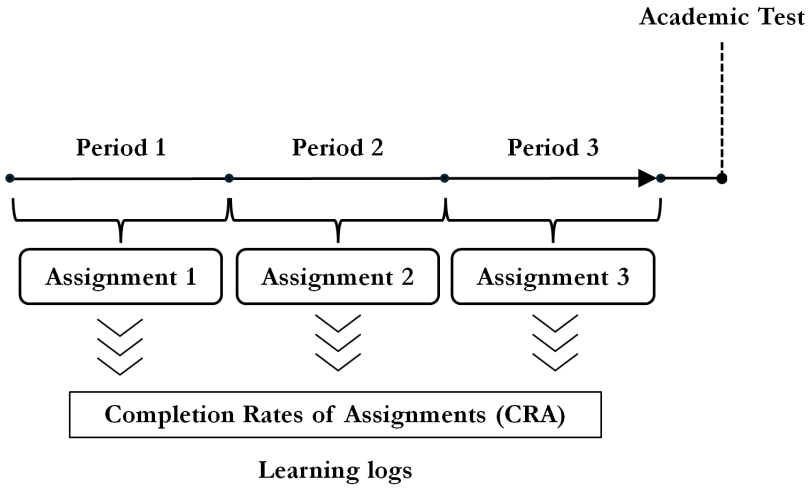
Assessment of Psychological Traits. In mid-December 2024, the participants completed the questionnaire survey to evaluate psychological traits, grit and self-efficacy. To assess students' grit, Japanese version of the Short Grit Scale (Grit-S) developed by Nishikawa et al. (2015) was used. The Grit-S consists of eight items divided into two factors: Perseverance of Effort (e.g., "I finish whatever I begin.") and Consistency of Interest (e.g., the reverse-scored "I often set a goal but later choose to pursue a different one."). All items were rated on a 5-point scale, with a maximum possible total score of 40. This scale has been validated against the original version of the Short Grit Scale (Duckworth & Quinn, 2009), confirming the same factor structure.

Self-efficacy was measured based on the academic self-efficacy scale by Nakanishi (2004). This scale addresses self-efficacy towards general learning aspects and is derived from the scale by Pintrich and De Groot (1990), which was translated into Japanese, with overlapping questions removed. Two primary modifications were made to the Nakanishi (2004) scale for the present study. First, the response format was changed from the original 9-point scale to a 4-point Likert scale. This modification was intended to reduce the cognitive load on participants and, by removing the neutral midpoint, to encourage a clearer indication of their self-efficacy beliefs. Second, one item from the original six-item scale was excluded. The removed item, "I think I study in an effective way," was judged to assess a student's perception of their current study strategies rather than the core concept of academic self-efficacy: a future-oriented belief in one's ability to understand upcoming course content and achieve good grades. This exclusion was intended to enhance the scale's construct validity by focusing solely on academic self-efficacy. Consequently, participants responded to the remaining five items on a 4-point scale. The items were: "If I set my mind to it, I think I can do well in my studies," "I think I can understand what is taught in college," "I think I can handle the questions and assignments given in class," "I think I can get good grades," and "I think I will be able to understand what will be taught in the upcoming classes."

Assignment Distribution and Collection of Learning Logs. In mid-December 2024, spanning the winter break until the academic test scheduled in early January 2025, self-study assignments were distributed over three periods (each lasting one week) via Monoxer. Participants engaged in mobile learning through Monoxer at their preferred times outside of classrooms to complete the assignments. The mean CRA was recorded throughout each of the three periods.

Figure 2 provides a flowchart of the assignment distribution and collection of learning logs. The academic test consisted of 100 multiple-choice questions aligned with the National Physical Therapy Examination, covering areas such as anatomy and kinesiology.

Figure 2.
Assignment distribution and collection of learning logs



Statistical Analysis. To analyze the data, we conducted a logistic regression analysis employing the forced entry method. The dependent variable was the CRA, categorized into "Having Study Habit (HSH)" (CRA ≥ 0.3) and "Not Having Study Habit (NHSH)" (CRA < 0.3). This threshold was determined to ensure a balanced distribution of participants into the two groups, approximating a median split of the sample. The independent variables were the cumulative GPA, which represents the average GPA from the first to the second year, Grit-S and self-efficacy scores. Furthermore, a correlation analysis was implemented to investigate the relationship between students' academic test scores and their CRA across all periods. The statistical software EZR was used for all analyses, and the significance level was set at 5%

Results

Table 1 shows the factor loadings and reliability of the Self-Efficacy Scale. The overall Cronbach's alpha for the scale was 0.885, indicating high reliability. All factor loadings for the five items were above 0.60 (ranging from 0.610 to 0.987), suggesting a robust relationship between each item and the underlying self-efficacy factor. The eigenvalue of the factor analysis was 3.064, which, being substantially greater than 1.0, supports the likelihood that the scale measures a single primary factor. The variance explained by this factor was 61.3%, a high proportion indicating that the extracted factor effectively captures the variance in the items, providing evidence for construct validity. Item-total correlations ranged from 0.610 to 0.870. These high correlations suggest that each item is strongly related to the overall scale score and that the items within the scale consistently measure the same underlying construct, indicating a high level of internal consistency. Although the chi-square test of model fit was statistically significant ($\chi^2 = 17.07$, df = 5, $p = .004$), suggesting that more than one factor might improve model fit, the high factor loadings and strong theoretical coherence of items justify the adoption of a single-factor model.

Table 1
Factor Loadings and Reliability of Self-Efficacy Scale

Item	Question	*M*	*SD*	Factor Loading	Uniqueness	Item-total correlation	Cronbach's α if item deleted
Q1	If I set my mind to it, I think I can do well in my studies	3.22	0.89	.610	.628	.610	.885
Q2	I think I can understand what is taught in college.	3.05	0.74	.850	.278	.677	.850
Q3	I think I can handle the questions and assignments given in class.	3.22	0.67	.640	.591	.640	.870
Q4	I think I can get good grades.	2.70	0.97	.766	.413	.731	.860
Q5	I think I will be able to understand what will be taught in the upcoming classes.	3.05	0.70	.987	.025	.870	.817

Overall Cronbach's α = .885, Eigenvalue = 3.064, Variance explained = 61.3%, $\chi^2(5) = 17.07$, $p = .004$

Table 2 presents the CRA by periods. While the mean CRA varied across the three periods, significant positive correlations ($p < .001$) were observed between the CRA of all individual periods.

Table 2
Completion Rates of Assignments (CRA) by Periods

	M	*SD*	1	2	3	4
1. CRA (period 1)	0.61	0.40	——			
2. CRA (period 2)	0.42	0.44	.80 *	——		
3. CRA (period 3)	0.28	0.39	.66 *	.76 *	——	
4. CRA (all periods)	0.44	0.36	.93 *	.91 *	.84 *	——

*$p < .001$

Table 3 provides the baseline characteristics of the HSH and NHSH groups. Regarding academic background, cumulative GPA, which represents the average GPA from the first to the second year, showed a significant difference between the groups ($p < .05$), with the HSH group having a higher average GPA (2.6 ± 0.5) compared to the NHSH group (2.3 ± 0.4). Moreover, the HSH group showed significantly higher scores in Grit-S and self-efficacy compared to the NHSH group ($p < .01$).

Table 3
Baseline Characteristics of the HSH and NHSH Groups

	HSH Group ($n = 21$) (CRA ≥ 0.3)	NHSH Group ($n = 16$) (CRA < 0.3)	*p*
CRA in all periods (SD)	0.69 (0.26)	0.10 (0.09)	
Females (%)	7 (33.3)	7 (43.8)	
Cumulative GPA (SD)	2.6 (0.5)	2.3 (0.4)	.020
Grit-S (SD)	28.0 (5.0)	23.0 (3.6)	.002
Self-efficacy (SD)	16.3 (2.4)	13.9 (3.8)	.003

Abbreviations: HSH = Having Study Habits; NHSH = Not Having Study Habits; CRA = Completion Rates of Assignments; Grit-S = Japanese version of Short Grit Scale

Table 4 illustrates the spearman rank correlation coefficients between independent variables and the dependent variable.

Table 4
Spearman Rank Correlation Coefficients Between Independent Variables and the Dependent Variable

	M	*SD*	1	2	3	4
1. CRA (all periods)	0.44	0.36	——			
2. Cumulative GPA	2.46	0.49	.49 **	——		
3. Grit-S	25.84	5.06	.45 **	.31	——	
4. Self-efficacy	15.24	3.29	.36 *	.37 *	.48 **	——

*$p < .05$ **$p < .01$

Table 5 presents the results of the logistic regression analysis. The overall model fit was significant ($p = .003$). After controlling cumulative GPA and self-efficacy, only Grit-S emerged as a significant positive predictor of study habits (p

= .038). Variance Inflation Factors (VIFs) for all three independent variables were below 5.0, suggesting low multicollinearity.

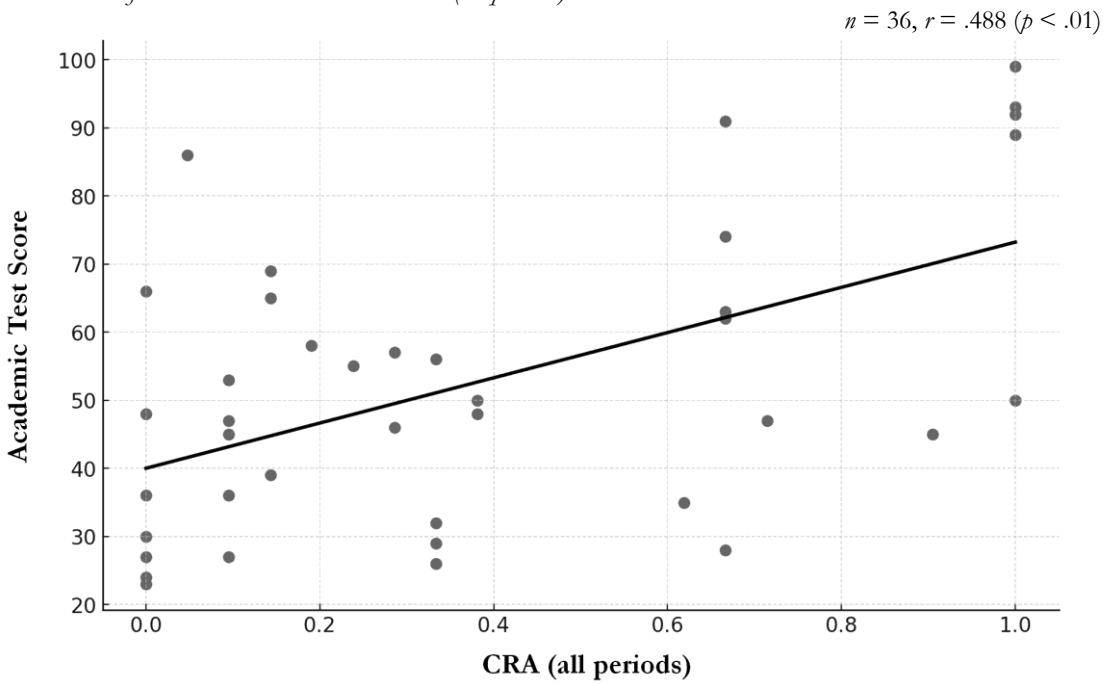
Table 5
Results of the Logistic Regression Analysis

Independent Variables	Odds Ratio (OR)	95% Confidence Interval (CI)	*p*	VIF
Cumulative GPA	4.92	0.612 – 39.60	.134	1.06
Grit-S	1.24	1.01 - 1.53	.038	1.12
Self-efficacy	1.08	0.81 - 1.43	.617	1.18

Analysis of Deviance: $p = .003$

Figure 3 shows the scatter plot of academic test score versus CRA across all periods. One participant was absent for the test, resulting in analysis sample of 36. A positive correlation was observed between academic test score and CRA ($r = .488$, $p < .01$).

Figure 3.
Scatter Plot of Academic Test Score vs. CRA (all periods)



Discussion and Conclusion

This study investigated the relationship between psychological traits—grit and self-efficacy—and study habits, operationalized as engagement with a mobile learning app, among Japanese physical therapy students. As hypothesized, students who demonstrated more consistent study habits exhibited significantly higher levels of both grit and self-efficacy. The logistic regression analysis revealed that after controlling for cumulative GPA and self-efficacy, only grit (Grit-S) emerged as a significant positive predictor of consistent study habits. This finding suggests that while self-efficacy may play a role in academic engagement, grit appears to be a more direct and influential factor in driving consistent app-based learning. Furthermore, a positive correlation was observed between overall learning app engagement and academic test scores, supporting our hypothesis that consistent study habits, as captured by app usage, are associated with better academic performance.

Although the current study operationalized study habits as a consistent pattern of daily learning activity, previous research has often employed study time, also reflecting consistent daily learning, typically defined as the duration spent

studying and often measured by questionnaire surveys. A variety of factors influence students' study time in higher education. For instance, Plant et al. (2005) reported that students who typically study in quiet environments such as libraries tend to exhibit shorter study times. This finding suggests that efficient learning in focused settings can lead to a reduction in the overall duration of study. Moreover, Nonis & Hudson (2010) found a significant association between study time and scheduling abilities, defined as the practice of scheduling regular review periods. Consequently, future research should consider incorporating these environmental aspects and individual learning strategies as variables in addition to psychological traits to investigate factors influencing consistent study habits. Another important direction for future research is to investigate study habits longitudinally, as past study time can be a factor that influences future study time.

Previous studies have used path analysis to examine a model where self-efficacy mediates the relationship between grit and learning engagement. Derakhshan and Fathi (2024) investigated the relationships among online learning self-efficacy (OLSE) (Zimmerman & Kulikowich, 2016), domain-specific grit in second/foreign language learning, online learning engagement, and foreign language enjoyment (FLE) in Iranian English as a foreign language learners. Using structural equation modeling, their findings showed a significant positive effect of OLSE on online learning engagement and indicated that grit indirectly affected online learning engagement through the mediation of OLSE. They suggested that a lack of confidence in online contexts might lead to low learning engagement even among learners with higher grit. Although our study did not conduct a mediation analysis due to the limited number of participants, future research should explore whether self-efficacy mediates the relationship between grit and engagement with learning apps in mobile learning environments.

A key contribution of our study is its objective measurement of study habits through students' learning logs, allowing us to avoid bias from subjective evaluations. Moreover, this study suggests the potential for grit to play a significant role in the study habits of physical therapy students within a mobile learning environment. This finding should be considered in the design of future educational programs integrating a mobile app. The limitations of our research were the limited number of participants and the exclusive focus on physical therapy students. Therefore, to enhance the generalizability of the findings, future research should examine a wider population of students, including those from other healthcare disciplines.

References

Alhadabi, A., & Karpinski, A. C. (2020). Grit, self-efficacy, achievement orientation goals, and academic performance in University students. *International Journal of Adolescence and Youth*, *25*(1), 519–535.

Artino, A. R. (2012). Academic self-efficacy: from educational theory to instructional practice. *Perspectives on Medical Education*, *1*(2), 76–85.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Advances in Behaviour Research and Therapy*, *1*(4), 139–161.

Bandura, A., Barbaranelli, C., Caprara, G., & Pastorelli, C. (1996). Multifaceted impact of self-efficacy beliefs on academic functioning. *Child Development*, *67*(3), 1206–1222.

Calo, M., Judd, B., Chipchase, L., Blackstock, F., & Peiris, C. L. (2022). Grit, Resilience, Mindset, and Academic Success in Physical Therapist Students: A Cross-Sectional, Multicenter Study. *Physical therapy*, *102*(6), pzac038.

Crompton, H., & Burke, D. (2018). The use of mobile learning in higher education: A systematic review. *Computers & Education*, *123*, 53–64.

Derakhshan, A., & Fathi, J. (2024). Grit and foreign language enjoyment as predictors of EFL learners' online engagement: The mediating role of online learning self-efficacy. *The Asia-Pacific Education Researcher*, *33*(4), 759–769.

Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: perseverance and passion for long-term goals. *Journal of Personality and Social Psychology*, *92*(6), 1087–1101.

Duckworth, A. L., & Quinn, P. D. (2009). Development and validation of the short grit scale (grit-s). *Journal of Personality Assessment*, *91*(2), 166–174.

Duckworth, A., & Gross, J. J. (2014). Self-Control and Grit: Related but Separable Determinants of Success. *Current Directions in Psychological Science*, *23*(5), 319–325.

Elias, S. M., & MacDonald, S. (2007). Using past performance, proxy efficacy, and academic self-efficacy to predict college performance. *Journal of Applied Social Psychology*, *37*(11), 2518–2531.

Honicke, T., & Broadbent, J. (2016). The influence of academic self-efficacy on academic performance: A systematic review. *Educational Research Review*, *17*, 63–84.

Iqbal, J., Asghar, M. Z., Ashraf, M. A., & Yi, X. (2022). The impacts of emotional intelligence on students' study habits in blended learning environments: The mediating role of cognitive engagement during COVID-19. *Behavioral Sciences*, *12*(1), 14.

Kearney, M., Schuck, S., Burden, K., & Aubusson, P. (2012). Viewing mobile learning from a pedagogical perspective. *Research in Learning Technology*, *20*.

Kojima, S., Mitani, M., & Ishikawa, A. (2011). Development of an E-learning resource on mobile devices for kinesiology: A pilot study. *Journal of Physical Therapy Science*, *23*(4), 667–672.

Lam, K. K. L., & Zhou, M. (2022). Grit and academic achievement: A comparative cross-cultural meta-analysis. *Journal of Educational Psychology*, 114(3), 597–621.

Miller-Matero, L. R., Martinez, S., MacLean, L., Yaremchuk, K., & Ko, A. B. (2018). Grit: A predictor of medical student performance. Education for Health (Abingdon, England), 31(2), 109–113.

Montas, M., Rao, S. R., Atassi, H. A., Shapiro, M. C., Dean, J., & Salama, A. R. (2021). Relationship of grit and resilience to dental students' academic success. *Journal of Dental Education*, *85*(2), 176–186.

Motiwalla, L. F. (2007). Mobile learning: A framework and evaluation. *Computers & Education*, *49*(3), 581–596.

Nakanishi, Y. (2004). Seikou/Shippai no Houryaku Kizoku ga Jiko Kouryoku Kan ni Ataeru Eikyou (in Japanese) [Effects of strategy attribution for success/failure on self-efficacy], *The Japanese Journal of Educational Psychology*, *52*(2), 127–138.

Nishikawa, K., Okugami, S., & Amemiya, T. (2015). Nihonban Short Grit Shakudo (Grit-S) no Sakusei (in Japanese) [Development of the Japanese Short Grit Scale (Grit-S)], *The Japanese Journal of Personality*, *24*(2), 167–169.

Nonis, S. A., & Hudson, G. I. (2010). Performance of College Students: Impact of Study Time and Study Habits. *Journal of Education for Business*, *85*(4), 229–238.

Pate, A. N., Payakachat, N., Harrell, T. K., Pate, K. A., Caldwell, D. J., & Franks, A. M. (2017). Measurement of grit and correlation to student pharmacist academic performance. *American Journal of Pharmaceutical Education*, *81*(6), 105.

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology, 82*(1), 33–40.

Plant, E. A., Ericsson, K. A., Hill, L., & Asberg, K. (2005). Why study time does not predict grade point average across college students: Implications of deliberate practice for academic performance. *Contemporary Educational Psychology*, *30*(1), 96–116.

Rowland, C. A. (2014). The effect of testing versus restudy on retention: a meta-analytic review of the testing effect. *Psychological Bulletin*, *140*(6), 1432–1463.

Stinebrickner, R., & Stinebrickner, T. R. (2004). Time-use and college outcomes. *Journal of Econometrics*, *121*(1), 243–269.

Weinstein, Y., Madan, C. R., & Sumeracki, M. A. (2018). Teaching the science of learning. *Cognitive Research: Principles and Implications*, *3*(1), 2.

Wolters, C. A., & Hussain, M. (2015). Investigating grit and its relations with college students' self-regulated learning and academic achievement. *Metacognition and Learning. 10*, 293–311.

Zimmerman, B., Bandura, A., & Martinez-Pons, M. (1992). Self-motivation for academic attainment: The role of self-efficacy beliefs and personal goal setting. *American Educational Research Journal*, *29*(3), 663–676.

Zimmerman, W. A., & Kulikowich, J. M. (2016). Online learning self-efficacy in students with and without online learning experience. *The American Journal of Distance Education*, *30*(3), 180–191.