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Peer Climate Matters for Academic Motivation and Student Functioning in Higher Education

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Abstract

The current study tested a mediational model accounting for the hypothesized sequence of relationships between the perceived peer-created learning climate, academic motivation, and indices of student functioning across two cohorts in a Higher Education setting. Utilizing a total of 373 undergraduate psychology students from two independent samples (cohort 1: n=172; cohort 2: n=201), our findings revealed that a perceived peer-autonomy supportive climate significantly and positively related to both types of academic motivation, albeit more strongly for autonomous relative to controlled regulation, and was inversely associated with amotivation. In turn, higher levels of autonomous motivation were strongly related with higher levels of engagement, and lower levels of burnout symptoms among the participants, whereas the inverse was observed for controlled and amotivation. Indirect effects were also found concerning the mediational role of academic motivation, and our findings were replicated across samples ruling out the possibility of a potential cohort effect. Overall, our findings point towards the theoretical and practical significance of peer influence for fostering academic motivation and healthy functioning among students in Higher Education. However, they also highlight the potential of peers to create climates which may, on the face of it, appear autonomy-supportive, but promote more introjected and external reasons for student motivation which, in turn, undermines their psychological functioning. Future research unpacking the complex influence of peer climates on student motivation in Higher Education is needed.

Keywords: Peer autonomy support, Self-determination, Student motivation, Student functioning, Well-being, Higher Education

For many students, studying for a University degree is a challenging yet rewarding experience marked by heightened confidence via the realization of one's academic potential (e.g., Holliman et al., 2018; Zhao et al., 2021). Nevertheless, it is important to note that mere course enrolment alone does not guarantee students' fulfilment of their academic development, persistence, and attainment (for reviews, see Moore, 1993; Tinto, 1975, 2006). That is, students can feel pressurized, disengaged, and dissatisfied by their University experience and as a result may encounter low attainment, poor mental health, and even intentions to, and actual, withdrawal from one's degree course (e.g., Bewick et al., 2010; Bruffarets et al., 2018; Deci & Ryan, 2002; Holliman et al., 2021; Vansteenkiste et al., 2005). The current study drew from self-determination theory (SDT; Ryan & Deci, 2017) to advance understanding of the motivational processes accounting for variation in student functioning in Higher Education (HE). Extensive SDT research has demonstrated the importance of the motivational environment created by teachers for student motivation, engagement, and well-being in school settings (e.g., Bartholomew et al., 2018; Reeve, 2006). However, there is a scarcity of work in tertiary education investigating how other social agents (e.g., peers) facilitate or undermine student motivation and their subsequent academic functioning. With this in mind, our aim was to focus exclusively on how different aspects of the peer-created climate are associated with students' academic motivation, engagement, and burnout in HE.

Student Functioning in Higher Education

In recent years, promoting optimal student functioning and well-being has moved to the forefront of HE Institutions' agenda. Indeed, student satisfaction and engagement, alongside achievement (i.e., learning and attainment outcomes), are arguably the most important indicators of an educational institutions' effectiveness (Al-Hemyari & Al-Sarmi, 2016), yet students often report occurrences of feeling chronically stressed (e.g., Liu et al.,

2023). In the current study, we focused on academic engagement and burnout as t indicators of optimal and inhibited student functioning, respectively. The contemporary psychology literature suggests that engagement and burnout are distinct yet negatively related constructs that have different antecedents and outcomes (e.g., Leiter & Maslach, 2017; Schaufeli & Bakker, 2004). In other words, the two constructs can co-exist (i.e., the mere presence of engagement does not indicate the absence of burnout). For example, a University student could be experiencing symptoms of mild burnout (exhaustion) but may also be heavily engaged in their studies.

According to Schaufeli et al. (2002), student engagement is defined as a positive, fulfilling and work-related state of mind characterized by absorption (i.e., being fully focused and immersed in one's studies), dedication (i.e., meaningfully pursuing academic attainment), and vigor (i.e., being highly energized, stimulated and invested in one's studies). Previous research has positively linked engagement with academic achievement and performance (e.g., Collie et al., 2017; Fredericks et al., 2016; Holliman et al., 2018; Salanova et al., 2010). Conversely, academic burnout,(Schaufeli et al., 2002), an indicator of ill-being, is known to be health-impairing.In HE, for example, students' who perceive their study demands (e.g., completing assessments) to outweigh the personal resources available to them (e.g., resilience, motivation), are at higher risk of experiencing burnout (Jagodics & Szabó, 2022). Student burnout is characterized by feelings of emotional and physical exhaustion, adopting a cynical attitude, and reduced levels of academic efficacy (Schaufeli et al., 2002). It is a widespread issue in HE (Liu et al., 2023) with harmful consequences for students whichincludediminished performance, higher absenteeism, and drop-out (e.g., McCarthy et al., 1990; Rosales et al., 2021). In the current study, we sought to determine the motivational antecedents of student engagement and burnout.**Self-Determination Theory**

SDT (Ryan & Deci, 2017) is a useful framework applicable to understanding the implications of motivational processes underpinning the brighter (i.e., academic engagement) and darker sides (i.e., burnout symptoms) of student functioning in HE settings. According to SDT, individuals have three basic psychological needs (i.e., autonomy, competence, and relatedness) essential for one's self-determination and optimal functioning (Deci & Ryan 1985). Self-determination refers to feeling the origin of one's choices and decisions and assimilating behaviors and values that are congruent with the self (de Charms, 1968). In HE, for example, some students may possess a high degree of self-determination in their studies, whereas other students may exhibit less or none.

At the highest end of the self-determination continuum is *intrinsic motivation* which represents the inherent enjoyment derived from participating in the activity (Deci & Ryan, 1985). Next, *extrinsic motivation*, a multidimensional construct, refers to behavior that is regulated by achieving outcomes that are separate to participation in the activity itself (Ryan & Deci, 2002; 2017). *Integrated* regulation refers to performing behaviors that are congruent with one's sense of self. *Identified* regulation involves participating in an activity because one identifies with, and accepts, its underlying values. *Introjected* regulation refers to performing an activity out of internal pressures (e.g., guilt or shame avoidance) or for ego-enhancement. *External* regulation refers to behavior that is controlled by external pressures (e.g., controlling behavior by significant others). Finally, *amotivation* reflects a complete absence of self-determination for, and intentions to drop-out from, the activity (Deci & Ryan, 2000). In line with theoretical assumptions (Ryan & Deci, 2017), the SDT-based research in HE has supported that higher levels of self-determination (i.e., intrinsic motivation, integrated, and identified regulation) is associated with adaptive student outcomes and optimal functioning, whereas lower levels of, and non-, self-determined motivation (i.e., introjected and external regulations, amotivation) are linked to maladaptive outcomes and diminished functioning

(e.g., Holliman et al., 2019; Vansteenkiste et al., 2005). In line with the recent SDT literature (Bartholomew et al., 2011), we distinguished academic motivation in terms of autonomous (i.e., intrinsic and self-determined forms of extrinsic motivation) and controlled (i.e., non-self-determined; introjected and external) regulations and amotivation.

Peer-Climate and its links to Self-determination and Student Functioning

A key postulate of SDT is that need satisfaction and subsequent high levels of self-determination (or autonomous regulation) operating in a domain, like HE, is not an automated process; it requires ongoing nourishment from the social environment (Deci & Ryan, 2000). Two facets of the social environment assumed to hold implications for student functioning are the degree of autonomy support and interpersonal control emphasized by social agents (Deci & Ryan, 1987; Ryan & Deci, 2017). For instance, in HE, an autonomy supportive climate (Deci & Ryan, 1987) would be reflected by significant others (e.g., teaching staff, supervisors) providing a rationale for asking students to engage within an activity, promoting independent problem-solving and decision-making, initiating choice, and minimizing external pressures (Ryan & Solky, 1996). A controlling environment is reflected by pressurizing others to behave or think in a specific way (Deci & Ryan, 1987; Reeve, 2009).

Aligned with theoretical predictions, the work stemming from the SDT-based educational literature indicates that students benefit from environments perceived to be high in autonomy support and low in controlling interpersonal behaviors (Black & Deci, 2000; Deci & Ryan, 2002). For example, past correlational and experimental research (Jang et al., 2016; Reeve, 2006; 2009; Reeve & Jang, 2006) suggests that social agents (e.g., teachers, parents) who engage in higher levels of autonomy supportive behaviors enhance levels of student engagement in primary and secondary education settings. Such findings have also been corroborated in HE with research indicating that teaching environments high in

autonomy supportive features are associated with higher levels of student functioning (e.g., Hassan & Al-Jubari, 2016; Johansen et al., 2023; Vansteenkiste et al., 2005) and a reduced likelihood of maladaptive behavior and ill-being (e.g., Adie & Wakefield, 2011). Furthermore, SDT research has also found that controlling (or autonomy-thwarting) styles exhibited by social agents are associated with reduced autonomous (or controlled) motivation and ill-being (e.g., Bartholomew et al., 2011; Tilga et al., 2019; Vansteenkiste et al., 2005).

Across two studies, Vansteenkiste and colleagues (2005) found that self-determined (i.e.,more autonomous) motivation predicted higher levels of student engagement and academic success, whereas lower levels of self-determination (i.e.,more controlled forms of motivation) was associated with higher drop-out rates and maladaptive learning strategies. A second study found parental autonomy support (relative to control) predicted adaptive learning strategies, and this was mediated by students' relative autonomy (i.e., higher levels of self-determination). In extending the above findings and further supporting SDT propositions, recent research by Johansen et al. (2023) found teacher autonomy thwarting behaviors to be associated with controlled motivation and effort, and teacher autonomy support to predict autonomous motivation and optimal functioning (i.e., increased engagement, vitality, and learning) among Norwegian University students. To date, the majority of SDT education-based research has tested and empirically supported a hypothesized sequence of relationships between perceived autonomy support and interpersonal control, motivational processes, and student functioning from the perspective of teacher and/or parent-created environments (e.g., Black & Deci, 2000; Lavigne et al., 2007; Ratelle et al., 2005). Less SDT work exists focusing on the influence of other social agents in educational contexts.

In physical education (PE), studies have shown that *peers* provide an additional useful source of autonomy support in enhancing adolescents' need satisfaction, autonomous

motivation, and longer-term physical activity behaviour and well-being (e.g., Koka, 2014; Tilga et al., 2021). In primary and secondary education settings, research has also begun to explore and confirm that multiple social agents providing autonomy supportive behaviours are associated with student functioning. For example, a study by Zhou et al. (2019) found that autonomy support provided by parents, teachers, and peers each predicted engagement via psychological need satisfaction among Chinese primary school children. It has also been argued and empirically supported that peer interactions and influence become increasingly more pertinent as we grow older (e.g., Hakimzadeh et al., 2016; Zhou et al., 2019). In HE settings, for instance, adult students frequently interact and develop close working relationships (and friendships) with their peers both directly (e.g., engaging with collaborative learning and group-based assessments) and indirectly (e.g., peer-mentoring schemes, social media), which can influence their academic progression and welfare (e.g., Räisänen et al., 2021). To this end, peers act to provide a regular source of instruction and feedback which has the potential to impact the motivation and functioning of their fellow students.To the best of our knowledge, SDT research concerning adult peer influences has only focused on health-related behaviours (e.g., binge drinking, cardio-respiratory fitness) in relation to peer pressure (e.g., Knee & Neighbors, 2002), or peer need-support (e.g., Giacobbi et al., 2014), in undergraduate student populations. Thus, a gap in the SDT literature currently exists focusing on the implications of different types of perceived peer-created learning environments on student functioning in HE, and whether this is mediated by academic motivation.

The Present Study

Grounded in SDT (Ryan & Deci, 2000; 2017), and extending previous SDT-related work conducted in HE (e.g., Adie & Wakefield, 2011; Johansen et al., 2023; Vansteenkiste et al., 2005), the current study aimed to test a mediational model examining the hypothesized

links between different features of the perceived peer-created climate with indices of student functioning via their academic motivation. More specifically, we hypothesized that perceiving a peer-climate to be high in its autonomy supportive features would be associated with higher levels of autonomous motivation (and lower levels of controlled regulation and amotivation), which in turn, would positively link with students' engagement and inversely relate to their self-reported burnout symptoms. We also expected that perceptions of high levels of controlling peer behaviors would be related to higher levels of controlled and amotivation (and decreased levels of students' autonomous motivation), which in turn, would positively link with burnout symptoms and negatively relate to engagement. A subsidiary aim of the study was to test the invariance of our mediational model across two independent samples. In other words, we attempted to ascertain the replicability of our mediational model by testing for a potential cohort effect.

Methods

Design and Participants

Based on using a G*power (version 3.1.9.7) *a priori* calculation, estimating a medium sized effect ($f^2 = .15$) with alpha and power set at .05 and .95 respectively, along with two predictors (peer-autonomy support, peer-interpersonal control) and three mediators (autonomous regulation, controlled regulation and amotivation) in our regression-based analyses, a minimum sample size of 92 participants were required[1]. In this cross-sectional study, participants were 373 undergraduate psychology students ($M_{age} = 20.13$; SD = 2.09 years; men = 85; women = 287; unreported = 1) from a large University in central England, UK. Two independent samples (cohort 1: n=172; cohort 2: n=201) completed the study in exchange for course credits.On average, participants reported 13 hours of additional study per week outside of class.

Procedures

Ethical approval was granted from the first authors' University's research ethics committee, and BPS ethical guidance was followed. The study was advertised as part of a research methods class to second year undergraduate psychology students at the first and second authors' University. Interested participants were then provided with written and verbal instructions explaining the nature and requirements of the study andtheir rights to withdraw. After obtaining informed written consent, participants were administered a multi-section questionnaire measuring their perceptions of the peer-created climate, academic motivation, and indices of student functioning within a classroom setting. Participants (cohort 1: n=172) completed the questionnaire in approximately 20 minutes and were subsequently debriefed. The above steps were repeated a year later by obtaining a new sample of students (cohort 2: n=201) taking the same class. Out of those invited to participate (total cohort 1 size = 228; total cohort 2 size = 265), the response rates for cohort 1 and 2 were 75.7% and 75.8%, respectively. None were partial respondents (i.e., all respondents answered items on every measure)**Measures**

Perceived peer-created climate. Similar to Zhou *et al.* (2019), we adapted the Learning Climate Questionnaire (LCQ; Williams & Deci, 1996) to assess the extent to which students perceived their peers to provide autonomy support. In the current study, the full 15-item version was modified by changing the source of support from teachers to peers (e.g., "*My peers try to see how I see things before suggesting a new way to do things*"). To assess students' perceptions of peer controlling behavior, we adapted a 4-item version of an instrument originally validated to assess the interpersonal style of teachers (Assor et al., 2002). The 4-item measure (Tsai et al., 2008 tapping into interpersonal controlling behaviors (e.g., disrupting students' natural rhythm of learning, being intrusive and overly demanding) was modified by changing the referent of the items to peers (e.g., "*My peers are critical of me*"). When completing both adapted measures, participants responded to the stem, "*Think*

about the typical atmosphere created by your peers on this course…" The responses were anchored on a scale of 1 (*strongly disagree*) to 7 (*strongly agree*). Previous education-based research had found these scales to exhibit good psychometric properties (e.g., Adie & Wakefield, 2011; Tsai et al., 2008; Zhou et al., 2019). In the present study, the internal consistency for the autonomy support scale was very good (α = .86), but poor for the peer controlling behavior scale (α = .40), as such peer controlling behavior was not taken forward for analyses.

Academic Motivation. The college version of the Academic Motivation Scale (AMS-C28; Vallerand et al., 1992; 1993) was used to assess students' degree of self-determined motivation for studying their course. The AMS-C28 measures intrinsic motivation (e.g., "*Because I experience pleasure and satisfaction while learning new things*"); and three extrinsic motivation subscales which vary in their relative autonomy: The most autonomous extrinsic motivation is identified regulation which involves engaging in a behaviour because its outcomes are valued by the individual (e.g., "*Because I believe that a few additional years of education will improve my competence as a worker*"). The two more controlled forms of extrinsic motivation assessed by the AMS-C28 include introjected regulation (e.g., "*Because I want to show myself that I can succeed in my studies*"), and external regulation (e.g., "*In order to obtain a more prestigious job later on*"). The final AMS-C28 subscale measures amotivation (e.g., "*I don't know; I can't understand what I am doing on this course*"). Participants responded to a modified stem, "*Why do you study your course*?" Participants rated how true the items were for them on a 7-point Likert-scale ranging from "*Does not correspond at all*" (1) to "*Corresponds exactly*" (7). This measure has been found to demonstrate support for measurement invariance, predictive and construct validity, and high levels of internal consistency in research utilizing college student populations (e.g., Smith et

al., 2010). In the present study, the internal consistency for all subscales was found to range from good to excellent (α = .78-.92).

For the purpose of addressing our research question, and in line with SDT and other education-based studies (e.g., Bartholomew et al., 2011), intrinsic and identified motivation were aggregated to represent a composite score of autonomous motivation, and introjected and external motivation were used to compute a composite score of controlled motivation. Amotivation, the complete absence of any form of motivation, was modelled independently.

Student functioning. To measure indices of student functioning, the current study employed the Work Engagement Scale for Students (WESS) and the Maslach Burnout Inventory-Student Survey (MBI-SS) both developed by Schaufeli, Salanova, et al. (2002). The WESS has 14 items and was used to capture the degree to which students felt they engaged with their course. This measure has three subscales: vigour (5 items; e.g., "*when I'm studying, I feel mentally strong*"), absorption (4 items; e.g., "*time flies when I'm studying*") and dedication (5 items; e.g., "*I find my studies to be full of meaning and purpose*"). The MBI-SS has 15 items along three subscales: exhaustion (5 items; e.g., "*I feel emotionally drained by my studies*"), cynicism (4 items; e.g., "*I doubt the significance of my studies*") and reduced efficacy (6 items; e.g., "*During class I feel confident that I am effective in getting things done*"; reversed scored item). The responses to the items of the WESS and MBI-SS were scored on a frequency rating scale ranging from 1 (*never*) to 7 (*always*). Both questionnaires produce evidence of internal consistency, predictive and cross-cultural validity (Salanova et al., 2010; Uladağ & Yaratan, 2010; Zhang, Gan, & Cham, 2007). The WESS (α = .83) and MBI-SS (α = .89) had very good internal consistency in the present study.

Results

Preliminary Analysis

Following the recommended guidance by Newman (2014), an all-available data approach was utilized on the basis that missing data in the current study was extremely low (<1%), observed at the item-level only, and that our analyses were exclusively focused at the construct-level (e.g., Path analysis).

Table 1 displays means, standard deviations, and zero-order bi-variate Pearson's correlations for the core measures in this study. On average, each cohort reported low levels of academic amotivation, moderate levels of burnout symptoms and engagement (midpoint = 3.5), moderately high levels of perceived peer autonomy support, autonomous and controlled regulation.

Table 1 here

Hypothesized Model

All analyses were performed using M*plus* 8 (Muthén & Muthén, 2018). In order to test the hypothesized mediation model, across the two cohorts, we estimated a multi-group path analysis model using maximum likelihood estimation and 5,000 bootstraps, with bias corrected confidence intervals (CIs), to estimate the indirect effects. Indirect effects are argued to be statistically reliable when the 95% bias-corrected CIs do not include zero (Preacher & Hayes, 2008).

First, we estimated an unconstrained model in which all parameters were free to vary between the two cohorts. The unconstrained model fit the data well: χ^2 (4) = 4.23; CFI = .99; TLI = .99; RMSEA = .018 [.00-.11]. Next, we estimated a fully constrained model in which all parameters were fixed to be equal across the two cohorts. The constrained model also fit the data well: χ^2 (15) = 22.132; CFI = .98; TLI = .96; RMSEA = .078 [.048-.12]. A chi-square difference test suggested that the unconstrained and constrained models were not

significantly different (χ^2 (11) = 17.90, p = .08)although some individual pathways were significantly different (see Table 2) but not in such a way that alters any substantive interpretations. The non-significant chi-square difference test supported our invariance hypothesis (i.e., our mediational model was found to be equivalent across cohort 1 and 2). Therefore, we only present the parameter estimates from the constrained model (see Table 2). peer autonomy support was significantly and positively related with autonomous and controlled regulations, and inversely associated with burnout. In turn, autonomous, controlled and amotivation displayed weak to strong relationships with engagement and burnout in the expected directions. The proportion of variance explained by the hypothesized model in Autonomous Regulation, Controlled Regulation, Amotivation, Burnout and Engagement was 4%, 1%, 3%, 45% and 44%, respectively.

The indirect effects are displayed in Table 3. The results revealed that peer autonomy support had a significant indirect effect on engagement, and a non-significant direct effect (see Table 2), suggesting autonomous motivation fully mediated this relationship. Autonomous regulation and amotivation were found to partially mediate the indirect relationships between peer autonomy support and burnout as a direct effect was also observed (see Table 2).

** Table 2 here **

Table 3 here

Discussion

Grounded in SDT (Ryan & Deci, 2000; 2017), the study tested a mediational model examining the hypothesized links between the perceived peer-climate, academic motivation, and indices of optimal and inhibited functioning across two independent cohorts of students in a HE setting. More specifically, the study findings supported a hypothesized mediational

model suggesting that students' academic motivation mediated the indirect relationships between perceived peer-created autonomy support with academic-related engagement and burnout symptoms. The findings supported our invariance hypothesis across the two independent cohorts.

Peer Autonomy Support, Academic Motivation and Student Functioning

A novel feature of the current study was examining the indirect relationship between perceptions of the peer climate and student functioning via autonomous, controlled and amotivation. Previous SDT studies have only investigated these relationships in school settings. To the best of our knowledge, we are one of the first studies to do so in a HE setting. In partial support of our first hypothesis and SDT (Ryan & Deci, 2017), the observed findings indicate that when peers were perceived to create a learning environment high in autonomy supportive features, students expressed higher levels of autonomous motivation, and lower levels of amotivation, during their undergraduate studies. These results corroborate findings from other education-based studies that have examined the implications of peer-climate in school (e.g., Zhou et al., 2019) and PE settings (e.g., Koka, 2014). Although they point towards the importance of how other social agents (besides parents and teachers) can provide autonomy support to benefit University students' autonomous motivation to learn, our findings also found peer autonomy support to be associated with increased controlled regulation. One plausible explanation is that peers may provide autonomy support in the sense of other aspects of University. For example, many HE institutions share high-tuition fees, with an assessment-driven and employability focus. Thus, peers who provide their fellow students with autonomy support may inadvertently also be contributing to the internal and external pressures (e.g., being ahead of the competition, the pressure to pass assessment) that may govern students motivation (e.g., "Can I find a job to pay back my course fees?"). Another possible explanation could be that some items from the LCQ ("I feel that m*y peers*

care about me as a person") may not be interpreted exclusively as tapping into peer autonomy-support. For example, a fellow student may really care about their course mate, who may be concerned about their performance on a course, by telling them how intelligent they are and that their studies will all be worth it to get a higher paid job at the end of their degree course. Although this on the surface may seem like promoting autonomous motivation (identified regulation), it may contribute to a controlled form of regulation, as indicated by items from the AMS-C28 that tap into introjected ("...*because of the fact that when I succeed in my studies I feel important*") and external ("...*In order to obtain a more prestigious job later on*") regulations.

Congruent with the second set of hypotheses, higher levels of autonomous regulation were associated with increased levels of student engagement, and lower levels of burnout symptoms and the opposite pattern of findings was shown for controlled motivation and amotivation. Our findings suggest that when students are more autonomously motivated to learn on their course, they are more dedicated, absorbed, and invigorated by their studies. Similar to other SDT work in HE (e.g., Holliman *et al*., 2018; Vansteenkiste et al., 2005), our results suggest that the more students feel their choices and decisions stem from themselves and assimilate the values of their academic experience, the higher their level of optimal functioning and engagement during their studies. With respect to the links with burnout, our findings suggest that students who feel more personal autonomy, and less or no self-determination during the course of their studies are less likely to adopt a cynical attitude towards their work, feel less emotionally and physically exhausted by the demands of their course, and experience lower levels of inefficacy concerning their academic performance.

In partial support of our penultimate hypotheses, we found that students' autonomous motivation and amotivation mediated the relationship between peer-created autonomy support with both levels of engagement and self-reported burnout symptoms. Our findings

tentatively suggest that students should aim to foster support for their fellow classmates' autonomy as a way of promoting student welfare and engagement within their University course. However, it should also serve as a reminder that fostering autonomy support also has the potential to facilitate controlled motivation, albeit to a lesser extent. This is problematic in that controlled motivation was associated with less academic engagement and higher levels of burnout. Overall, our novel mediational findings extend previous work by considering key motivational processes underpinning the role of teacher and parental autonomy support on student functioning in HE (e.g., Adie & Wakefield, 2011; Vansteenkiste et al., 2005), as well as corroborating work examining indirect effects of peer-autonomy support and student functioning, albeit in school contexts (e.g., Zhou et al., 2019).

Absence of a Cohort Effect

Another added contribution to the SDT-based educational literature is that our study found the links between perceived peer autonomy support on academic motivation, and subsequent student functioning were invariant across two independent samples from the same student population. Indeed, the absence of a cohort effect is an indicator of replicability of our mediational model. This is an important theoretical development as not only do the findings imply support for SDT's universality hypothesis of motivational processes holding across different groups and settings (Ryan & Deci, 2000; 2017) but they also point towards the potential implications of motivation as being a key driver of student functioning, regardless of a cohort effect.

Practical Implications

The current results yield potentially important practical implications for developing peer-learning interventions. In corroboration with findings from other SDT-based studies in education (e.g., Tilga et al., 2021; Zhou et al., 2019), it is recommended that peer-led learning environments aimed at promoting optimal student functioning, and preventing ill-being, can

be achieved by attempting to foster students' autonomous motivation. To accomplish these aims, educators may want to help train and guide students to develop autonomy supportive behaviours both in class (e.g., problem-based learning activities) and outside (e.g., assessment-support). For example, students may support their fellow classmates by initiating choice and decision-making, taking the others' perspective, minimising controlling language and pressure (Reeve, 2009). It may also be useful for peers to consider adopting other need-supportive behaviors too (e.g., competence-support, relatedness support; Giacobbi et al., 2014) to contribute to the potential academic functioning of their classmates.

Limitations and Future Directions

Despite support for our hypothesized model, several limitations exist concerning the interpretation of the findings. First, the results stem from cross-sectional data. Follow-up studies considering a longitudinal design are necessary to discover how ongoing autonomy support created by peers (and teachers) impacts University students well-being over time, and to empirically test the temporal ordering of such pathways. The correlational nature of the design also meant that we could not infer causality of the relationships found in the current study. Therefore, experimental replications of our findings are necessary. For example, it may be possible to observe the short- and long-term effects of manipulating the peer-created autonomy supportive climate with a view to enhancing fellow students' optimal functioning over the course of a single class, academic semester, or the entire degree. This could involve assessing the short-term effectiveness of trained students on existing peer-mentoring schemes designed to support peer development and well-being. The employment of multi-level modelling may also help to determine how perceived (peer) autonomy-support is understood at both an individual and class-level on well-being outcome variables, as well as exploring reciprocal effects (e.g., Jang et al., 2016).

At a measurement level, our adapted uni-dimensional measure of controlling behaviors (Assor et al., 2002) for peers was problematic, and subsequently dropped. One potential explanation is that SDT researchers have found that interpersonal control is a multi-faceted construct, and current measures (albeit focused on instructors) assess multiple dimensions (e.g., the use of negative conditional regard, rewards, intimidation, and excessive personal control; see Bartholomew et al., 2010). Thus, it could be that we did not tap into different features represented by this construct when assessing perceptions of the peer-climate. Future research attempting to replicate our work may consider choosing more robust measures to modify (i.e., the Controlling Coach Behavior Scale; Bartholomew et al., 2010), or developing a new validated measure to capture controlling peer behaviors. We also only assessed peer influence. It would also be interesting to compare the unique variance of parent, teacher, and peers attributable to explaining indices of student functioning and attainment in HE settings utilizing more objective measures (e.g., cortisol response, degree completion). Another limitation of the work is that our findings may also only be generalizable to face-to-face courses. Future work may wish to collect data and replicate our findings with distance learning/online courses where students potentially desire more interaction from their peers.

At a conceptual level, several issues are noted. First, we only assessed psychological engagement. Future researchers may wish to incorporate other dimensions of student functioning (e.g., cognitive, emotional, and behavioral engagement; see Fredericks et al., 2016; Jones, 2008) as a result of investigating the influence of the perceived peer climate in HE settings. Secondly, basic psychological need satisfaction (and frustration) was only assumed, but not actually tested, in relation to participants' levels of self-determination in the current study. According to SDT, the basic psychological needs requiring ongoing nourishment from the social environment (i.e., autonomy support) are essential for promoting self-determined motivation, and subsequent well-being. Basic Psychological Needs Theory

(BPNT; Ryan & Deci, 2000), a sub-theory of SDT (Ryan & Deci, 2017), assumes and has empirically supported that the psychological needs directly predict student well-being too. Future research, therefore, may wish to test a more comprehensive model of motivational processes by understanding the hypothesized sequence of relationships between the perceived peer climate, psychological basic needs, all types of motivational regulations (i.e., intrinsic to amotivation), and indices of well- and ill-being.

Conclusion

Extending past SDT research in educational settings (see Jang et al., 2016; Reeve, 2009), the current findings supported a theoretically-informed hypothesized model, invariant across two samples, predicting autonomous motivation as a key mediator of the indirect relationship between perceived peer-created autonomy support and optimal student functioning in HE. From an applied perspective, our findings suggest that peers matter as part of the HE learning environment used to support students' autonomous motivation and academic functioning. However, we also observed the potential risk of peer autonomy support fostering controlled regulation. Further SDT work is necessary to unpack the complex influence of peer climates on student motivation in HE settings.

Footnote. [1]A Monte Carlo simulation study was conducted in M*plus* to provide further verification of informing our sample size requirements for more complex mediational analysis in SEM (see Muthén & Muthén, 2002; Thoemmes et al., 2010). The simulated model examined comprised two predictors, three mediators, and two outcomes across various sample sizes (5000, 500, 100, 50). The findings consistently showed medium effect sizes for all paths across different sample sizes, with average path coefficients ranging approximately from 0.29 to 0.31. Notably, the proportion of significant results was consistently high (100%) for larger sample sizes (5000 and 500), indicating robustness in the path estimates. However, as the sample size decreased to 100 and 50, the proportion of significant results showed greater variability (ranging from 57.4% to 83.5%), suggesting increased uncertainty in smaller samples. This pattern underscored the influence of sample size, and the need for our overall (and independent) sample(s) to include more than 100 participants, to retain confidence in the stability and reliability of the mediational SEM multi-group path analysis.

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Declarations

Ethical Approval. The study (P26784) was granted ethical approval by the research ethics committee at Coventry University, UK. Data collection was conducted in accordance with BPS ethical guidelines.

Informed consent. Informed written consent was obtained from all participants.

Conflict of Interests. The authors have no known financial or non-financial competing interests to disclose.

Data availability. Due to ethical restrictions, the data generated by the survey research and analyzed during the current study is kept under password protection on the Open Science

Framework, (OSF; https://osf.io/thjsz). Interested researchers wanting to access the data must do so as a reasonable request to the corresponding author (J.Adie@staff.newman.ac.uk) in order to retrieve the password.

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List of Tables

Table 1

Descriptive Statistics and Bivariate Correlations among all Study Variables for each Cohort

Variable	*Cohort 1*		*Cohort 2*		1	2	3	4	5	6
	M	*SD*	*M*	*SD*						
1. PAS	4.84	0.81	4.79	0.78	–	.20**	.09	-.21**	-.26**	.16*
2. Autonomous Regulation	5.39	0.82	5.32	0.85	.16*	–	.73**	-.43**	-.44**	.59**
3. Controlled Regulation	5.64	0.88	5.56	0.85	.14*	.66**	–	-.15*	-.07	.18*
4. Amotivation	1.63	0.88	1.80	1.02	-.18*	-.46**	-.21**	–	.50**	-.48**
5. Burnout	3.24	0.77	3.21	0.93	-.23**	-.50**	-.16*	.55**	–	-.68**
6. Engagement	4.33	0.92	4.34	0.93	.14*	.62**	.24**	-.38**	-.65**	–

Notes. *$p < .05$; **$p < .01$; PAS = Peer Autonomy Support. Correlations above the diagonal are calculated from cohort 1 and, those below the diagonal are from cohort 2.

Table 2

Parameter Estimates for the Constrained Path Model

Path	*B*	β	R^2
PAS → Autonomous Regulation	.17	.17**	.04
PAS → Controlled Regulation	.13	.12*	.01
PAS → Amotivation	-.23	-.23**	.03
Burnout			.45
PAS → Burnout	-.13	-.13*	
Autonomous Regulation → Burnout	-.49	-.49**	
Controlled Regulation → Burnout	.30	.30**	
Amotivation → Burnout	.36	.36**	
Engagement			.44
PAS → Engagement	.04	.04	
Autonomous Regulation → Engagement	.85	.73**	
Controlled Regulation → Engagement	-.35	-.35**	
Amotivation → Engagement	-.12	-.12*	

Notes. *$p < .05$; **$p < .01$; PAS = Peer Autonomy Support. *B* = unstandardized coefficient; β = standardized coefficient

Table 3

Indirect effects of Peer Autonomy Support on Burnout and Engagement via Autonomous Regulation, Controlled Regulation, and Amotivation from the Constrained model

Mediator	**Outcome**	**Standardized IE**	**Unstandardized**			
			IE	**SE**	**CI**	
					LLCI	**ULCI**
Total Indirect	*Burnout*	*-.12***	*-13*	*.04*	*-.21*	*-.05*
Autonomous Regulation	Burnout	-.08*	-.09	.03	-.15	-.03
Controlled Regulation	Burnout	.04	.04	.02	.01	.08
Amotivation	Burnout	-.09*	-.08	.02	-.13	-.04
Total Indirect	*Engagement*	*.11***	*.13*	*.04*	*.05*	*.22*
Autonomous Regulation	Engagement	.13**	.15	.05	.05	.23
Controlled Regulation	Engagement	-.04	-.04	.02	-.11	-.01
Amotivation	Engagement	.02	.03	.01	.01	.06

Notes. *$p < .05$; **$p < .01$; IE = Indirect effect, SE = standard error; LLCI = lower confidence interval, ULCI = upper confidence interval