RESEARCH

Measurement of Grit and Correlation to Student Pharmacist Academic Performance

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Objective. To describe grittiness of students from three pharmacy schools and determine if grit is associated with academic performance measures.

Methods. Pharmacy students completed an electronic questionnaire that included the Short Grit Scale (Grit-S). Associations were determined using logistic regression.

Results. Grit-S total score was a significant and independent predictor for participants who reported a GPA ≥ 3.5, and Consistency of Interest (COI) and Perseverance of Effort (POE) domain scores were significantly higher compared to participants with a GPA of 3.0-3.49. Participants reporting a D or F had slightly lower average total Grit-S scores and COI domain scores compared to participants who did not. In addition, the group who reported a GPA < 3.0 had lower scores in the POE domain compared to those with a GPA of 3.0-3.4.

Conclusion. Grittiness may be associated with student pharmacist academic performance and the Grit-S Scale may have substantive implications for use in pharmacy programs.

Keywords: grit, academic performance, effort, perseverance, interest

INTRODUCTION

The Accreditation Council for Pharmacy Education (ACPE) Standards 2016 underscore the importance of assessing academic performance throughout the pharmacy program, including monitoring of progression and attrition rates. Compared to previous iterations, both the Standards 2016 and Center for the Advancement of Pharmacy Education (CAPE) Outcomes 2013 also place more emphasis on noncognitive factors, especially the personal and professional development of student pharmacists in Doctor of Pharmacy (PharmD) degree programs. Specifically, Domain 4 of CAPE Educational Outcomes and ACPE Standard 4.1 maintain that pharmacy graduates must exhibit metacognitive skills to demonstrate self-awareness of their own strengths and limitations, as well as persistence and flexibility in a wide variety of environments. ACPE Standard 16.7 affirms that schools also must give consideration to these qualities in the admissions processes. Consequently, colleges and schools now are seeking to identify best approaches to measure not only academic factors, but such noncognitive skills upon admission and throughout the pharmacy program.

Associations between a variety of noncognitive factors and academic success have been described in the literature as early as 1984 by Sedlacek and colleagues, and the resultant implications for admissions decisions have been substantially developed over the decades. Grit is one such noncognitive factor, or trait, being discussed broadly across many education genres and in the mainstream media. It has been defined as “perseverance and passion for long-term goals” by Duckworth and colleagues. Grit involves long-term stamina, enabling individuals to work strenuously toward aims over years. Individuals displaying high levels of grit (“gritty”) maintain effort and interest in reaching goals even in the face of significant setbacks. Through their research, Duckworth and Quinn developed and validated a self-reported, self-administered, written survey to measure grit, which takes less than five minutes to complete (Short Grit Scale, Grit-S). This scale has been used repeatedly and has been shown to predict successful outcomes independent of intelligence measures (ie, IQ) in a number of
specific adult and adolescent populations. Collectively, several studies\textsuperscript{14,16,17} have consistently, with the exception of one,\textsuperscript{18} shown that grittier individuals attain higher levels of education, higher measures of academic performance, higher levels of retention, and make fewer career changes.\textsuperscript{14} It also is interesting to note that grit appears to increase with age, while still preserving variability among individuals,\textsuperscript{14} possibly indicating that grit is not a fixed trait.

Given the body of evidence in broader populations, grit is now garnering attention and being researched in medical and health care professional training. A review of the literature revealed a small number of studies in medical residents and nursing students that assessed the utility of grit across multiple demographic and other individual characteristics.\textsuperscript{19-22} In general, the conclusions were that among medical residents grit could be considered as a marker and risk factor for attrition,\textsuperscript{19} and for nursing students there was a correlation between grit and course engagement.\textsuperscript{21} Another common finding was that grit scores did not necessarily correlate with standardized test scores.\textsuperscript{20,21}

Grit also has been evaluated in other situations that may be applicable to pharmacy education, students with mental health issues, and in the admissions process. One study among medical residents concluded that measuring grit may assist in the identification of those who are at greatest risk for certain mental health issues.\textsuperscript{22} Another study looked at the potential use of grit in the admissions process, in which program administrators stated that using grit as part of the interview process was particularly useful, perhaps even more so than other standardized test scores, including the Graduate Record Exam (GRE).\textsuperscript{23} In both medical and pharmacy education, there have been calls for a more holistic approach to the admissions process.\textsuperscript{24,25} Ray and Brown recommend evaluating grit and other “soft skills” in order to generate more diverse cohorts of students without compromising quality. This recommendation is echoed by the American Association of Colleges of Pharmacy’s (AACP) Special Committee on Admissions in their white paper, Developing a Diverse Workforce to Meet the Health-Care Needs of an Increasingly Diverse Society.\textsuperscript{25}

In addition to effects on admissions, attrition, and mental health, researchers are attempting to define how and if grit can be enhanced and improved.\textsuperscript{26} One promising avenue of research involves application of Carol Dweck’s “growth mindset.” Dweck’s research has found that a person’s perception of intelligence, fixed versus growth, can predict performance. Specifically, those who believe that they can improve and develop their intelligence “growth mindset” consistently outperformed those who thought intelligence was fixed.\textsuperscript{27} Using this idea of changing one’s mindset to improve performance may be similar to developing grit, although no research has been conducted to explore linking the two.

Based on an examination of existing literature, no published research has established a correlation between grit and academic performance in pharmacy students to date. Because students admitted to professional schools inherently have attained measures of academic success, it is unknown whether grit can predict academic success in this group. The majority of studies in health care professionals have focused on grit and academic factors, and so the purpose of this study was to measure grit and determine if there is a correlation between grit and academic performance specifically among pharmacy students. Based on previous research and the assumption that grittier students would contribute more effort to schoolwork we hypothesized that participants who had a D or F in their pharmacy curriculum would have a lower Grit-S score than the group who did not. We also hypothesized that Grit-S domain and total scores were independent predictors of participants who had high academic performance measured by self-reported cumulative GPA in their pharmacy curriculum.

**METHODS**

This study was a cross-sectional, self-administered electronic survey study, which was conducted in three public colleges of pharmacy in the US South-Central region between September 2015 and October 2015. The survey was delivered to all student pharmacists in professional years 1 through 4 (P1 to P4) using the global e-mail listserv or paper administration at each college by site investigators. The personalized e-mail described the study objectives and provided site investigators’ contact information and a link to the electronic survey. Two reminder e-mails were sent at one week and two weeks after the first announcement e-mail. All participation was anonymous and voluntary, and all data were collected in a de-identified manner. Aggregate, de-identified data were exported to and stored within the investigators’ encrypted, password-protected computers in a locked office for analysis. Only investigators had access to the data. No incentive was provided for participation. The study was approved by the institutional review board at each study site. We determined that a sample of at least 306 students was needed to be representative of the total student population at the three schools.

The 22-item survey was comprised of three parts, including demographics, previous and current academic performance, and the Grit-S instrument. The 8-item Grit-S was designed to measure trait-level perseverance and passion for long-term goals.\textsuperscript{15} The Grit-S has a 5-response Likert option for each item. The maximum possible score
on the scale is 5 (extremely gritty), and the lowest possible score on the scale is 1 (not at all gritty). Four items of the Grit-S instrument were reverse coded (ie, “very much like me” scored as 1 rather than 5, and “not like me at all” scored as 5 rather than 1, etc.) in the manner of Duckworth and Quinn to create a consistent scoring method across all items, resulting in higher scores representing higher grittiness. These scale scores were not visible to study participants, and this process has no impact on reliability or validity of the scale. The Grit-S offers two domain scores, including Consistency of Interest (four items) and Perseverance of Effort (four items), and a total score. Table 1 shows the details of scoring and subdomain components. The total score was calculated by summing all eight items and dividing by 8. Each domain score was calculated by summing all four domain items and dividing by 4. The survey took approximately 5 minutes to complete.

Descriptive statistics were generated for all participants and for each site. We then compared the study sample to the population of the three study sites using Chi-square or t-test statistics where appropriate. Psychometric testing was conducted to ensure validity of the Grit-S in our sample. Internal consistency of Grit-S was calculated using Cronbach’s alpha. Confirmatory factor analysis (CFA) was conducted to evaluate construct validity of the two subscales of Grit-S. Acceptable model fit indices (CFI) was conducted to evaluate construct validity of the Grit-S in our sample. Internal consistency of Grit-S was calculated using Cronbach’s alpha. Confirmatory factor analysis (CFA) was conducted to evaluate construct validity of the two subscales of Grit-S. Acceptable model fit indices (CFI) >0.9; Standardized Root Mean Squared Index (CFI) >0.9; Standardized Root Mean Squared Residual (SRMR) <0.08; and Root Mean Squared Error of Approximation (RMSEA) <.05.28,29 Difference of Grit-S scores among the three study sites was explored using analysis of variance (ANOVA). Tukey HSD pairwise comparisons were used to investigate Grit-S scores if ANOVA revealed any score difference among three study sites. A two-tailed t-test statistic was used to determine whether Grit-S scores were lower among participants with a D or F in their pharmacy curriculum. Multinomial logistic regression was conducted to examine whether Grit-S domain and total scores predicted academic performance as measured by self-reported cumulative pharmacy GPA as well as to explore other demographics that might be associated with Grit-S scores, controlling for cluster effects from different study sites. Relative-risk-ratios (RR) were reported. Statistical significance was set a-priori at a p value of .05. All statistical analyses were conducted in Stata/SE 14.1 (StatCorp LP, College Station, TX).

RESULTS

A total of 724 student pharmacists participated in the study. Site response rates varied from 39% (n=152 out of 390) to 71% (n=317 out of 445), with an overall response rate of 55%. The majority were reported age <25 years (72%), female (69%) and white (85%). Ninety-one percent of the participants pursued pharmacy as their first career. Thirty percent of participants were P1 students. P2, P3, and P4 students comprised 20%, 30.5%, and 19.5% of the total cohort, respectively. Approximately 15% of respondents reported having a D or F in their pharmacy career. More than one-third of the participants reported a cumulative GPA of ≥3.5 in their pharmacy curriculum. Table 2 presents demographics of the participants. The study sample’s demographics were comparable to the population of the

### Table 1. Grit-S Subscales and Scoring

| Items                                                                 | Response Option and Scoring |
|-----------------------------------------------------------------------|----------------------------|
| **Consistency of Interest**                                           |                            |
| New ideas and projects sometimes distract me from previous ones.      | 1=Very much like me; 2=Mostly like me; 3=Somewhat like me; 4=Not much like me; 5=Not like me at all |
| Setbacks don’t discourage me.                                         |                            |
| I often set a goal but later choose to pursue a different one.        |                            |
| I have difficulty maintaining my focus on projects that take more than a few months to complete. |                            |
| **Perseverance of Effort**                                           |                            |
| I have been obsessed with a certain idea or project for a short time but later lost interest. | 1=Very much like me; 2=Mostly like me; 3=Somewhat like me; 4=Not much like me; 5=Not like me at all |
| I finish whatever I begin.                                            |                            |
| I am diligent.                                                        |                            |
| I am a hard worker.                                                   |                            |
Table 2. Participant Demographics

| Participants          | n  | %   |
|-----------------------|----|-----|
| College A             | 255| 35.2|
| College B             | 152| 21.0|
| College C             | 317| 43.8|
| Age (years)           |    |     |
| <25                   | 527| 71.8|
| 25-29                 | 154| 21.0|
| >29                   | 53 | 7.2 |
| Race (%)              |    |     |
| White                 | 621| 84.9|
| Non-white             | 110| 15.1|
| Highest level of education prior to entering pharmacy school | | |
| No degree or associate degree | 423| 58.3|
| Bachelor’s degree     | 283| 39.0|
| Master or higher degree | 20 | 2.7 |
| Current student status|    |     |
| P1                    | 223| 30.8|
| P2                    | 145| 20.0|
| P3                    | 215| 29.7|
| P4                    | 141| 19.5|
| Self-reported GPA in pharmacy curriculum | | |
| <3.0                  | 127| 20.6|
| 3.0-3.49              | 200| 32.5|
| ≥3.5                  | 194| 31.6|
| Decline to answer     | 94 | 13.3|
| Self-reported received D or F in pharmacy curriculum | | |
| Yes                   | 105| 14.5|
| No                    | 617| 85.5|

The number might be different from 734 due to missing data

Table 3. Comparative Analysis of Sample Population

|                          | Population (n=1,196) | Study (n=724) | p value |
|--------------------------|----------------------|---------------|---------|
| Female (%)               | 61                   | 69            | <.001   |
| White (%)                | 81.4%                | 85            | ns      |
| No degree or associate degree prior to entering pharmacy school (%) | 54% | 58 | ns |
| Average age              | 24.5                 | 24.3          | ns      |
| Average GPA              | 3.26                 | 3.30          | ns      |

ns = not significant

three study sites in terms of age, race, educational degree prior to entering pharmacy school, and current cumulative GPA (Table 3). However, the study sample comprised of more female participants than the population (69% vs 61%, p<.001).

The Grit-S instrument demonstrated acceptable reliability in our sample with Cronbach’s alpha of .73. The CFA confirmed construct validity of the Grit-S in this sample as both domains had significant factor loadings from the domain items (p<.001). The CFA model of Grit-S also yielded excellent model fit indices (CFI=.98; SRMR=.024; RMSEA=0.034). Based on the total participants in the study, we achieved 76% power to detect a difference with 95% confidence.

Table 4 shows the aggregate mean total Grit-S score from the three study sites was 3.7 (SD=0.5). There was no difference in Grit-S scores from individual study sites. The Consistency of Interest and Perseverance of Effort domain scores averaged 3.4 (SD=0.7) and 4.0 (SD=0.5), respectively. Participants who reported having a D or F in their pharmacy curriculum had lower Grit-S score when compared with the participants who did not (3.6 vs 3.7, p=.057), but it did not reach statistical significance. However, we found that the Consistency of Interest domain scores were significantly lower among participants who reported having D or F when compared with participants who did not (3.2 vs 3.4, p=.033). No significant difference was found between the two groups on the Perseverance of Effort domain scores. Additionally, when controlled for age, gender, GPA, and PCAT we found that Grit scores decreased in P2 and P3 year, compared to P1 (p=.022 and .014, respectively). No difference was found between P1 and P4.

Figure 1 presents factors associated with academic achievement measured by self-reported current GPA in pharmacy program. As we hypothesized, the Grit-S total score was a significant and independent predictor for the participants who reported their GPA of $\geq 3.5$ (RR=1.8, 95% CI of 1.5-2.3) when compared with participants with GPA 3.0-3.49, controlled for age, gender, race, and previous degree. However, Grit-S total scores were not significantly different between the group that reported GPA $<3.0$ and GPA 3.0-3.49. We also found that the Grit-S Consistency of Interest and Perseverance of Effort domain scores were significantly higher in the group with a reported GPA $\geq 3.5$ (RR=1.8, 95% CI of 1.5-2.3) when compared with participants with GPA 3.0-3.49, controlled for age, gender, race, and previous degree. However, Grit-S total scores were not significantly different between the group that reported GPA $<3.0$ and GPA 3.0-3.49. In addition, the group who reported a GPA $<3.0$ had
significantly lower scores on the Grit-S Perseverance of Effort domain (RR = 0.7, 95% CI of 0.6-0.8) when compared with the group with a GPA 3.0 to 3.49.

**DISCUSSION**

This is the first multi-center research study to describe an association between grit and academic performance in student pharmacists. Results confirmed the research hypothesis that Grit-S score was an independent predictor of high academic performance, defined as self-reported GPA ≥ 3.5. In addition, high performing students had high scores in both Grit-S domains (Consistency of Interest and Perseverance of Effort). Low performing students in contrast showed lower scores in both domains, but to a statistically significant degree in the Consistency of Interest domain score. Although we did

|                          | Total Sample | No D or F | Received D or F | p value<sup>a</sup> |
|--------------------------|--------------|-----------|----------------|---------------------|
| **Grit-S<sup>b</sup>**   | 705          | 3.7 (0.5) | 600            | 3.7 (0.5)           | 100          | 3.6 (0.6)     | .057          |
| Consistency of Interest<sup>c</sup> | 710          | 3.4 (0.7) | 603            | 3.4 (0.7)           | 102          | 3.2 (0.8)     | .033          |
| Perseverance of Effort<sup>c</sup> | 712          | 4.0 (0.5) | 606            | 4.0 (0.5)           | 101          | 3.9 (0.6)     | .091          |

<sup>a</sup> Two-tailed t-test was conducted to compare score differences between students who reported receiving D or F and students who did not.

<sup>b</sup> Grit-S total scores were calculated by summing all eight items and dividing by 8, which range from 1 (low grittiness) to 5 (high grittiness).

<sup>c</sup> Grit-S domain scores were calculated by summing all four items in the domain and dividing by 4, which range from 1 (low grittiness) to 5 (high grittiness).

![Figure 1. Grit-S and Subscales as Predictors of GPA](image-url)

Figure 1. Grit-S and Subscales as Predictors of GPA

<sup>a</sup> Multinomial logistic regression was conducted to determine associations of the Grit-S scores (total scores and the two domains scores) in different GPA groups, controlling for previous education level. The group reported GPA of 3.0-3.49 was used as a reference. RR = Relative-risk-ratios

95% Confidence intervals (CI) were calculated using standard errors adjusted for clustering effects of study sites.
not find a statistically significant difference in the overall Grit-S scores between students who reported receiving a D or F and those who did not, we found that students who reported receiving a D or F scored significantly lower on the Grit-S Consistency of Interest domain than the group who did not. These findings may have substantive implications for pharmacy education in a variety of areas.

The positive correlation found in this research provides the foundation that will hopefully allow pharmacy programs to further evaluate and define the potential application of grit in pharmacy education. Our findings provide an initial interest in the ability to utilize grit in admissions as part of achieving Standard 16.7, helping schools get a more holistic view of a candidate measuring the non-cognitive trait domain. Specifically it may be a useful admissions criterion to identify if a weaker candidate based on objective measure (PCAT, GPA) will make up for deficiencies with outstanding non-cognitive performance as called for by the AACP Special Committee on Admissions. Current pharmacy education research in this area has identified the Multiple Mini Interview (MMI) as one of the most promising noncognitive measurement tools for use in admissions, but this is a resource and time intensive tool. Other non-cognitive tools including the Non-Cognitive Questionnaire, Selection for Medicine (MOR), etc. are available and have been written about, but formal research in academic pharmacy is lacking. Applications as those described by Powell suggest grit can play a role in admissions decisions and subsequently increase the diversity of a student population. Although a theoretical role for grit in admissions is plausible, the authors contend that caution and thoughtful consideration must be used utilizing this scale in these important decisions, and with such a dearth of formal evidence authors are not advocating for wholesale adoption or weighting in the admissions process.

Several factors may affect a student’s potential to succeed in the pharmacy curriculum and their subsequent professional career. Research in pharmacy on predictors of academic performance and success or struggle are varied and mostly come from single site studies. These studies have found previous 4-year degree, location of prepharmacy coursework, math/science GPA, age, MMI score, gender, SAT verbal score, PCAT score, and repeating pharmacy and prepharmacy coursework (ie, making a D or F) as predictors of success or failure at respective institutions. Based on these findings, grit potentially could be added to this list of predictors. Applying the theoretical model relating thinking and self-control to pharmacy education would suggest that identified objective predictors of success/failure are really measuring separate constructs of intelligence (PCAT, SAT verbal score, etc.) and self-control (previous bachelor’s degree, GPA, etc.). Grit is one of many potential tools that may help schools further evaluate and clarify the self-control or non-cognitive domain of students.

An additional promising application of grit is using it for identification of at-risk students for early intervention programs and attempting to increase the grittiness of these at-risk students to hopefully decrease attrition rates and help them be successful. In light of findings from one single site study that students making a D or F in a pharmacy course had a 23% lower first-time pass rate on the NAPLEX, serious consideration with regards to assisting and early identification of these students during the pharmacy curriculum is warranted. Given that one of the significant findings from this research was that low performing students’ Consistency of Interest score is more associated with poor performance than the Perseverance of Effort score, there is potential that at-risk students ultimately have the perseverance to succeed, but lose focus during a semester or year of pharmacy school. Anecdotally, many educators have witnessed and can agree with this assertion regarding student interest. Our results also hint at this, finding a difference in grit when analyzed based on year in pharmacy school, which may be indicative of this change in interest. But limited conclusions can be made because of the research methods utilized in this study. Hastings’ and colleagues’ work also supports the hypothesis that student motivation changes during the course of a pharmacy curriculum. This change in motivation/interest may provide an opportunity to utilize grit, specifically the Consistency of Interest scale, to identify students at risk and allow faculty members to help these students before they fail.

Lastly, the authors believe grit has potential as a meta-cognitive tool to encourage student self-reflection. Given the increased emphasis on student self-awareness and increasing importance of noncognitive factors, Grit-S seems to be a logical and easy to administer assessment tool that may help schools meet CAPE outcomes and ACPE Standards. Many student pharmacists’ only academic goal thus far may have been to gain admission into pharmacy school, which provides an opportunity after admission to frame a self-reflection conversation around redirecting long-term goals, consistency of interest, and grit. A potential example of this type of activity can be found in Duckworth’s book, Grit: The Power of Passion and Perseverance. This activity specifically relates to interests and creating goals using a goal hierarchy, which may help students establish more concrete plans to be a “successful” student and ultimately pharmacist. Faculty members could assist students in creating and aligning larger goals with smaller concrete ones needing to be
accomplished in order to achieve these larger goals. Helping students create a goal hierarchy and identify the foundational steps necessary to achieve these goals (ie, successful completion of pharmacy school, etc.) could decrease “positive fantasizing” about becoming a pharmacist.49 We believe this is an area with great potential regarding future research and hope that many other metacognitive activities utilizing grit will be developed to improve student success, with subsequent research findings disseminated within the Academy.

**Strengths and Limitations**

The strengths of this study include being a multicenter study, using a validated survey instrument, and having a relatively large sample size of more than 700 student pharmacists. This sample size allowed us to conduct factor analysis to confirm psychometric properties of the Grit-S in this population. The limitations of this study include having a small number of D/F students for comparison, inherent biases with self-reporting data, and moderate overall response rate. While age, race, average GPA, and previous degree status of participants did not differ from the overall student population at the three schools, female students were overrepresented in the study. We believe that the results of this study represented pharmacy students from three study sites, but generalizability may be limited for pharmacy students in different regions or in private institutions. Additionally, progression GPA requirements were not consistent at all schools; two have a 2.0 requirement to progress while one has a fluctuating requirement based on year in school ranging from 2.0 to 2.75, which may have affected results. Although our results showed that Grit-S scores predicted high academic performance of pharmacy students, foreseeable challenges may occur when applying Grit-S in pharmacy education. One such challenge is that the scale is relatively transparent, and if used in admissions decisions one cannot exclude the possibility of candidates selecting the socially desirable “right” answers rather than answering the scale truthfully. Lastly, the authors recognize that associations found between Grit-S scores and academic performance are temporal due to the cross-sectional study design. Future research using a cohort study design to confirm our findings is warranted.

**CONCLUSION**

Grit-S has the potential to be used in multiple areas to help define non-cognitive factors associated with success including, but not limited to, admissions, early alert/intervention programs after admission, or as a metacognitive tool for student development. Grit-S also has the potential for application in many other areas including generational research, faculty development, preventing burnout, Dweck’s fixed vs growth mindset, and pharmacy residency education that are beyond the scope of this article. This topic is one that warrants further research, and the authors look forward to the evolution and applications of grit in pharmacy education.

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