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Dark personality traits and psychological need frustration explain future levels of student satisfaction, engagement, and performance☆

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ABSTRACT

Grounded in Self-Determination Theory (SDT), we integrate personality traits and basic psychological need frustration to explore relationships between students' 'dark' personality traits and the core student outcomes of satisfaction, engagement, and performance. Using time-separated, multi-source data ($N = 330$), we examined whether students' perceived need frustration mediated the effects of dark triad traits (i.e., Psychopathy, Machiavellianism, Narcissism) and the dark core (i.e., the common variance among the dark triad) upon student outcomes. Correlations and structural equation models showed that need frustration is related to reduced student satisfaction and engagement (though not grades), and partially mediated the effects of the dark traits. The dark traits also had a significant indirect effect on grades via student engagement. The dark core was positively associated with a heightened sense of need frustration and lower engagement, suggesting that common antagonistic features of dark traits lead students to see university environments as obstructive. However, the constituent dark traits showed differential associations: Psychopathy correlated positively with need frustration, whereas Narcissism correlated negatively. The results demonstrate the theoretical and explanatory utility of integrating personality traits and SDT-based constructs for understanding how individuals experience their environments.

1. Introduction

Student satisfaction, engagement, and learning/performance are arguably the most important student outcomes and indicators of an educational institutions' effectiveness (Al-Hemyari & Al-Sarmi, 2016). Beyond general mental ability, personality traits are one of the main individual-level predictors of student well-being (Anglim et al., 2020) and performance (Poropat, 2009). However, few studies have examined why this might be the case. In this time-lagged study, we integrate personality traits and Self Determination Theory (SDT; Deci & Ryan, 1985; Ryan & Deci, 2017) to propose and test a mediation model in which students' need frustration mediates the effects of their 'dark' personality traits upon satisfaction, engagement, and grades.

1.1. Basic psychological needs in education

Basic Psychological Needs Theory (BPNT; Deci & Ryan, 2000; Ryan & Deci, 2002), an important sub-theory of the SDT framework, states that optimal human functioning requires the satisfaction of three universal, basic psychological needs (Deci & Ryan, 1985; Ryan & Deci, 2017): autonomy (perceived volition over decisions and actions), competence (perceived mastery or efficacy), and relatedness (feelings of meaningful connections with others).

Satisfying the need for autonomy, competence, and relatedness has proven essential for satisfaction, engagement, and performance across numerous contexts (see Ryan & Deci, 2017) including educational settings (e.g., Buzzai et al., 2021; Earl et al., 2019; Reis et al., 2000; Vandenkerckhove et al., 2019). When students' needs are met they

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experience heightened levels of intrinsic motivation, more effective self-regulation (Chen et al., 2021), and improved academic performance (Kryshko et al., 2022). In contrast, student motivation, regulation, and performance suffer when needs are unfulfilled or frustrated (Buzzai et al., 2021; Earl et al., 2019; Ryan & Deci, 2008, 2017).

SDT researchers distinguish between need satisfaction, need dissatisfaction, and needs that are actively frustrated (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011). Need satisfaction develops in social contexts that support the three needs; need dissatisfaction occurs in passive social contexts that exclude the student from the possibility of satisfying needs; and need frustration develops in intrusive social contexts that actively thwart the satisfaction of the three needs (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Vansteenkiste & Ryan, 2013). For example, students might struggle to achieve a sense of competence when learning new material (need dissatisfaction), but this is different from being actively criticised by condescending teaching staff (need frustration). Similarly, students might struggle to meet new friends when arriving at university (need dissatisfaction), but this is different from being actively ostracised by peers (need frustration).

Research suggests that need frustration is more harmful for well-being and performance than need dissatisfaction (Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011; Ryan & Deci, 2008; Vansteenkiste & Ryan, 2013). Indeed, student engagement suffers greatly when students' needs are frustrated (Earl et al., 2017; Vandenkerckhove et al., 2019), regardless of which individual need, or combination of needs, is frustrated. In practice, although needs can be differentially frustrated, most evidence to-date suggests that the three psychological needs mostly operate in unison in natural settings (e.g., Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Vandenkerckhove et al., 2019). Thus, rather than positing separate hypotheses for each need we focus on overall need frustration.

Hypothesis 1. Students' perceptions of need frustration will correlate negatively with student satisfaction, engagement, and performance.

1.2. Personality and basic psychological needs

Numerous environmental antecedents of psychological need satisfaction and frustration have been identified (Ryan & Deci, 2017; Van den Broeck et al., 2016), but the role of personality traits has typically been overlooked (Prentice et al., 2019). Given that needs and traits influence our behaviour, it is surprising that very few studies have assessed both sets of variables. Even fewer have assessed traits and need frustration, resulting in numerous recent and prominent calls for further integration (Prentice et al., 2019; Ryan et al., 2019; Sheldon & Prentice, 2019).

Personality traits describe our characteristic patterns of cognition, emotion, and behaviour that are relatively stable over time and circumstance (Hughes & Batey, 2017). Relatively stable meaning that personality traits have two major components: stable trait levels and variable moment-to-moment personality expressions (Irwing et al., 2020). People have a typical level of Extraversion, for example, which is evident across most situations, but sometimes they deviate from this typical level according to environmental constraints (e.g., studying within a lecture). Fluctuating personality expressions do not mean that personality traits are changing from moment to moment, rather that personality expression is flexible around stable trait levels (Fleeson & Jayawickreme, 2015).

In contrast, basic psychological needs drive our goals and desires (Sheldon & Gunz, 2009). Although our needs are also stable, need satisfaction and frustration are much more state-like than trait-like, fluctuating, sometimes substantially, due to environmental circumstances. Thus, whereas personality traits are characterised by cross-situational stability, need satisfaction and frustration are characterised by considerable cross-situation variability (Bratko et al., 2022).

When considering how personality traits and need satisfaction/frustration might be related we must consider effects in both directions. First, it is possible that need satisfaction/frustration might influence personality, especially momentary personality expressions. For example, it is plausible that failing an examination might lead to the frustration of the need for competence, which in turn leads to an increase in conscientious behaviour. However, students might also respond to poor performance by disengaging and reducing conscientious behaviour. Equally, as is central to BPNT, needs can and often are satisfied or frustrated dynamically, varying moment to moment and across situations. One can be exposed to need satisfying and need frustrating environments simultaneously (e.g., education vs. hobbies). Thus, although need satisfaction or frustration likely explains variance in momentary personality expressions, it is difficult to see how need satisfaction or frustration in any one context (i.e., education) would lead to systematic changes in trait levels of personality. Personality trait changes would more likely occur if all environments that one experiences over a long period of time repeatedly produce the same need satisfaction or frustration and subsequent contra-trait personality expressions in response (see Wrzus & Roberts, 2017). Thus, it is unlikely that educational need frustration alone would produce consistent population level changes in personality traits, rather than idiosyncratic changes, shaped in-part by the individual differences already held in personality.

In contrast, it seems highly likely that personality "traits are tools for satisfying basic psychological needs" (Prentice et al., 2019, p.67; see also Ryan et al., 2019; Sheldon & Prentice, 2019). That is, personality traits describe systematic variation in the way that we view and engage with the world around us, both of which are almost certainly antecedents of need satisfaction and frustration (Prentice et al., 2019; Ryan & Deci, 2017; Ryan et al., 2019; Sheldon & Prentice, 2019). In the case of the present study, it is highly likely that variation in personality elicits different responses from the social environment (Ryan et al., 2019). For example, because agreeable individuals are typically considerate and kind, they perceive others and their environments as more welcoming. They also treat others well and thus enjoy high quality social relationships that help to satisfy their need for relatedness (Prentice et al., 2019). By contrast, those low in agreeableness (a common feature of dark traits) are often suspicious of others' and behave in hostile ways that might interfere with and actively frustrate attempts to satisfy their own and others' needs for competence, autonomy, and relatedness (e.g., Jonason & Ferrell, 2016; O'Boyle et al., 2012). It is these darker aspects of personality, and their potential relationships with need frustration, that formed our second set of hypotheses.

Before formulating further hypotheses, however, it is worth noting that within this study we assessed personality traits (not momentary personality expressions), relatively exogenous variables that describes a person's relatively stable patterns of cognition, emotion, and behaviour, before later assessing education-specific need frustration, a relatively endogenous variable shaped by the person and environment. Thus, any association between the two sets of variables within this study will most likely reflect the effects of personality upon education-specific need frustration (exogenous → endogenous) and not the other way around (endogenous → exogenous) (Antonakis et al., 2010; Hughes et al., 2018).

1.3. The dark triad and basic psychological need frustration

The dark traits are considered 'dark' because they share common personality traits subsumed by the general personality domain of antagonism or agreeableness (e.g., callousness, deceitfulness) which are considered to be socially aversive (Jones & Figueredo, 2013; Kotov et al., 2017; Miller, Lynam, et al., 2017; Tokarev et al., 2017). There are at least two ways in which the common socially aversive facets of these traits might shape perceptions of need frustration (Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011; Bartholomew,

Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Prentice et al., 2019).

First, individuals high on dark traits might encounter personality-driven biases that shape the way they perceive and appraise their environment (Ryan et al., 2019). Specifically, the 'dark core' includes a sense of entitlement and superiority (Gustafson & Ritzer, 1995), which renders those high on the dark traits difficult to satisfy ('*I deserve more!*'), resulting in negative evaluations of the environment (Jonason & Ferrell, 2016). It is thus possible that those high on the dark traits might perceive and appraise certain educational events (e.g., assessment and feedback) as threatening and need frustrating rather than need supporting opportunities to develop (e.g., Ryan et al., 2019).

Second, personality traits can elicit different responses from the social environment, with these responses affecting needs-based experiences (Ryan et al., 2019). Below we discuss how the characteristic behaviours exhibited by those relatively higher on each of the dark traits might result in personality-driven changes to the environment (especially people's attitudes and behaviour towards them) that might serve to actively frustrate need satisfaction (Jonason & Ferrell, 2016).

Beyond the common "dark core" the three dark traits also have unique components (Miller, Hyatt, et al., 2017; Miller, Lynam, et al., 2017; Paulhus & Williams, 2002). Briefly, Psychopathy is characterised by antagonism plus disinhibition and impulsivity (or low conscientiousness); Narcissism is characterised by antagonism plus grandiosity and attention seeking (or high extraversion); and Machiavellianism is characterised by antagonism plus strategic thinking and self-discipline (or high conscientiousness). We now consider Psychopathy, Machiavellianism, and Narcissism individually.

Those high in Psychopathy tend to be competitive (Jonason et al., 2015), aggressive (Dinic & Wertag, 2018), disregard social conventions, and engage in heightened levels of bullying (Baughman et al., 2012). As a result, they are typically unpopular (Rauthmann, 2012) and will likely have poorer relationships with peers and academic staff, meaning their need for relatedness is frustrated. Individuals high on psychopathy also strive for control and power (Jonason et al., 2015), which can be difficult to achieve as a student (e.g., attendance regulations reduce control and teaching staff have more power), meaning that they view educational contexts as actively frustrating their need for autonomy. Further, those high on psychopathy often act impulsively (e.g., exhibit disruptive classroom behaviour) and with disinhibition (e.g., lack academic integrity), paying little attention to the long-term consequences of their actions. In educational settings such impulsivity tends to result in reduced educational attainment (Hassall et al., 2015). Because of their sense of entitlement, those high in Psychopathy will likely attribute poor performance externally (e.g., teaching quality, unhelpful peers, 'unfair' assessment), and as a result, feel that their need for competence is being frustrated.

Hypothesis 2. Psychopathy will be positively related to need frustration.

Regarding Machiavellianism, we expect identical relations to those outlined for Psychopathy. Current Machiavellianism measures fail to capture the strategic, self-controlled elements of the construct, which renders them indistinguishable from measures of Psychopathy (e.g., Miller, Hyatt, et al., 2017; Miller, Lynam, et al., 2017; Vize et al., 2018). Indeed, Jonason and Ferrell (2016) found few differences in the correlations of Psychopathy and Machiavellianism with various motivational constructs, including need satisfaction and need dissatisfaction. Thus, we include Machiavellianism for completeness but do not hypothesize any deviation from Psychopathy due to unavoidable measurement limitations (e.g., Miller, Hyatt, et al., 2017; Miller, Lynam, et al., 2017; O'Boyle et al., 2012; Vize et al., 2018).

Hypothesis 3. Machiavellianism will be positively related to need frustration.

Regarding Narcissism, Jonason and Ferrell (2016) found that narcissists experience low levels of need satisfaction. However, we anticipate a different pattern of results. As we noted earlier, feeling dissatisfied and actively frustrated are qualitatively different experiences (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Vansteenkiste & Ryan, 2013). Perceiving the environment to thwart one's opportunities to shine goes against narcissists' self-aggrandized, positive self-view (Campbell et al., 2011; Rauthmann, 2012). Further, those high in Narcissism tend to interpret environments as unrestrictive, matching their desire for control (Jonason et al., 2015), which should reduce appraisals of autonomy-based need frustration. In addition, and somewhat unique from Psychopathy, those high in Narcissism tend to pursue social integration and display communal behaviours (Jonason & Fletcher, 2018; Jonason & Zeigler-Hill, 2018), which, in the short-term at least, are likely to enhance feelings of relatedness and reinforce their positive self-image (Jonason & Ferrell, 2016). Because narcissistic individuals tend to have an over-inflated self-image and assume they are popular across contexts, it is possible that they will perceive their environment as supportive regardless of reality.

Hypothesis 4. Narcissism will be negatively associated with need frustration.

1.4. Summary

In summary, the present study addresses calls to integrate SDT, specifically BPNT, and personality (Prentice et al., 2019; Ryan et al., 2019). Our primary goal was to test a model examining a series of hypothesized temporal relationships between dark personality traits, psychological need frustration, student engagement, student satisfaction, and objective performance among University students. More specifically, drawing on SDT, we examine whether perceived need frustration mediates the effects of dark traits upon student outcomes. To the best of our knowledge, this is the first study to assess whether need frustration mediates the relationship between the dark triad traits and student functioning over the course of an academic year. The study makes several contributions. Theoretically, we addressed calls to integrate personality traits and SDT (Prentice et al., 2019; Ryan et al., 2019) and calls to examine multiple dark traits concurrently to determine their unique effects (O'Boyle et al., 2012). Further, by using time-separated data and objective performance criteria (i.e., teacher assessed grades) we addressed empirical limitations of previous studies of the dark triad and psychological needs which have tended to collect entirely self-report data within cross-sectional designs (e.g., Buzzai et al., 2021; Earl et al., 2017; Jonason & Ferrell, 2016).

2. Methods

2.1. Design

The study employed a time-lagged design with data collected from two English universities, one located in the midlands and one in the south east. Prior to data collection, the study gained approval from both Institutional Research Ethics committees, joint application approval number P28585. Upon completion of all parts of the study, students received participation credits required for their studies. At time point 1 – early in the academic year (i.e., October–November) - participants completed an online survey assessing demographics, the dark triad, and need frustration; at time point 2 – mid-way through the academic year (i.e., December–January) - participants completed an online survey assessing student satisfaction and engagement; at time point 3 – end of academic year (i.e., June) – students' final grade point average was recorded. All survey scales used a 7-point Likert-type scale (1 = Strongly Disagree, 7 = Strongly Agree).

2.2. Participants

In total, 330 (female N = 268) full-time psychology students

participated. The mean age was 19.99 (*SD* = 3.08), 57.9 % were first-year undergraduates, 36.1 % were second-year undergraduates, 3.9 % were third-year undergraduates, and 2.1 % were postgraduate students.

2.3. Measures

Dark Triad – We used the Short Dark Triad inventory (SD3; Jones & Paulhus, 2014), which assesses Machiavellianism (e.g., "It's not wise to tell your secrets"), Narcissism (e.g., "People see me as a natural leader"), and Psychopathy (e.g., "I like to get revenge on authorities") with 9-items each. However, two Psychopathy items were omitted due to ethical concerns regarding references to sexual promiscuity and criminal activity. We assessed the impact of shortening the Psychopathy scale using a separate data set (*N* = 301), collected with non-student adults primarily for a different study. The full 9-item scale and shortened 7-item scale used in this study correlated at *r* = .96** and their internal consistencies were equivalent (long: α = .70; Ω = .77; short: α = .69; Ω = .77). The short form correlated with Narcissism at *r* = .25** and Machiavellianism at *r* = .49**, which was almost identical to the long form (Narcissism r = .25**; Machiavellianism *r* = .50**). Thus, reducing the Psychopathy scale to 7-items does not appear to substantially alter the nature of the emergent latent variable. This is perhaps unsurprising given that Bollen and Lennox (1991) have shown that equally reliable effect indicators of a factor are effectively interchangeable and similar findings with other Psychopathy scales have been reported elsewhere (e.g., Tokarev et al., 2017).

Need Frustration – We used the 12-item Psychological Need Thwarting scale (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011), which assesses perceived frustration of autonomy (e.g., "I feel pushed to behave in certain ways"), competence (e.g., "There are times when I am told things that make me feel incompetent"), and relatedness (e.g., "I feel others can be dismissive of me") with 4-items each. Bartholomew, Ntoumanis, Ryan, and Thøgersen-Ntoumani (2011) originally reported Raykov's composite reliability coefficients for autonomy (.80), competence (.82) and relatedness (.77) and the macdonald's omega estimates of reliability in the current study were autonomy (.81), competence (.89) and relatedness (.79).

Student Satisfaction – We used the Course Experience Questionnaire (Ramsden, 1991) that assesses perception of the Quality of Teaching (6-items; e.g., "Teaching staff here normally give helpful feedback on how you are going"; α = .87), Goal Clarity and Standard (4-items; e.g., "You usually have a clear idea of where you're going and what's expected of you in this course"; α = .80), Assessment Appropriateness (3-items; e.g., "Staff here seem more interested in testing what we have memorized than what we have understood"; α = .71), Workload (4-items; e.g., "The sheer volume of work to be got through in this course means you can't comprehend it all*"; α = .77), and Skill Development (6-items; e.g., "Students here are given a lot of choice in the work they do"; α = .72). The McDonald's omega estimate of reliability for the overall scale within this study was Ω = .92.

Engagement – We used the 14-item Work Engagement Scale for Students (UWES-S; Schaufeli et al., 2002), which assesses student absorption (e.g., "Time flies when I'm studying"; α = .73), vigour (e.g., "When I'm studying, I feel mentally strong"; α = .79), and dedication (e.g., "My studies inspire me"; α = .86) with 5-items each. The McDonald's omega estimate of reliability for the overall scale within this study was Ω = .94.

Grade – Student performance was assessed through their end of year Grade Point Average calculated as an average of raw scores (i.e., grade out of 100) for all course credits completed within that academic year. Students signed a grade release form at the onset of the study and grades were collected from the central repository managed by the registrar.

3. Results

3.1. Analytical strategy

Using M*plus* 8.0 (Muthén & Muthén, 1998–2015), all scales were subject to item-level confirmatory factor analysis to assess dimensionality, we then estimated a complete measurement model, followed by structural models (Anderson & Gerbing, 1998). The weighted least squares means and variances adjusted (WLSMV) estimator was used in all analyses, because it is suitable for ordinal-level data and robust to violations of multivariate normality (Booth & Hughes, 2014; Flora & Curran, 2004). Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) values ≥0.90 were taken as indicative of acceptable model fit (Hu & Bentler, 1999; Marsh et al., 2005). Typically, Root Mean Square Residual (RMSEA) values ≤0.08 are also taken as indicative of acceptable model fit. However, when modelling factors with few indicators (i.e., short scales) that load strongly (>0.8), the ≤0.08 guideline tends to over-reject models (McNeish et al., 2018). Instead, a cut-off around 0.2 provides a more reliable marker of model fit (McNeish et al., 2018).

3.2. Dimensionality

In all cases, we modelled the scales as recommended by the scale developers and/or rigorous validation studies. In general, the CFI and TLI indicated acceptable fit for unidimensional item-level CFA models, but the RMSEA was higher than would be preferred, although acceptable given the short scales and generally large loadings (McNeish et al., 2018) (Table 1). However, for Narcissism and the global 'dark core' model, all indices suggested misfit. Accordingly, we made minor modifications, a procedure commonly required due to sub-optimal personality scale construction (Booth & Hughes, 2014). For Narcissism, we removed one weakly loading item (λ = 0.025; 'I feel embarrassed if someone compliments me') and correlated the residual terms of two similar items which represent the grandiose element of narcissism ('I

Table 1
Fit indices for item-level CFA models.

Construct	χ^2	DF	SIG	CFI	TLI	RMSEA
Psychopathy	16.86	14	*p = .264*	.996	.994	.025[.00–.06]
Narcissism	135.37	27	*p < .001*	.803	.737	.110[.09–.13]
Narcissism Revised	44.26	19	*p < .001*	.947	.921	.063[.04–.09]
Machiavellianism	86.81	27	*p < .001*	.935	.909	.101[.08–.12]
Dark Triad (2nd order)	605.98	205	*p < .001*	.860	.843	.077[.07–.08]
Dark Triad Revised	394.41	165	*p < .001*	.918	.905	.065[.06–.07]
Autonomy Frustration	31.38	2	*p < .001*	.977	.932	.211[.15–.28]
Competence Frustration	30.10	2	*p < .001*	.986	.957	.206[.15–.27]
Relatedness Frustration	3.28	2	*p = .194*	.999	.998	.044[.00–.13]
Need Frustration (2nd order)	205.87	51	*p < .001*	.975	.967	.096[.08–.11]
Engagement (2nd order)	358.28	74	*p < .001*	.954	.943	.11[.09–.12]
Satisfaction (2nd order)	683.34	202	*p < .001*	.931	.921	.085[.08–.09]

Note. Engagement and Satisfaction were modelled according to the specifications set out by the scale developers, with the general factor loaded by sub-factors, which were loaded by their constituent items. For RMSEA, 90 % CIs are provided in brackets.

know that I am special because everyone keeps telling me so' with 'I am an average person' – reverse coded). The removed item does not represent Narcissism and consistently relates weakly to the construct (e.g., item-Θ correlation = 0.17; Bonfá-Araujo et al., 2021). For the global 'dark core' model, we retained the modifications to Narcissism and allowed a single cross-factor loading (the Psychopathy item, 'It's true that I can be mean to others' loaded onto Machiavellianism).

3.3. Correlations

Next, we estimated two measurement models which included all study variables. One measurement model included the higher-order factors for the dark core, need frustration, satisfaction, and engagement, the second measurement model omitted these higher-order factors so that we could estimate correlations between the sub-factors. Both the higher-order (CFI = 0.909; TLI = 0.902; RMSEA = 0.051 [0.05–0.06]) and the sub-factor (CFI = 0.924; TLI = 0.917; RMSEA = 0.048 [0.04–0.05]) measurement models provided adequate fit. Notably, Narcissism loaded weakly (λ = 0.35) on the global dark core factor indicating that a non-trivial proportion of variance was not captured by the dark core factor. Table 2 contains the correlations derived from the standardized measurement models. The correlations support all hypotheses proposed in the literature review.

3.4. Structural models

We estimated three structural models, examining whether the effects of the 'dark core' (Model 1) and the unique effects of the dark traits (Model 2 and 3) on student outcomes (student satisfaction, engagement, performance) were mediated by need frustration. For mediation to be supported, the predictor-to-mediator pathway (dark traits to need frustration), mediator-to-outcome pathway (need frustration to outcomes), as well as their product term must be significant (Iacobacci et al., 2007). A product term (or indirect effect) is considered significant when its 95% bias-corrected Confidence Intervals (CIs) do not include zero. We calculated CIs using 5,000 bootstrapped samples (Preacher & Hayes, 2008).

The dark core model (Fig. 1, Panel A) provided adequate fit to the data ($\chi^2(922) = 1638.370$, $p < .001$; CFI = 0.902; TLI = 0.900; RMSEA = 0.059 [0.05–0.06]). The dark core was significantly related to need frustration (β = 0.38), need frustration was significantly associated with student satisfaction (β = −0.51) and engagement (β = −0.23) but not grades (β = −0.08), and engagement (β = 0.14) but not student satisfaction (β = 0.11) was significantly associated with grades. Regarding mediation, the dark core had a significant indirect effect on student satisfaction (β = −0.19[−0.11,-0.27]) and a non-significant direct effect (β = −0.08), suggesting that need frustration fully mediated the effect. For engagement, both the direct (β = −0.21) and indirect effects (β = −0.08[−0.03,-0.13]) were significant. Further, the dark core had a significant indirect effect on grades, via engagement (β = −0.08[−0.03,-0.12]). Model 1 accounted for 14 % of the variance in need frustration, 25 % in student satisfaction, 5 % in engagement, and 6 % in grades.

Next, we sought to examine the unique effects of the three dark personality traits. However, the model failed to converge due to a linear dependency (i.e., a correlation of 1) between Psychopathy and Machiavellianism. As discussed earlier, this is the result of sub-optimal measurement of Machiavellianism in existing scales (Miller, Hyatt, et al., 2017; Miller, Lynam, et al., 2017; Vize et al., 2018). Accordingly, in Model 2 (Fig. 1, Panel B), we dropped Machiavellianism, and focused on Psychopathy and Narcissism. Model 2 provided acceptable fit ($\chi^2(785) = 1076.597$, $p < .001$; CFI = 0.919; TLI = 0.912; RMSEA = 0.061 [0.06–0.07]) and the hypothesized pathways between need frustration, student satisfaction, engagement, and grades remained largely unchanged from Model 1. However, the sub-factors of the dark triad showed diverse effects. Psychopathy was positively related to need frustration (β = 0.56) and had significant negative indirect effects on student satisfaction (β = −0.39[−0.24,-0.66]) and engagement (β = −0.09[−0.28,-0.02]). Further, Psychopathy had a significant indirect effect on grades, via engagement (β = −0.10[−0.03,-0.45]). In contrast, Narcissism had a negative effect on need frustration (β = −0.42) and a significant positive indirect effect on student satisfaction (β = 0.33 [0.85,0.58]) and engagement (β = 0.05[0.04,0.24]). Further, Narcissism had a significant positive indirect effect on grades, via engagement (β = 0.11[0.03, 0.46]). Model 2 accounted for 44 % of the variance in need frustration (30 % more than Model 1), 26 % in student satisfaction, 17 % in engagement, and 9 % in grades.

In Model 3 we assessed Machiavellianism and Narcissism as the exogenous predictors (Fig. 1, Panel C). The results were virtually identical to Model 2 providing further evidence that the SD3 Machiavellianism scale essentially replicates the SD3 Psychopathy scale (Miller, Hyatt, et al., 2017; Miller, Lynam, et al., 2017; Vize et al., 2018).

3.5. Exploratory analysis

During the review process, we were asked to explore the effects of participant sex upon the model parameters. Accordingly, we re-estimated Models 1–3 including sex as a predictor of students' need frustration, satisfaction, engagement, and grades. Sex (coded as 1 = male, 2 = female) did not explain unique variance in need frustration (β = −0.031 to −0.033), satisfaction (β = −0.004 to −0.006), or engagement (β = −0.010 to −0.012) and its inclusion resulted in only minor differences to the parameter estimates of the other variables (typically having no effect or resulting in a change at the 2nd or 3rd decimal). Sex was a statistically significant predictor of grades (β = 0.16[0.07, 0.24]) and increased the overall variance explained from 9 % to 11 % but its inclusion in the model had no effect on the other predictors of grades. Thus, the results appear robust when accounting for student sex.

Table 2
Zero-order correlations.

		1	2	3	4	5	6	7	8	9	10	11	12
1	Dark Triad	(.83)											
2	Psychopathy	–	(.85)										
3	Narcissism	–	.62**	(.78)									
4	Machiavellianism	–	.89**	.40**	(.80)								
5	Need Frustration	.41**	.39**	−.16*	.37**	(.91)							
6	Autonomy Frustration	.37**	.44**	−.12*	.42**	–	(.81)						
7	Competence Frustration	.23**	.31**	−.25**	.29**	–	.80**	(.89)					
8	Relatedness Frustration	.28**	.34**	−.20**	.30**	–	.78**	.84**	(.79)				
9	Engagement	−.09	−.15*	.24**	−.11	−.22**	−.17*	−.26**	−.15*	(.94)			
10	Satisfaction	−.26**	−.31**	−.03	−.21**	−.50**	−.51**	−.47**	−.40**	.50**	(.92)		
11	Grade	−.13*	−.13*	−.10	−.11	−.15*	−13*	−13*	−14*	.18*	.20*		
12	Age	−.05	.00	.00	−.11*	.02	.03	−.01	.05	.11*	.08	−.08	
13	Sex	−.24**	−.19**	−.21**	−.16**	−.04	−.12*	.06	−.03	−.03	.02	.16*	−.06

Note. ** = $p < .001$; Omega (ω) reliability coefficient along the diagonal; Sex is scored 1 = male, 2 = female.

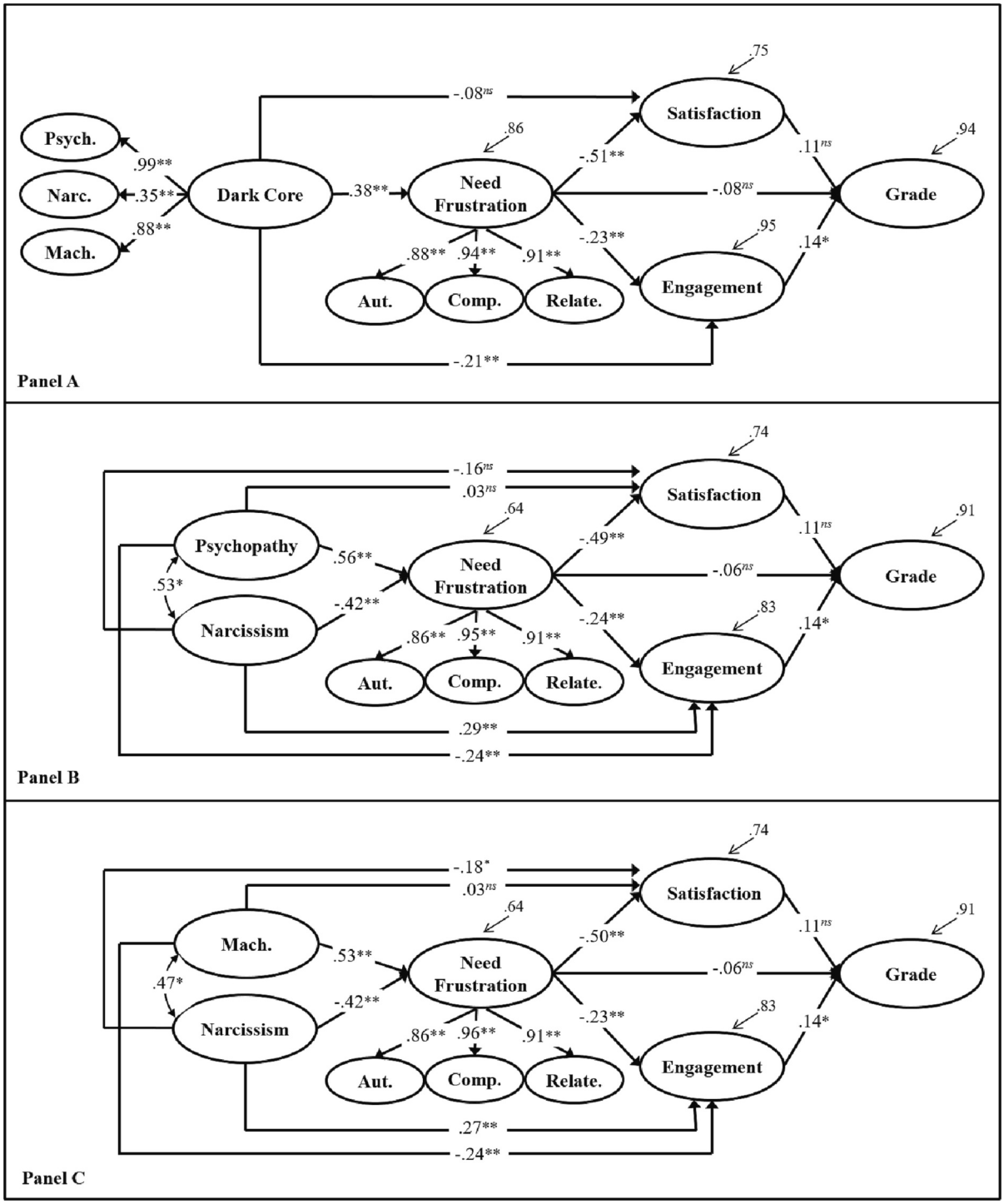

Fig. 1. Standardized WLSMV parameter estimates for structural models of: the effects of the dark triad global factor (Panel A), concurrent effects of Psychopathy and Narcissism (Panel B), and concurrent effects of Machiavellianism and Narcissism (Panel C) on student satisfaction, engagement, and grades, mediated by need frustration. Residual variance components indicate the amount of unexplained variance for each latent variable, thus, r^2 = (1 – residual variance).

4. Discussion

The major findings of this study are that frustrated needs are detrimental to student satisfaction and engagement, and that dark traits appear to be an important antecedent to the occurrence of need frustration, extending previous studies of basic needs in education (Chen et al., 2021; Wang et al., 2021). Specifically, need frustration was negatively associated with student satisfaction and engagement (though not grades), and partially mediated the effects of the dark triad. Further, dark traits had indirect effects on student performance, via engagement. Thus, our results are consistent with the SDT-informed hypotheses and indicate that integrations of personality and basic psychological needs can be informative in helping us understand important student outcomes (Prentice et al., 2019; Ryan et al., 2019).

Model 1 showed that students reporting relatively higher dark core scores perceived heightened need frustration, feeling actively rejected, restrained, and incompetent. However, Model 2 showed that the interpretation of the results is not uniform across all dark traits, the dark core

factor obscured the fact that Psychopathy correlated positively with need frustration whereas Narcissism correlated negatively. Thus, although the dark traits share an antagonistic dark core, they are best considered, analysed, and discussed as separate entities (Glenn & Sellbom, 2015; Tokarev et al., 2017).

Those scoring higher on Psychopathy behave in counterproductive and hostile ways that serve to frustrate their psychological needs (e.g., Jonason & Ferrell, 2016; O'Boyle et al., 2012; Tokarev et al., 2017). They will, more frequently than those lower on Psychopathy, lie, manipulate, argue, boast, hold grudges, and act recklessly. All of which are likely to alienate peers and staff, potentially provoke reciprocation (Vansteenkiste & Ryan, 2013), and create a toxic environment (Tokarev et al., 2017) that serves to frustrate needs.

In contrast, relatively higher levels of Narcissism were associated with lower levels of perceived need frustration. This finding might appear to conflict past research that found Narcissism was negatively correlated with need satisfaction (Jonason & Ferrell, 2016). However, feeling dissatisfied and actively frustrated are qualitatively different experiences (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Vansteenkiste & Ryan, 2013). Feeling frustrated requires an appraisal that others dislike you and that the environment governs ones' psychological outlook (Ryan et al., 2019). Such appraisals would run contrary to narcissists' grandiose belief system, which results in a view that they can control environments (Campbell et al., 2011). Equally, for students, university settings are typically viewed as emerging zones (i.e., short-term, loosely structured social networks) that provide fertile ground for self-enhancement, short-term mating, and positive, if sometimes inauthentic, social interactions. Thus, because narcissists put effort into social relationships and communal behaviours (Jonason & Fletcher, 2018; Jonason & Zeigler-Hill, 2018), it is possible that they are unlikely to feel these needs being actively frustrated, even if they are not fully met (Jonason & Ferrell, 2016). Therefore, university settings seem to frustrate the needs of those higher on Psychopathy but not those higher on Narcissism (Campbell & Campbell, 2009).

4.1. Limitations and future research

The total sample was reasonably sized and provided adequate statistical power. However, the participants were all psychology students (and thus predominantly female), which precludes conclusions about the effects in other disciplines (especially those with different sex ratios, e.g., mathematics). Personality influences educational subject choices such that average levels of personality differ across subjects (Verbree et al., 2021). Thus, future research should examine whether the effects observed here are consistent across subject areas.

Despite being one of the dominant dark triad scales, the SD3 provided poor assessment of Machiavellianism, which was essentially identical to Psychopathy (Miller, Hyatt, et al., 2017; Vize et al., 2018). Future research should seek to develop accurate and appropriate scales (see Hughes, 2018) so that the effects of Machiavellianism can be estimated (Miller, Hyatt, et al., 2017). We also had to modify the Psychopathy scale (for ethical reasons) and the Narcissism scale (for measurement reasons). Although these modifications had very small effects on the overall factors (see the methodology) future research might benefit from using more reliable and psychometrically robust dark triad scales.

Although we collected multi-source and time-separated data, we were unable to use experimental manipulation and collected self-report personality and need frustration data. Thus, we cannot make firm conclusions regarding the precise magnitude of the effects or the nuances of the causal processes implied (e.g., whether some effects are reciprocal) due to endogeneity biases such as common method and omitted variable biases (Hughes et al., 2018). For example, it would be useful to explore personality traits and environmental factors concurrently to examine their relative and collective effects on need frustration and student outcomes. Future research should also seek to incorporate more multi-source objective assessments of variables other than grades (e.g., engagement metrics: student attendance/interaction with online materials).

The nature of our design also precluded the examination of the extent to which students' need frustration was associated with personality-driven biases (appraisal mechanisms) or from personality-driven changes to the environment (proactive mechanisms, see Ryan et al., 2019). Disentangling these effects would be helpful in the development of staff/student training and policy recommendations.

4.2. Conclusion

In sum, students' dark traits explain non-trivial proportions of variance in students' need frustration, and do so in interesting ways. The dark core, common to all dark traits, is related to heightened levels of perceived frustration, as is Psychopathy. However, some elements of Narcissism appear to be related to reduced perceptions of need frustration (Ryan et al., 2019). In addition, we found that both personality traits and need frustration are associated with subsequent student satisfaction, engagement, and, to a lesser extent, grades. Thus, our study demonstrates the explanatory value of integrating personality traits and SDT-based constructs when seeking to understand substantive student outcomes.

CRediT authorship contribution statement

David J. Hughes: Conceptualization, Data curation, Formal analysis, Methodology, Software, Supervision, Validation, Visualization, Investigation, Resources, Writing - original draft, Writing - review & editing. **James W. Adie:** Conceptualization, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing - original draft, Writing - review & editing. **Ioannis K. Kratsiotis:** Formal analysis, Writing – original draft, Writing – review & editing. **Kimberley J. Bartholomew:** Investigation, Project administration, Resources, Writing – original draft, Writing – review & editing. **Roy Bhakta:** Data curation, Methodology, Project administration, Writing – review & editing. **John Martindale:** Formal analysis, Writing – review & editing.

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