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The Role of Grit in Determining Engagement and Academic Outcomes for University Students

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Abstract The concept of grit as described by Duckworth (Journal of personality and social psychology 92:1087, 2007) has captured the attention of educators and researchers alike. A measure of a student's ability to effortfully persist in the face of struggle, grit is proposed to be an important characteristic required for students to succeed academically (Duckworth in Journal of personality and social psychology 92:1087, 2007). Some evidence suggests that grit has a positive relationship with a range of academic outcomes, and yet others argue that grit offers little in terms of predictive value for understanding academic outcomes. In addition, there is conflicting evidence about the presence of gender differences in grit, and very little research around the role of being the first member of the family to attend university in the development of grit. In order to address conflicting findings about the importance and correlates of grit, and to explore the role of engagement in the relationship between grit and academic outcomes, a cross sectional survey study was conducted. The current research measured grit, engagement and academic productivity among 395 Australian university students. Findings suggest that there is no difference in grit between genders, although this cannot be concluded with certainty due to a large imbalance of male to female participants. It also appeared that being the first in family to attend university was associated with an increased level of the grit factor 'effort'. There was a positive relationship between grit, engagement and academic productivity. Further analysis revealed that engagement mediated the relationship between grit and productivity,

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suggesting that a person with higher grit is more likely to have higher engagement, and that engagement leads to greater academic productivity. These findings highlight the relevance of grit as a desirable student characteristic, and the importance of engagement in the grit-productivity relationship.

Keywords Grit · Engagement · Student · Grades · First in family

Introduction

Angela Duckworth has become celebrated for her exploration of a personality characteristic she calls grit. Grit is defined as the ability to effortfully persist in the face of struggle (Duckworth 2007). It has two elements, an interest element, capturing the ability to maintain interest, and an effort element, which captures the broader concept of persistence and effort (Duckworth 2009; Duckworth 2007). Grit attempts to capture the ideas of resilience, conscientiousness, self-control and perseverance in one measure, concepts that have previously been argued to be central to academic success (Bashant 2014). Resilience, within the academic context, has been defined as "the process of, capacity for, or outcome of successful adaption despite challenging or threatening circumstances," which is considered an important component driving success in students (Martin 2002). The personality dimension of conscientiousness is generally thought to be a relatively fixed characteristic, though there is ongoing contention regarding this matter (p. 41; Mischel 2013), discussion of which is beyond the scope of this project. Conscientiousness includes the ideas of dependability and being hardworking and has been shown to have a strong positive relationship with academic outcomes (Barrick 1991). Self-control captures the "capacity to regulate attention, emotion and behaviour in the presence of temptation" (Duckworth 2014, p. 1). Perseverance, alternatively referred to as persistence, has been defined as an individual's ability to continue to apply effort with a difficult task (Lufi 1987). Some research suggests that grit is an important trait which has links to success within a broad range of academic settings (Bowman 2015; Cross 2014; Duckworth 2007; Fillmore 2015; Gorman 2015; Ryan 2015; Wolf 2015). Other authors suggest that grit has no real value in terms of predicting academic outcomes (Bazelais 2016; Ivcevic 2014; Stewart 2015; Wolf 2015; Wolters 2015). These studies are briefly reviewed below. Clearly, further research is required to better understand whether grit is an important student characteristic with academic correlates.

The oft cited Duckworth (2007) research encompassed a number of studies investigating grit as a predictor of academic outcomes. Duckworth (2007) found a small positive relationship between grit and the scholastic aptitude test scores for high achieving undergraduate students ($r = 0.25$, $p < 0.01$). Spelling bee finalists high in grit also outperformed their peers, and cadet's one standard deviation higher than average in grit, were 60% more likely to complete training. It is noteworthy, however, that grit was only able to explain between 1.4% and 6.3% of variance in academic outcomes (Duckworth 2007).

Other researchers have found similar results. Students with higher levels of grit in an introductory programing course were found to attain higher grades (Wolf 2015). Cross (2014) reported a small positive relationship between grit and grade point average (GPA) among doctoral students, however it was only present for females and the effect size was very small (Adjusted $R^2 = 0.006$, $p = 0.04$, $N = 669$). Reraki (2015) found that, while grit alone had a medium sized effect for the prediction of academic achievement ($R^2 = 0.28$), it accounted for only 1% of the variance after controlling for the effect of

academic motivation. The perseverance of effort factor of grit was found to have a small relationship with college GPA (Bowman 2015).

A number of other studies investigating the grit-grades relationship have not found an association between variables. Bazelais (2016) found that grit was not a significant contributor to academic outcomes, however they controlled for past academic performance, which may have, in effect, been a product of student grit. In other studies, grit showed no relationship with GPA among first year college students (Stewart 2015) and, after controlling for the big five personality variables, grit did not add to the prediction of school outcomes (Ivcevic, 2014). In yet another study, grit was not correlated with english or math test scores for eighth grade students (West 2015).

This review of evidence suggests that, if grit plays a role in academic outcomes for university students, this effect may be quite small. One of the key challenges associated with this kind of research is the small correlations between student characteristics and outcomes. These beg the question as to whether, in the university setting, concepts such as grit have a large enough effect to warrant further investigation as an avenue for intervention. It may be the case that grit plays such a small role in academic and engagement type outcomes that it is of no real-world value. Nonetheless, these concepts have garnered a high level of interest within education settings, and so further research is required to determine whether they have value within the post compulsory education setting as an avenue for intervention or, perhaps, as a control variable for understanding the university experience within the context of a broader model. It is possible, however, that grit interacts with other variables that sometimes mask its effect. While grit is perceived as a relatively stable trait which is developed over years, research also suggests that it may be malleable (Aronson 2002; Blackwell 2007) and interact with other individual characteristics. Some research suggests gender differences in grit (Christensen 2014; Rojas 2012). Christensen (2014) found that female upper secondary school students were higher in the consistency of interest component of grit than males. Rojas (2012) also found that girls (grade 4–8) had higher grit than boys. Other research has found relationships between grit and grades that are gender specific (Cross 2014; Stewart 2015). Batres (2011) found a significant correlation between grit and grades for female doctoral students but not for males, and Stewart (2015) found a correlation between grit and grades for male first year college students, but not for females. Still other research has found no gender differences (Batres 2011; Gorman 2015; Washington 2016). These inconsistent, and often small, effects, suggest that gender based differences in grit among students may be either so small that they are inconsequential, or be situation-specific and, therefore, potentially reflect other underlying variables that differ systematically across available studies.

Another, potentially related, demographic characteristic, which may play a role in grit, is being the first in family (FiF) to attend university. Collier (2008) found that students who were FiF to attend university had a lesser understanding of the student role and faculty expectations, when compared with other students. Completion rates for students whose parents' highest qualification was year 12, however, were 2% higher in comparison to those whose parents held a degree or diploma (Marks 2007). In contrast however, Cupitt (2015) found that among online students, those who were not FiF were actually more likely to have a higher grit score (Cupitt 2015). Further research is required to determine whether grit is different for FiF students in comparison to not. Further to this (Key 2015) found that there was a relationship between grit and both physical and mental health. If it is the case that grit plays a role in academic success, understanding how it may be moderated by gender, health and being the first in family to attend university may have important implications for supporting these students. If it is the case that grit plays a role in academic

success, understanding how it may be moderated by gender and being the first in family to attend university may have important implications for supporting these students.

Also lacking at present, is a compelling theoretical explanation for how grit may have an impact on academic outcomes. One possibility is that grit may promote a deeper level of engagement with the academic environment. Robinson (2015) highlighted a lack of research around the possible relationship between grit and engagement and went on to investigate this issue among nursing students. She found that there was a strong association between grit and course engagement ($r = 0.56$, $p < 0.01$). Perseverance of effort, an important component of grit, also positively predicted behavioural engagement and flourishing among Filipino teenagers, and both the perseverance of effort and interest factors were negatively related to behavioural disengagement, with the effects ranging between small and medium in size (Datu 2016). Perseverance of effort was also related to self-regulated learning and academic achievement among 213 ethnically diverse college students (Wolters 2015). However, after controlling for self-regulated learning, the relationship of perseverance of effort to self-regulated learning activities did not account for achievement. Consistency of interest, on the other hand, was not related to engagement or academic achievement, but was positively related to time and study environment management and negatively associated with procrastination.

The literature suggests, therefore, that grit may have an important role in engaging students in education. The relationship between grit and academic outcomes tends to be quite small, however, and some research has found no relationship. Hence, further work is required to establish this. Determining whether gender, or being the first in family to attend university, influences grit, has important implications for understanding how best to support these students. The present investigation sought to better understand the role of grit in improving academic outcomes, by assessing the putative grit-grades and grit-engagement relationships within the university setting. Based on available literature we did not anticipate finding gender differences in the level of grit displayed but, based on the assumption that those students who are the first in their family to attend university have to work harder to get there, it was hypothesized that grit would be higher for first in family students. To assess the validity of grit as a predictor of productivity, it was hypothesized that there would be a positive association between grit and productivity, as measured by grades and self-rating of academic achievement. It was also expected that students with higher levels of grit would be more engaged in their studies.

Method

Participants

A cross-sectional study was undertaken which included university students from across Australia. The survey was entirely online and advertising was conducted via social media, posters and a website. A total of 50 male and 345 female students fully completed the voluntary survey, a further 89 opened the survey but completed less than 50% and were removed prior to the analysis. Participants were aged between 19 and 58 years, with males ($M = 23.28$ years, $SD = 4.92$) and females ($M = 22.96$ years, $SD = 6.74$) being of a similar age. In order to potentially compensate for their time, participants were offered the chance to win either a $50 voucher or a double movie pass. The survey was available for 6 months; institutional ethics approval was granted (SHE CHESC 15\135).

Measures

Grit Scale

The 8 item grit scale (Duckworth 2009) included two subscales, one being consistency of interest (*interest*), which captured the individual's ability to maintain interest over time. The *interest* factor included reverse scored items such as 'new ideas and new projects sometimes distract me from previous ones,' and, 'my interests change from year to year.' The second subscale was perseverance of effort (*effort*), which captured perseverance characteristics with items such as 'I am diligent', 'I finish whatever I begin,' and 'I am a hard worker' (Duckworth 2007). These statements were rated from never (1) to always (5). Duckworth (2007) confirmed the presence of two factors, both having adequate internal validity with differential predictive value for each. Within the current study both *interest* ($\alpha = 0.80$) and *effort* ($\alpha = 0.71$) had acceptable internal consistency (Field 2013).

Engagement

A slightly modified version of the Utrecht work engagement scale for schools (UWES-9 (S); Schaufeli 2003) was used to assess student engagement. This engagement scale was chosen because it has been used successfully in a range of settings. In addition, a longer version of the scale has been used within university settings, albeit with some adjustments made to improve readability, cultural relevance and applicability (Schaufeli et al. 2002). We were unable to use the longer version due to survey length constraints, however we took the nine Likert style statements used to assess three components of engagement (vigour, dedication, and absorption) in the shorter version of the scale, and adapted these in a similar way. The changes made to adapt it to the university setting, are included below (Table 1). The original survey included nine Likert style statements to assess three components of engagement (*vigour, dedication* and *absorption*). *Vigour* was assessed using statements such as "when I get up in the morning I feel like going to class," *dedication* was assessed with statements such as "I feel my studies are full of meaning and purpose," and *absorption* included statements such as "time flies when I am studying." In order to improve readability, cultural relevance and applicability to the university setting, some changes were made (Table 1). The internal consistency of the vigour, dedication and absorption subscales were satisfactory and exceeded the original scale, with scores of $\alpha = 0.83$, $\alpha = 0.85$, $\alpha = 0.82$ respectively. The total *engagement* score also had an acceptable Cronbach's alpha ($\alpha = 0.89$).

Table 1 Changes to UWES-9(S) to improve readability and applicability to university students

Items from UWES-S- 9(S)	Modified items used in current study
I feel strong and vigorous when I am studying or going to class (removed)	I feel enthusiastic when I am studying or going to class (added)
I feel fit and vigorous when I am studying or in class (removed)	When I get up in the morning I feel like studying (added)
My study inspires me	University inspires me
I am proud of my studies	I am proud of the work I have done at university

Productivity

Three questions from the job demands-resources scale (Bakker 2014a) were used to assess the students' beliefs about their academic performance (*performance*). These were rated from never (1) to always (5), and included statements such as "I meet all deadlines and requirements" ($\alpha = 0.71$). In addition, students were asked "What was your average grade?" (*grade*), rated with six options from "less than 50%" through to "90–100%." A total score was also created (*productivity*) using the standardized mean score of the *performance* item questions, and the standardized mean of the *grade* score.

Demographics

These questions asked students to state their *age*, *gender* and *health,* and if they were the first person in their family to attend university (*FiF*). Health was identified as a possible confounding variable and so was measured using the 10 point Likert style statement "On a scale of 1–10, with 1 being very poor to 10 being perfect, how would you rate your current physical health."

Data Analysis

Assumptions of normality, linearity, homoscedasticity and independence of residuals were assessed, and all non-normal distributions were transformed according to procedures outlined by Tabachnick (2001). The negatively skewed variables, *effort, health,* and *performance,* were transformed using a square root transformation. Independent samples *t* tests were conducted to determine the presence of group differences on grit (*interest, effort*) according to *gender* and *FiF*. A series of hierarchical regressions were conducted to determine the relationships between *grit* and the dependent variables, with the significant demographic correlates of the relevant dependent variable entered at step one along with *gender*. Structural equation models (SEM) were utilised to assess the relationships between key variables using AMOS 22 (Arbuckle 2014). Verification of SEM models was based upon RMSEA, CFI, TLI, Hoelter and Chi squared statistics. Mediation analysis was conducted using the PROCESS macro to assess relationships between key variables.

Results

A correlation analysis was conducted to assess relationships between demographic variables, engagement and grit factors (Table 2). There were significant correlations between grit factors, engagement and demographic factors. Apart from age and gender, only the grit factor, interest correlated with first in family.

In order to determine whether gender played a role in grit, an independent samples *t* test was conducted to assess whether the grit factor scores (*interest & effort)* were different for males in comparison to females. There were no gender differences for either *interest* $t(391) = -0.226$, $p = 0.82$ or *effort* $t(391) = -0.81$, $p = 0.42$, suggesting that male and female university students have equivalent levels of grit.

In order to determine whether *grit* is different for students who are the first in their family in comparison to not, independent samples *t*-test was conducted. Students who were

Table 2 Correlations between grit, engagement factors, age, gender, first in family (FiF), health, grades and self-rated performance

	2	2	4	5	6	7	8	9	10	11
1. Interest	0.37**	0.27**	0.20**	0.29**	0.13*	0.15**	0.18**	0.04	0.01	−0.02
2. Effort		0.40**	0.38**	0.37**	0.23**	0.35**	0.55**	0.08	0.04	−0.10*
3. Vigour			0.67**	0.55**	0.19**	0.24**	0.37**	0.23**	−0.03	0.04
4. Dedication				0.51**	0.14**	0.29**	0.46**	0.07	0.01	0.04
5. Absorption					0.02	0.28**	0.37**	0.16**	0.07	0.05
6. Health						0.11*	0.19**	−0.03	−0.09	0.02
7. Grade							0.63**	0.15**	0.03	0.06
8. Performance								0.09	0.07	0.06
9. Age									−0.02	0.06
10. Gender										−0.08
11. FiF										

* $p < 0.05$, ** $p < 0.01$

FiF reported higher *effort* scores $t(391) = 2.01$, $p < 0.05$, $\delta = 0.21$ but the *FiF* groups did not differ for *interest* $t(391) = 0.40$, $p = 0.69$.

In order to test whether *grit* was positively related to *productivity,* a hierarchical regression was undertaken, including *health, age* and *gender* at step one, and grit (*interest & effort*) at step two to predict *productivity*. Both step one R2 = 0.06, F (3,351) = 7.99, p < 0.01 and step two were related to productivity, R2 change = 0.25, F (2,349) = 63.76, p < 0.01, (Table 3). Only age and effort were uniquely associated with grade in the final model. With the inclusion of interest and effort variables at step two the association of health to productivity was diminished. This suggests that, after controlling for the positive relationship between *health, age* and *gender* with *productivity,* the *effort* characteristic of grit had a medium sized positive relationship with productivity.

In order to test the hypothesis that *grit* would be positively related with *engagement,* a hierarchical regression was conducted using *FiF, health, age* and *gender* at step one and *interest* and *effort* at step two. The model was associated at both step one, R2 = 0.05, F (4, 350) = 4.28, p < 0.01 and step 2 R2 change = 0.31, F (2, 348) = 84.02, p < 0.01 with engagement. With the inclusion of interest and effort variables at step 2, the association of health to engagement was reduced. Only *interest* and *effort* were uniquely associated with

Table 3 Hierarchical regression analysis results using health, age and gender at step 1 and grit (interest and effort) at step 2 to predict productivity

	β	*r*	*sr*	R^2 *ch*	*p*
Step 1				0.06	<0.01
Health	0.16*	0.15	0.16		
Age	0.18*	0.18	0.18		
Gender	0.10	0.08	0.10		
Step 2				0.25	<0.01
Health	0.03	0.15	0.03		
Age	0.12*	0.18	0.12		
Gender	0.06	0.08	0.06		
Interest	−0.05	0.21	−0.04		
Effort	0.54*	0.54	0.47		

* $p < 0.05$

Table 4 Hierarchical regression with FIF, health, age and gender at step one and interest and effort at step two to predict engagement

	β	*r*	*sr*	R^2 *ch*	*p*
Step 1				0.05	<0.01
FiF	0.02	0.03	0.02		
Health	0.14*	0.14	0.14		
Age	0.16*	0.16	0.16		
Gender	−0.01	−0.03	−0.01		
Step 2				0.31	<0.01
FiF	0.08	0.03	0.08		
Health	0.03	0.14	0.03		
Age	0.09*	0.16	0.09		
Gender	−0.05	−0.03	−0.05		
Interest	0.17*	0.40	0.16		
Effort	0.48*	0.56	0.41		

* $p < 0.05$

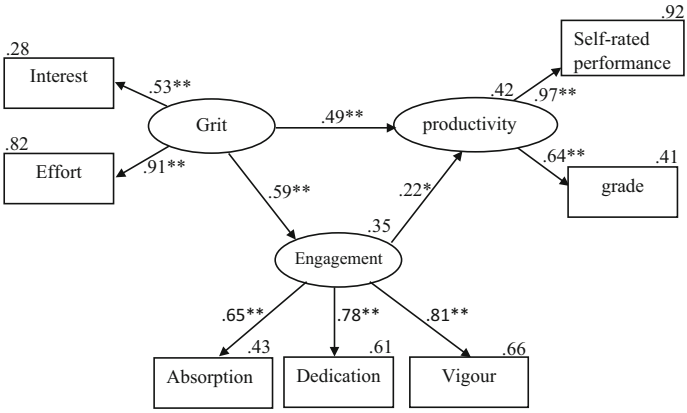

Fig. 1 Structural equation model with grit factors (interest & effort) predicting engagement (absorption, dedication & vigour) and productivity (self-rated performance & grade), (**p < 0.001, * p < 0.01)

engagement, with *effort* contributing more than twice that of either *age* or *interest* (Table 4) to the explanation of the variance of *engagement*. This suggests that the greater the student's level of *interest* and *effort* the more likely that they will be engaged.

Considering the significant grit-productivity, grit-engagement relationships and the correlations between productivity and engagement a full grit-engagement-productivity model was tested (Fig. 1). The theoretical model was supported by the empirical data (RMSEA < 0.07, CFI = 0.98 1, TLI = 0.96, Hoelter = 260, $\chi^2 = 27.90$, df = 11, $p < 0.01$) suggesting that grit has a direct effect on grades, and suggests a possible indirect effect through engagement.

As the SEM was supported, the next phase of analysis involved identifying which of the observed variables were primarily responsible for the successful model fit, and further what the path of association was. In order to verify the possibility that *engagement* might mediate the relationship between *grit* and *productivity*, a mediated regression was conducted, as outlined by Preacher (2004; Fig. 2). There was a significant indirect effect $b = 0.14$, CI [0.10, 0.20], which represents a medium effect size $\kappa^2 = 0.14$, CI [0.09,

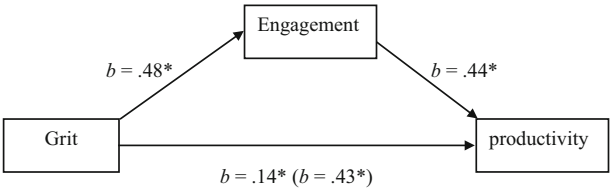

Fig. 2 Structural equation model assessing the mediating role of engagement in the relationship between grit and productivity (* $p < 0.01$)

0.19]. The alternative path was also tested, using *engagement* to predict productivity, as mediated by *grit.* While a significant indirect effect was found, $b = 0.01$, CI [0.00, 0.02], it had only a small effect size, $\kappa^2 = 0.08$, CI [0.03, 0.14], suggesting that the first model better fits the data. This finding suggests that the effect of *grit* on productivity is facilitated by a heightened level of *engagement*.

Discussion

This study aimed to assess the role of grit within the university education setting, by determining whether grit is related to productivity and engagement. Males and females did not differ in either component of grit, but students who were the first in their family (FiF) to attend university had higher levels of the grit factor called effort, than did their counterparts. Effort, but not interest, made a small, but significant contribution to the prediction of productivity. Both interest and effort significantly predicted engagement, with medium sized positive relationships being evident, however effort contributed more than interest. The complete model testing suggests that both grit and engagement play a role in explaining productivity. Further to this, a mediation analysis indicated that the relationship between grit and productivity was also partially mediated by engagement. Combined, these findings suggest that, while grit has a direct effect upon productivity and engagement, the path of association is best illustrated as grit-engagement-productivity. These findings suggest that the concept of grit has a role to play in better understanding student outcomes within the university context. While these results help to clarify the mechanism by which grit may improve academic outcomes, these findings provide limited opportunities for intervention due to the relatively small effect sizes. Grit was only able to explain 2.4% of the variance in academic productivity and 3.2% of the variance in engagement, which suggests that grit is not really a worthwhile avenue for intervention. Despite this, the results do provide information about personal characteristics that may play a role in academic success. It may be worth investigating this further, perhaps within the context of a larger model.

In contrast with some previous research (Christensen 2014; Cross 2014; Rojas 2012), this research found no evidence of a difference between males and females for either of the grit subscales. Evidence supporting differences based on gender was largely based upon effect sizes that were small, and with school students. It may be the case that grit develops differentially between genders, and that these differences cease to exist by the time of university enrolment. Our research concurs with Batres (2011); Washington (2016), and Gorman (2015) who also found that males and females had equivalent grit scores. Care must be taken in interpreting this finding, however, as there was a disproportionate number

of females in comparison to males. While a number of attempts have been made to argue that males and females have differing levels of grit, this research suggests that there may is, in fact, be no difference for university students, but this needs to be tested in a more representative sample.

Considering the changing nature of the university demographic in Australia, with greater numbers of students coming from families where parents have not attended university, it is interesting to note that, in the sample used in the current study, students from families with no involvement with higher education showed greater levels of effort than students from families with a history of post-compulsory education. This could be interpreted in several ways. First, it may indicate that students from families without a history of post-compulsory education, have a higher level of grit in general. Alternatively, and perhaps more likely, it may indicate that FiF students with higher levels of grit, better navigate their way through the obstacles to attend university. This idea is supported by the finding that, despite disadvantages associated with being the first in family to attend university, these students seem to perform just as well academically as their peers (Marks 2007). One of the challenges associated with the concept of grit is the potential of cultural bias, in that the characteristics of grit may be more 'in sync' with the characteristics of middle class institutions and so, as noted by Lareau (2015), the relationship between grit and academic success may reflect the overlap between the grit characteristic and the demands of the institution. This could mean that the grit characteristic, while important for success in particular institution, may not be important where that cultural bias is not present. Despite this, the characteristic of grit appears to be related to academic success within the Australian university setting, and further research is required to determine whether grit continues to be related to success within non-academic settings. This highlights the challenge faced by these students, but also the possibility that students who do manage to gain entrance from this background, have had to work harder to get there, and may, therefore, be more equipped to cope with the rigors of independent learning.

Students who reported being higher in the effort component of grit had higher productivity. While there was a positive relationship between age and productivity, the addition of grit, in particular effort, had a medium sized positive relationship with productivity. The contribution of effort was 30% larger than that of age. Research supports the idea of a relationship between grit and age, which suggests that grit is a characteristic that develops over time (Duckworth 2007). However, it could also be the case that grit develops differentially for different generations, as such a longitudinal study is required to answer this question. This evidence suggests, however, that grit is not singularly a product of age, alluding to its importance as a contributor to academic success. The relationships found between grit and productivity in this study, are comparable to Duckworth et al. (2007) and Cross (2014). What is of particular interest here, however, is that the dominant predictor of productivity was effort, and not interest. This aligns with Wolters (2015), who also found that effort was a key predictor of motivation, time management strategies, study environment management strategies, and procrastination. In essence, it is the student's determination to stay on task that enables them to be a better student, not their ability to maintain interest. While a student's ability to maintain interest may play an important role for other reasons, this research appears to suggest that the ability to maintain interest alone, does little to improve academic performance.

Students that are higher in grit have higher rates of engagement, with both interest and effort making an important contribution to the relationship with engagement. Effort was the largest contributor to engagement, suggesting that the greater the level of student effort the more likely they are to be engaged, but the level of interest also played a role. This

finding aligns with Datu (2016) and Von Culin (2014), who both found that both effort and interest play an important role in student engagement. Interestingly, Von Culin (2014) proposed that pursuit of engagement led to an increase in grit, and Datu (2016) argued that grit led to an increase in engagement.

The results of the complete model test suggest that both grit and engagement have a direct positive relationship with productivity, suggesting that both student grit and student engagement have an important role to play in the development of productivity at university. In addition to this, engagement appears to mediate the relationship between grit and productivity, suggesting that students that are higher in grit are more likely to experience higher engagement, which in turn has a positive relationship with productivity. The role of engagement, in relation to productivity type outcomes, has been well studied within the context of the job demands-resources model (Bakker 2014b). The job demands-resources model suggests that a combination of personal and workplace resources increase the likelihood of engagement (Bakker 2014b). While personal resources are ordinarily assessed with self-efficacy and optimism measures, it may be the case that grit is a useful addition to the job demands-resources model. This requires further investigation.

The current study was not without limitations. Being cross sectional in nature, it is not possible to draw full conclusions about the causative nature of effects, despite the theoretical support for these ideas. Future research would do well to assess student success at university over time, while concurrently tracking changes in grit. In addition, this applied study made no attempt to determine whether grit is captured by measures of conscientiousness, which have previously been shown to have high correlations (Duckworth & Quinn 2009). Considering the high degree of conceptual overlap between conscientiousness and grit, future research in the university context may benefit from an exploration of these two trait type characteristics. The student sample was entirely voluntary and recruited online, which likely means that participants were not truly representative of the population the sample was drawn from. In addition, the relationships found between grit and outcomes at university may be limited to the Australian context, perhaps due to the culture of the university experience within the Australian context. Indeed, there was a significant gender imbalance, with females comprising a large majority of the sample. This probably at least partly reflects the nature of recruitment, but means that caution is recommended in generalizing our findings to the broader population. It may be the case that the relationships between grit and outcomes are only present for females and as such further replication should be undertaken. This limitation is balanced, however, by the large sample that was recruited, which enabled the use of SEM to answer the research questions. Despite the popularity of self-report measures, such as grit and engagement, there is a risk, as with all self-report measures, that the relationships between variables are at least partially due to conceptual overlap. The focus of this research is on whether the broad trait type characteristic of grit has an impact upon the way in which a student engages in the university setting. Future research would benefit from the cross validation of these results with real world measures of engagement to ensure a full understanding of the influence of trait level grit upon situational engagement. Finally, although there were more females than males in our sample, there were no gender differences in level of grit. Although this is consistent with some previous studies it differs from others, which may indicate that the male participants were not representative of the broader population.

Considering the level of interest in the concept of grit, it is important to determine grit's worth, both theoretically and in application as a predictor of student outcomes. This research suggests that there are no gender differences for grit among university students, though this this finding urgently needs replication, nonetheless, due to the gender

imbalance in the sample. The research also suggests that students from families with no post-compulsory education history have higher effort scores. This research has highlighted the important implications of grit for academic outcomes, as higher scores on the effort characteristic appear to be associated with greater levels of engagement and performance at university. This research presents a novel approach to better understanding the implications of grit for students. It would appear that the next stage of research in this area will be to focus on the malleability of the grit construct, as finding ways to increase this dispositional or motivational style may serve to improve performance at post-compulsory educational institutions, and beyond.

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