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What's wrong with grit? – Considerations and Better Alternatives for Engineering Education Research

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ABSTRACT

CONTEXT

Grit is conceptualized as a combination of passion and perseverance. Engineering education researchers are increasingly interested in studying grit as factor in student persistence, retention and success. The number of engineering education publications on grit is steadily rising each year, and there has been enough research on the topic that a systematic literature review was recently conducted. Despite the growing interest however, studying grit is problematic for a variety of methodological and philosophical reasons.

PURPOSE

The purpose of this paper is to identify and explain eight methodological and philosophical problems with the concept of grit in the context of engineering education research. Our aim in doing so is to help engineering education researchers reflect more critically on its use and identify research questions that avoid the methodological and philosophical pitfalls identified. The paper contributes to this year's theme of 'capability development' by providing researchers with critical perspectives for better understanding the current research landscape and planning future studies.

APPROACH

This paper treats *grit* as a discourse and utilizes a post-structural discourse analysis approach to analyse its problematic assumptions and functioning. The evidence supporting the analysis and argument is historical, sociological, philosophical, and methodological in nature. Drawing on perspectives and insights from these other disciplines allows us to introduce critiques not yet widely recognized in engineering education.

OUTCOMES

The eight methodological, philosophical and functional problems with grit that this paper elucidates are divided into three aspects. The first aspect is *assumptions and blind spots* in study conceptualization. The second aspect is *construct and evidentiary* issues. The third aspect is *effects* on the engineering education system.

CONCLUSIONS

The reasons to reconsider researching grit are numerous and multifaceted. Perpetuating the problematic features of grit research is not in the best interest of students or the field. Both will be better served by framing persistence and retention studies with questions about institutional, structural, and cultural factors instead.

KEYWORDS

Grit; studying down; methodology

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Introduction

Grit is conceptualized as a combination of passion (or consistency of interest over time) and perseverance (Duckworth, 2016). Engineering education researchers are increasingly interested in studying grit as factor in student persistence, retention and success, often in the context of diversity. As seen in Figure 1, the number of engineering education publications on grit is rising, and has jumped dramatically in the past six years (ASEE, 2021). (Although not every hit in this search refers to the psychological construct of grit, the rise in those that do is telling). There has now been enough engineering education research on the topic that a systematic literature review was recently published (Direito, Chance, & Malik, 2021). The term is even making its way into recruitment and promotional materials. A brochure for a college engineering eagerly tells students to come "Test your competitive grit with the Global Formula Racing team" (OSU, 2018, p.3).

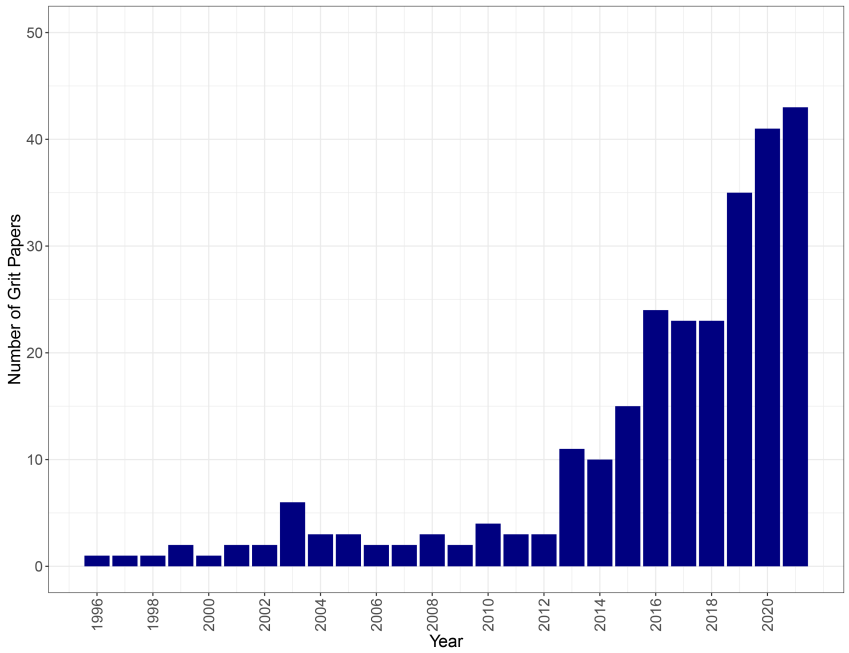

Figure 1: Number of ASEE conference paper 'hits' for grit by year*
*based on data from (ASEE, 2021). Note: May not reflect the entirety of 2021.

Despite the growing interest within the field however, studying grit is problematic for a variety of methodological, philosophical, and effect-related reasons. The purpose of this paper is to identify and explain eight such problems with the concept of grit in the context of engineering education research. Our aim in doing so is to help engineering education researchers reflect more critically on its use and identify research questions that avoid the pitfalls identified. The paper contributes to this year's conference theme of 'capability development' by providing researchers with critical perspectives for better understanding the current research landscape and planning future studies.

This paper treats *grit* as a discourse and utilises a post-structural discourse analysis approach to analyse its problematic assumptions and functioning (Hall, 2007; Howarth, 2000). Elsewhere *grit* has been called an 'ideology' (Gorski, 2016) and a 'hegemonic narrative' (Tefera et al., 2019), which are in alignment with our chosen terminology of 'discourse'. A similar approach has previously been utilised to critique the concept of 'fairness' in higher education leadership literature (Beddoes & Schimpf, 2018). Throughout the paper, when grit is italicised, it is meant to imply the *discourse of grit*, rather than the attribute of grit. Given the nature of this paper, it does not follow the traditional structure for engineering education papers. The eight interrelated methodological, philosophical, and

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functional problems with grit that this paper elucidates are divided into three aspects. The first aspect is *assumptions and blind spots* in study conceptualisation. The second aspect is *construct and evidentiary* issues. The third aspect is *effects* on the engineering education system. The next section of the paper presents and discusses each in turn. The conclusion suggests better questions to help researchers move away from grit research.

Eight Problems with Grit

Assumptions and blind spots in study conceptualization

1. Studying down: Studying down is the tendency in social science generally, and engineering education research (EER) specifically, to study (and locate problems within) marginalised groups (Beddoes, 2017, 2019; Nader 1974; Sprague, 2005). In the context of diversity, studying down is one instantiation of what Faulkner (2009) calls the deficit model approach to diversity – one that frames the problem and solutions around changing marginalised students. The problem with studying down is that it leaves dominant groups and those in positions of power (in this case, faculty/staff, administrators) as well as institutions, structures and cultures unproblematised. As Sprague (2005) explains:

> *… Research questions are more likely to focus on members of disadvantaged groups and explore their deficiencies, while the attributes and practices of those with social power are much less likely to be exposed to social science surveillance. And in addressing social problems, the emphasis is more on the attributes of those experiencing the problem than on considering what it is about the current social order that makes the problem likely. (p. 12)*

Grit is the latest in a long line of studying down research topics that have attracted engineering education researchers. One such long-standing example is self-efficacy, and similar critiques have been levied against that line of research as well. For example, Slaton's (2011) critique of self-efficacy is equally applicable to grit and its inherent studying down because such research directs:

> *…our attention to the behaviors and psychological states of individual minority students, obscuring the social context in which entry and success in engineering fields play out…Socio-cultural conditions (such as endemic racism, sexism or ageism), and the institutional practices that embody those inequities (such as majority-focused pedagogical theory, or biased treatment of minority students by instructors and administrators) are of more or less limited consequence to many of these researchers and those who deploy their findings. (p. 3)*

Further information about why studying down is dominant in EER and examples of studying up can be found in Beddoes (2017, 2018, 2019) and Beddoes & Panther (2018).

2. Ignoring social power-privilege, perpetuating the myth of meritocracy: The discourse of grit and the myth of meritocracy (or the belief that one's success is dependent solely on their own hard work or abilities) are two sides of the same coin. They both hide the fact that being a member of a dominant group conveys certain privileges that support one's success (Ferber, 2012; Gorski, 2016; McIntosh, 2012; VanDeventer Iverson, 2007). Beddoes (2021, 2022) uses the term power-privilege to highlight that "dominant systems of power work to establish and sustain particular advantages" (Sefa Dei et al., 2007, p. xii). In the context of engineering, being white and being a man convey privileges such as the presumption of competence, being "seen" as an engineer, being "heard" in group settings, relative freedom from sexual harassment, and a sense of belonging and feeling welcome (Beddoes, 2021, 2022; Douglas, 2015; Eastman et al., 2019). Salient financial and cultural privileges include not having to work while in school and understanding financial aid systems (Pawley, 2019). These forms of privilege are intersectional (Beddoes, 2021; Case et al., 2014; Ferber, 2012). As an ideology, *grit* fundamentally obscures the role of power-privileges in influencing who succeeds and who does not. Schreiner (2017) discusses this at length in the context of K-12 education. By obscuring privilege's roles in supporting success, the discourse of grit then also perpetuates the myth of meritocracy. In this light, it is not surprising that *grit* appeals to

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many in engineering education where the myth of meritocracy also finds considerable purchase (Cech, 2013; Slaton & Pawley, 2018).

3. Universalizing a singular motivation out of many: Students pursue engineering degrees for a variety of reasons (Margolis & Fisher, 2003; Matusovich et al., 2010). Not all of those reasons are related to passion for or interest in engineering per se. For instance, some students are motivated to pursue an engineering degree as a means to a profitable career, upward social mobility, a career outside of engineering, or because of influence from family (Margolis & Fisher, 2003; Matusovich et al., 2013; McLoughlin, 2009; Painter et al., 2017). Yet, by putting passion squarely at the centre of success, the discourse of grit normatively universalises the motivation of passion. It normalises the student who has loved tinkering since childhood, the student who wants to spend 18 hours a day coding. The work of Margolis & Fisher (2003) shows that this idealised image of a student passionate about engineering (based on only one type of student), causes others who do not fit that norm (do not share that passion) to see themselves as not belonging in engineering and to consider leaving. Focusing on grit and its attendant passion means that engineering educators may inadvertently exclude or marginalise students with other – equally worthwhile and valid – motivations and interests.

Construct and evidentiary issues

1. *Construct validity:* Grit is most commonly measured through survey instruments, frequently following the instruments created by Duckworth and colleagues (2007, 2009) (Credé et al., 2017; Direito et al., 2021). However, there have been methodological disagreements about the structure (construct validity) of grit. In the context of survey research, construct validity attempts to assess whether a research instrument measures the concept(s) or theoretical construct(s) it was designed to capture (Messick, 1989). Construct validity is typically tested with factor analysis, a statistical method for analysing if survey items measure similar, higher order constructs (called factors), identifying which questions map to which factors and examining if there is any relationship between factors (Kim & Mueller, 1978). In short, establishing construct validity is critical to ensure that the concepts researchers theorise align with the empirical measures they use.

Duckworth and colleagues (2009, 2007) define grit as composed of two sub-constructs, *continuity of interest (CI)* and *persistence of effort (PE)*, which they define as the ability to hold the same interests over time and to work hard toward a goal, despite difficulties or setbacks, respectively (Direito et al., 2021). Duckworth and Quinn (2009) argue that the questions in their instrument measure (or load onto) the CI and PE sub-constructs, which themselves load onto an overall grit construct, and they provide results to establish validity of this construct structure. However, several researchers have challenged Duckworth and Quinn's (2009) results, arguing that they incorrectly specified the type of model they tested for grit, and that the model they tested is equivalent to grit being composed of two correlated constructs (CI and PE) with no higher order 'grit' construct (Morell et al., 2021; Muenks et al., 2017). This matters for studies of grit because whether it is best described as two correlated measures or as an overall measure which has two related sub-constructs implies two different ways of calculating grit results and subsequently affects any inferences or implications that are drawn.

Furthermore, empirical work has demonstrated additional challenges with grit's construct structure by revealing that it varies depending on the population under examination (Datu et al., 2016; Morell et al., 2021; Muenks et al., 2017). These results imply a lack of invariance in grit's structure across different populations and raise questions about attempts to compare results across groups by age and cultural background. While a few studies have found some evidence of invariance for grit as a construct, these studies either did not examine alternative models for grit's structure (Fosnatch et al., 2019) or examined a limited set of models that may have affected their results (Datu et al., 2016). If there is a lack of invariance in grit's

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structure across age and culture (and possibly other untested demographic variables) this complicates any attempt to conduct longitudinal, interventional, and comparative work.

2. Evidentiary problems: Many researchers have theorised about and analysed the relationship of grit as a construct with academic outcomes or measures of academic success, such as GPA and retention (Direito et al., 2021; Credé et al., 2017; Chang, 2014; Choi et al., 2016; Ivcevic & Brackett, 2014). However, many of these studies examining grit's connection to academic outcomes in engineering education (e.g., retention, exam scores) report weak or contradictory results (Direito et al., 2021), which raises questions about its utility as a research construct. Outside of EER, drawing on a larger pool of research in psychology, education, and related fields, similarly tenuous relationships are seen. A meta-analysis revealed that grit correlated with GPA at .17, with retention at .16, and with intent to persist at .18 (Credé et al., 2017). (A perfect correlation is 1, and anything below .3 is generally considered low.) Importantly, the studies in the meta-analysis did not just include studies with weak to moderate relationships between grit and academic outcomes, but also studies that find *no relationship* between grit and academic outcomes. Therefore, grit's relationship to academic outcomes may be weaker or more nebulous than the combined results imply.

In summary, disagreements, and wide variations in findings about the construct validity and subsequent structure of grit as research measure, as well as weak or contradictory evidentiary findings on how grit may relate to key academic outcomes raise serious questions about the use of grit in EER. Considering the issues identified in this section, researchers interested in studying grit are encouraged to critically reflect on whether a construct laden with these challenges can advance the field in meaningful ways. Rather than encouraging further grit research to address and try to resolve the conflicting findings however, our position is that, given the problems identified in this paper, abandoning grit research entirely is the more useful, responsible, and meaningful route.

Effects on the engineering education system

1. Perpetuating a culture of poor mental health: Engineering students' mental health is troublingly poor in some regards (Danowitz & Beddoes, 2018, 2020). Beddoes has conducted interviews with current and former engineering students to identify aspects of engineering and engineering education cultures that undermine mental health. Those interviews revealed that several distinguishing features of engineering programs negatively impacted students' mental health, and caused some to leave engineering. Those findings will be published in the future (Beddoes & Danowitz, under development). What is of note here are the relationships between *grit* and some problematic aspects of engineering (education) culture identified in that study. Most notably a culture where stress, overwork, 'toughness', and the ability to succeed (or persevere) at any cost are valued, a "cut throat" culture where there is no room for people who cannot keep up, a culture where, consequently, suicide and poor mental health are normalised to the point of expectation. Interviewees expressed a sense that engineering students are expected to be capable of handling anything thrown at them regardless of its impact on their well-being. The discourse of grit plays into this ethos with its elevation of perseverance as ultimate good and its rhetorical, historic and symbolic association with *toughness* (Jaeger et al., 2010; Stokas, 2015). If *grit* is an increasingly mobilised discourse in engineering education, it risks perpetuating these aspects of engineering culture by further entrenching a value system that expects overwork, toughness, and succeeding at any cost. Engineering education should not be guided by the militaristic ethos where much of Duckworth's (2016) grit research originated.

2. Contributing to lack of change in diversity, equity and inclusion: In the context of diversity, equity and inclusion (DEI), grit research represents more of the same – in the sense that it studies down by problematising marginalised students. Such research has been going on for thirty-plus years. However, those three-plus decades of evidence suggest that grit research is not likely to change anything because similar research (and interventions based on that

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research) have not led to significantly improved representation in engineering. For example, at the undergraduate level in the United States, women's participation in engineering increased only 2.5% (from 18.4% to 20.9%) between 1997 and 2016 (NSF, 2019). Even more troubling is the fact that participation of some groups, such as Black and African American engineering students, has actually decreased since 2006 (Fletcher et al., 2017). At all levels, engineering is still a "low participation field" compared to other science fields (NSF, 2019). It is clear then that the significant amount of research devoted to increasing DEI in engineering has largely not succeeded in broadening participation to the extent intended. As argued elsewhere, one leading reason this is so is because the vast majority of that research has been studying down rather than studying up (Beddoes, 2017). And, as argued above, *grit* is the latest manifestation of that tendency to study down. Therefore, decades of evidence would suggest that grit research is not going to increase DEI in engineering in any meaningful ways.

3. Maintaining problematic dominant structures and culture: Grit contributes to maintaining the status quo within engineering education beyond just lack of change in representation however. It maintains dominant structures and culture in several interrelated ways. First, the discourse of grit is fundamentally about teaching students to accept and function within the status quo. In engineering education, the status quo has been critiqued on many fronts, from generating a lack of interest in public welfare concerns (Cech, 2014) and empathy (Walther et al., 2020), to having a very narrow sense of ethics (Foley & Gibbs, 2019), to having a culture of stress (Jensen & Cross, 2021), to being racist/raced, sexist/gendered, and ableist (Beddoes, 2012, 2019; Holly, 2020; McCall et al., 2020; Mills et al., 2010; Pawley, 2019; Riley, 2008), to not adequately preparing students for the workplace (Brunhaver et al., 2018), among other things. *Grit* fundamentally normalises those aspects of engineering education by not challenging them and teaching students they should adapt to them. Saltman (2014) implicated grit in neoliberal education reforms calling it a "pedagogy of control" in service to the "disimagination machine" (Giroux, 2013) that teaches students to be submissive and not challenge or think critically about social justice or inequities. Again, Slaton (2011) has made similar points about self-efficacy, contending that in self-efficacy research "discriminatory cultural norms, such as racism, and institutional conditions that embody those norms may either be left out of explanatory models all together or treated as conditions with which individuals should contend" (p. 4). In the context of engineering education, *grit's* historic and symbolic association with masculinity risks re-entrenching that aspect of engineering culture in ways that make it potentially more problematic than self-efficacy however. Even more troubling is the possibility that such structural problems could come to be seen as good because they *create* grit (or romanticise the struggle), as Ris (2015) explains was historically the case for poverty and K-12 students in the U.S. Indeed, there is some evidence of this belief structure in engineering education already, with some professors believing that they are doing women a favour by continuing to let them have negative experiences (Beddoes & Panther, 2018).

Second, if students cannot, or choose not to, function within that status quo, *grit* places the blame for failure squarely on those students for not being gritty enough (Golden, 2017; Schreiner, 2017). As Gorski (2016) put it, *grit* turns structural problems into individual failings. Consequently, we can see how this invokes the myth of meritocracy by hiding key structural factors in success by cloaking them as individual merit, worthiness, intellect, or hard work.

Conclusion

Given the eight reasons elucidated above, grit research is not likely to benefit individual students or the engineering education system as a whole, and may in fact cause harm. Nor do the eight interrelated problems we identified constitute an exhaustive list. There are, for example, questions about personality research more generally, what is fixed and what is malleable, and what is original about grit. Why then has engineering education grit research gained such popularity in recent years? The likely reasons are because it taps into the

dominant research landscape of studying down, because it taps into a dominant ethos of meritocracy and celebration of weed out culture, because it is not threatening to engineering educators' work or identities, and because it is expedient. Yet, these expediencies are problematic because they should not be the guiding criteria by which one chooses research questions. Research methods are forms of social power; they are world-making. What is interrogated and problematised, what is challenged or maintained, what is hidden or ignored, all play a role is shaping what comes to be, what is known, and how communities see the world. We have a responsibility then to ask better questions. To that end, Table 1 offers better alternatives to grit research questions. Asking better questions is undoubtedly harder on multiple levels. It may require being critical of colleagues, administrators, your institution, and, perhaps, yourself and a discipline you identify with (Beddoes, 2017). It may require reading from unfamiliar fields that do not purport to have easy answers. But that does not mean it should be avoided. Ultimately, both students and the field of engineering education research will be better served by studying up and asking questions about institutional, structural and cultural factors, and power-privilege instead of grit.

Table 1: Better alternatives to grit research questions

Instead of this	Ask this
In what ways is grit related to academic success?	What institutional, structural and cultural barriers keep students from succeeding?
How does grit vary across demographic groups?	How is power-privilege distributed among various groups in ways that influence outcomes?
How can students' grit be increased?	How can instructors' understanding of inclusive pedagogy be increased? How can engineering education systems be made more equitable and just?
How does grit motivate students to persist in the face of challenges?	What changes can be made so that systemic challenges do not disproportionately negatively affect marginalized groups?

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