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Explaining the negative impact of financial concern on undergraduates' academic outcomes:

Evidence for stress and belonging as mediators

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Abstract

Poorer financial circumstances among undergraduate students predict worse academic outcomes, yet there is a lack of research examining mediators. Accordingly, the present research aimed to identify such mediating variables. In Study 1, cross-sectional data were collected from UK undergraduates ($N = 516$). Controlling for background variables, path analysis indicated that stress, sense of belonging at university, working memory, and self-control mediated the negative relationship between financial concern and academic performance. In Study 2 an independent sample ($N = 2794$) was used to successfully validate the respecified model developed in Study 1. Additionally, longitudinal data were collected from UK undergraduates ($N = 453$) at three time points in an academic year. Controlling for background variables, financial concern predicted subsequent changes in intrinsic academic motivation, as mediated by changes in stress and sense of belonging at university. Together, this provides consistent evidence for stress and belonging as mediators of the impact of finances on academic outcomes. Our findings afford a more complete understanding of how financial concern may affect students' experience at university, highlight potential negative consequences of funding systems that place a financial burden on students, and could serve to inform interventions aimed at mitigating the negative effects of financial concern.

Keywords: financial concern; academic outcomes; stress; belonging; university

Research indicates that poorer financial circumstances are associated with worse academic outcomes in higher education. In particular, experiencing financial difficulties has been found to predict lower average marks (Harding, 2011), poorer performance in examinations (Andrews & Wilding, 2004), taking longer to graduate (Letkiewicz et al., 2014), and an increased risk of dropping out of university (Joo, Durband, & Grable, 2008). Further, it is common for students to report that financial difficulties have impaired their ability to study (Brennan, Duaso, Little, Callender, & Van Dyke, 2005; Ross, Cleland, & MacLeod, 2006), with only 42% of UK undergraduates surveyed in the 2011/12 academic year reportedly able to concentrate on studying without worrying about financial problems (National Union of Students, 2012a).

Another academic outcome apparently influenced by finances is motivation. For instance, qualitative research indicates that the alleviation of financial difficulties through financial aid increases students' academic motivation (Reed & Hurd, 2016). More generally, Sheehy-Skeffington and Rea (2017) claim that poor financial circumstances diminish the motivation to achieve one's goals, which in educational settings could equate to reduced academic motivation. Further, experimental evidence indicates that greater anticipated financial hardship undermines satisfaction of the psychological needs for competence and autonomy in university students, which from a self-determination theory perspective may impair students' intrinsic motivation (defined as motivation driven by the satisfaction inherent in achieving intellectual or personal goals, as opposed to any external incentives or disincentives [Dev, 1997]; Dupuis & Newby-Clark, 2016). In turn, intrinsic motivation has important implications for academic success (Kusurkar, Ten Cate, Vos, Westers, & Croiset, 2013; Richardson, Abraham, & Bond, 2012).

The influence of undergraduate students' finances on academic outcomes such as performance and intrinsic motivation could be mediated by a number of variables, including

stress, sense of belonging at university, social identification with other students, mental and physical health, cognitive function, hours in paid employment, self-control, and self-regulation. However, few studies have attempted to examine these potential mediating pathways, much less explore the relative contributions of these variables to mediation. Yet, an understanding of the mediating paths involved would aid efforts to mitigate the negative influence of finances on academic outcomes. Accordingly, the present research aimed to assess the relative importance of the variables listed above in mediating the relationships between financial concern and academic outcomes among UK undergraduate students. Initially, we present an overview of the evidence for each potential mediator, detailing (a) evidence that the mediator is influenced by financial circumstance, (b) that it impacts academic outcomes and (c), where available, that it mediates the relationship between the two.

Stress

Financial circumstances can be an important source of stress for university students. Indeed, finances were found to be the second most prevalent reported stressor in a sample of graduate students in the United States (El-Ghoroury, Galper, Sawaqdeh, & Bufka, 2012), and experiencing financial difficulties has been shown to predict greater perceived stress among UK undergraduates (Richardson, Elliott, Roberts, & Jansen, 2017; see also Struthers, Perry, & Menec, 2000; Linn & Zeppa, 1984).

Self-reported stress in turn has been found to predict both academic motivation and performance at university (Huang, Lv, & Wu, 2016; Park et al., 2012; Richardson et al., 2012). Further, a stress-management intervention has been shown to improve undergraduate students' academic performance (Lumley & Provenzano, 2003).

To date, however, no research has directly assessed whether stress mediates the relationships between finances and academic outcomes.

Belonging and Social Identification

Experiencing financial difficulties might also reduce students' sense of belonging at university (defined as feeling accepted and valued by others [Goodenow, 1993]), and their level of social identification with other students (defined as having an awareness of, and an emotional investment in, a shared group identity [Bliuc, Ellis, Goodyear, & Hendres, 2011]). For instance, poor financial circumstances are found to predict reduced social integration at university (in terms of interaction with other students and engagement in extra-curricular activities; Adams, Meyers, & Beidas, 2016; Engle & Tinto, 2008; Quadlin & Rudel, 2015), which appears likely to have attendant negative implications for both sense of belonging at university and social identification with other students.

Further, research indicates that sense of belonging at university and social identification with other students are determinants of academic performance (Bliuc et al., 2011; Walton & Cohen, 2007; Walton & Cohen, 2011), and sense of belonging has additionally been found to predict intrinsic academic motivation at university (Freeman, Anderman, & Jensen, 2007; see also Gillen-O'Neel and Fuligni [2013] and Goodenow and Grady [1993] for similar evidence in younger students).

As yet, however, whether or not sense of belonging or social identification mediate the influence of finances on academic outcomes appears to remain untested empirically.

Mental and Physical Health

A large body of research indicates that poorer financial circumstances predict worse outcomes in terms of many aspects of both mental and physical health among university students (Adams et al., 2016; Cooke, Barkham, Audin, Bradley, & Davy, 2004; Jessop, Herberts, & Solomon, 2005; Richardson et al., 2017; Walsemann, Gee, & Gentile, 2015; Wege, Muth, Li, & Angerer, 2016).

Additionally, health is considered an important antecedent to good performance within academic settings (Ding, Lehrer, Rosenquist, & Audrain-McGovern, 2009; Novello, Degraw, & Kleinman, 1992), and poor mental and physical health are linked with an increased risk of dropping out of university (Hixenbaugh, Dewart, & Towell, 2012). Moreover, one aspect of mental health – depressive symptoms – has been found to predict changes in academic motivation over time in adolescent students (Elmelid et al., 2015).

In terms of evidence for mediation, two studies provide evidence that one aspect of mental health – depressive symptoms – mediates the link between university students' financial circumstances and their academic performance (Andrews & Wilding, 2004; Keels, Durkee, & Hope, 2015). However, no existing research appears to have explored whether mediation exists regarding any other measures mental health, or indeed any measures of physical health.

Cognitive Function

Experiencing the scarcity of a given resource, such as money, is argued to drain cognitive and attentional resources, resulting in the temporary impairment of cognitive function (Mullainathan & Shafir, 2013; see also Gennetian & Shafir, 2015; Schilbach, Schofield, & Mullainathan 2016). Supporting this, experiencing recent financial hardship is found to predict poorer cognitive performance (Butterworth, Cherbuin, Sachdev, & Anstey, 2012), as is the experimental inducement of high financial concern salience (Mani, Mullainathan, Shafir, & Zhao, 2013). In particular, poor financial circumstances are argued to impair a group of cognitive abilities referred to as 'executive functions' which include, for instance, working memory (defined as the ability to hold information in mind and mentally work with it [Diamond, 2013]; Mullainathan & Shafir, 2013; Gennetian & Shafir, 2015).

In turn, basic cognitive abilities such as executive functions are considered to provide an essential foundation for success in many areas of life, including achievement within academic settings (e.g., Best, Miller, & Naglieri, 2012; Diamond, 2013).

However, to the best of our knowledge, research has not examined whether cognitive function serves to mediate the impact of students' finances on academic outcomes.

Hours in Paid Employment

Poor financial circumstances could mean that students have to work more hours in paid employment. Indeed, research indicates that students from poorer backgrounds, and those experiencing financial concerns, are more likely to work alongside studying, both in the UK and the United States (Humphrey, 2006; National Union of Students, 2012b; Soria, Weiner, & Lu, 2014). Further, in a sample of UK undergraduate students the most frequently cited reasons for working were found to be financial (e.g., avoiding debt, affording essential living costs; Purcell & Elias, 2010).

In addition, it has been suggested that working more hours in paid employment could result in less time being available for academic activities, in turn impairing students' academic performance (DesJardins, McCall, Ott, & Kim, 2010; Humphrey, 2006). Indeed, the number of hours worked in paid employment is predicts poorer academic outcomes in terms of marks and degree outcomes (Callender, 2008), the likelihood of degree completion (Mendoza, 2012), and the number of credits earned (Darolia, 2014). Moreover, a quasi-experimental study found that undertaking paid employment resulted in Swedish students taking longer to graduate (Avdic & Gartell, 2015).

To date, however, there appear to be no empirical tests of whether the impact of finances on academic outcomes is mediated by the number of hours in paid employment.

Self-control and Self-regulation

A number of the potential mediators discussed previously could influence academic outcomes by affecting self-control (defined as inhibiting impulsive thoughts and behavior [Baumeister, Vohs, & Tice, 2007]) and the related concept of self-regulation (defined as making goal-directed changes to thoughts and behavior [Vohs & Baumeister, 2011]). For example, experiencing high levels of stress is argued to reduce the ability to exert self-control (Oaten & Cheng, 2005; Maier, Makwana, & Hare, 2015; Muraven & Baumeister, 2000). Additionally, basic aspects of cognitive function are considered to provide the basis for higher-order cognitive abilities, such as self-control and self-regulation (Hofmann, Schmeichel, & Baddeley, 2012), and so impairments in basic cognitive functions are likely to undermine self-control and self-regulation.

Furthermore, both self-control and self-regulation are found to be determinants of academic performance in university students (Richardson et al., 2012; Tangney, Baumeister, & Boone, 2004), and an intervention designed to foster self-regulatory capacity has been found to boost academic motivation among adolescents (Doostian et al., 2014). Therefore, in a form of secondary (or ‘double’) mediation, it is possible that increases in stress, and impairments in basic cognitive function, resulting from poor financial circumstances could affect academic performance by disrupting students’ capacity for self-control and self-regulation.

Yet, no existing research appears to have directly examined whether either self-control or self-regulation serve to mediate the relationships between finances and academic outcomes.

Previous Evidence for Mediation

While the above review provides indirect evidence suggesting that each variable could potentially mediate the detrimental effect of students’ financial circumstances on

academic outcomes, very few studies have attempted to test for mediation. As highlighted previously, two studies provide evidence that one aspect of mental health – depressive symptoms – serves to mediate the relation between financial circumstances and academic performance among university students (Andrews & Wilding, 2004; Keels et al., 2015). However, to our knowledge, no other studies have directly tested the other potential mediating pathways, and no research has assessed the relative importance of different potential pathways within the same analysis.

The Present Research

To summarize, the existing literature indicates that university students' finances are related to various academic outcomes, and this could be accounted for by a number of potential mediating variables. As yet, however, the majority of these potential mediating pathways remain untested. Accordingly, the present research aimed to address this gap in the literature by examining whether the links between university students' financial concern and academic outcomes are mediated by the following variables: stress, sense of belonging at university, social identification with other students, mental health, physical health, cognitive function (assessed in terms of working memory), hours in paid employment, self-control, and self-regulation.

The present research comprises two studies, both of which were pre-registered with the Open Science Framework. Study 1 utilized path analysis to explore mediation of the cross-sectional association between students' financial concern and academic performance. Study 2 provided a confirmatory test of the path model developed in Study 1, which served to demonstrate the replicability of the model. Study 2 additionally assessed mediation of the longitudinal associations between students' financial concern and academic outcomes, therefore allowing stronger claims to be made regarding potential causal relations.

The extant literature on finances and academic outcomes has assessed a range of different financial variables, including the experience of financial difficulties (Harding, 2011), the amount of debt held (Dwyer et al., 2013), and financial concern (Letkiewicz et al., 2014; Joo et al., 2008). In both present studies we focused our analysis on the experience of financial concern. This was because such subjective appraisals of financial circumstances appear to be more closely linked with (and hence more important predictors of) academic outcomes among university students than more objective financial variables (see Hixenbaugh et al., 2012).

Study 1

Study 1 sought to use path analysis to examine whether the cross-sectional relationship between undergraduate students' financial concern and academic performance (assessed in terms of self-reported average marks) was mediated by the following variables: stress, sense of belonging at university, social identification with other students, mental health, physical health, working memory (as an indicator of cognitive function), hours in paid employment, self-control, and self-regulation.

Method

Design and Procedure

Study 1 employed a cross-sectional, correlational design. Participants were recruited opportunistically. Emails were sent to administrators at approximately 226 academic departments (from a total of 24 universities in the UK) asking them to forward the recruitment email to undergraduate students. The recruitment email indicated that the study was exploring links between students' financial circumstances and their experience of university, and contained the weblink to the online questionnaire. The first page of the questionnaire informed participants that the study would include questions about their background, personality, experience of university, and financial circumstances, along with a

short ‘brain training’-type task. Data were collected via online questionnaire in June 2016, and participation was incentivized with entry into a £100 (approximately US\$130) cash prize draw. In line with Kline’s (2011) recommendation regarding the number of cases typically required to achieve accurate parameter estimates within structural equation modeling, we set a minimum required sample size of 200 participants. Data collection ended when responses to the questionnaire had become infrequent. The study was pre-registered at <https://osf.io/2qya3/>.

Participants

Participants ($N = 516$) were a sample of undergraduate students from 14 UK universities. Eight hundred and twenty-three students responded to the questionnaire. The path analysis conducted in the present study required a complete dataset, and so 268 participants with missing data were not included in the analyses. A further 39 participants were excluded because they represented outliers, as indicated by z -scores greater than three on any variables to be included in the path analysis.

The final sample comprised 384 (74.42%) females and 132 (25.58%) males. Age ranged from 18 to 31 years ($M = 20.51$, $SD = 1.78$). One hundred and sixty-eight participants (32.56%) were first-year students, 179 (34.69%) were second-year students, 128 (24.81%) were third-year students, and 41 (7.95%) were in their fourth year. Four hundred and thirty-four participants (84.12%) were UK students, and 82 (15.89%) were international students. Four hundred and thirty participants (83.33%) identified their ethnicity as ‘White’, 49 (9.50%) identified as ‘Asian / Asian British’, 25 (4.84%) identified as ‘mixed/multiple ethnic groups’, 8 (1.55%) identified as ‘Black / African / Caribbean / Black British’, and 4 (0.78%) identified as ‘other ethnic group’.

In terms of age, ethnicity, and whether participants were UK or international students, the sample appeared to be representative of the UK undergraduate population (Higher

Education Statistics Agency, 2018). However, the sample comprised a substantially larger proportion of female students, who in the 2015/16 academic year made up 55.53% of the UK undergraduate population (Higher Education Statistics Agency, 2018).

Materials

Participants completed an online questionnaire including the measures detailed below. Measures are ordered based on their relevance to the focus of the present study, rather than in the order they appeared in the questionnaire. In addition to the following measures, participants completed a measure of personality (Rammstedt & John, 2007). This was included solely as an incentive for participation (personality feedback was given to students at the end of the questionnaire) and is therefore not reported below.

Financial concern. Financial concern was assessed using a measure adapted from Jessop et al. (2005). The adapted measure comprised seven items (e.g., “I would list financial difficulties as one of the major stresses in my life at the moment” and “I often worry about the debt I will have when I finish my degree at university”). Responses were made using Likert scales ranging from *strongly disagree* [1] to *strongly agree* [7]. A mean score was calculated for each participant, with higher scores indicating greater financial concern ($\alpha = .90$).

Stress. Stress was assessed using Cohen and Williamson’s (1988) 10-item Perceived Stress Scale (e.g., “In the last month, how often have you felt nervous and stressed?”). Responses were made using Likert scales ranging from *never* [1] to *very often* [5]. A mean score was calculated for each participant, with higher scores indicating greater stress ($\alpha = .89$).

Sense of belonging. Participants’ sense of belonging at university was assessed using Walton and Cohen’s (2007) 17-item measure of sense of social and academic fit (e.g., “People at my university accept me”). Responses were made using Likert scales ranging

from *strongly disagree* [1] to *strongly agree* [5]. A mean score was calculated for each participant, with higher scores indicating greater belonging ($\alpha = .89$).

Social identification. Social identification with other students was assessed using Doosje, Ellemers, and Spears' (1995) four-item group identification measure (e.g., "I feel strong ties with [name of institution] students"). The name of each participant's institution was inserted in to these items. Responses were made using Likert scales ranging from *strongly disagree* [1] to *strongly agree* [7]. A mean score was calculated for each participant, with higher scores indicating greater social identification ($\alpha = .84$).

Mental and physical health. Mental and physical health were assessed using the 12-item short form health survey (SF-12; Ware, Kosinski, & Keller, 1996). Separate summary scores were computed for mental and physical health. Scores may range from 0-100 for both mental and physical summaries, with higher scores indicating better health (mental health $\alpha = .80$; physical health $\alpha = .61$).

Working memory. Working memory was assessed using an automated version of the digit span sequencing task (Wechsler, 2008). Participants were presented with sequences of single-digit numbers. Each number was presented for one second. After each sequence, participants had to recall the sequence in ascending order. In example, if participants were presented with the sequence "5, 8, 3", they were required to recall these numbers in the order "3, 5, 8". The task began with two sequences of three numbers, with sequence size increasing by one number every other sequence until participants were presented with two sequences of nine numbers. Participants were given two practice sequences. Numbers could be presented more than once in the same sequence, and where this happened participants were instructed to recall the number the same number of times it appeared (as was demonstrated in one of the practice trials).

The sizes of sequences that had been correctly recalled in ascending order were summed to create a score for each participant. However, if a participant was unable to recall two sequences of the same size, correct responses to larger sequences were not included in their score. For example, if a participant correctly recalled two sequences of three numbers, one sequence of four numbers, one sequence of five numbers, neither sequence of six numbers, and one sequence of seven numbers, their score would be $(3 + 3 + 4 + 5 = 15)$; the sequence of seven numbers not being counted because the participant failed to correctly recall both sequences of six numbers). Higher scores indicated better working memory.

Hours in paid employment. Participants were asked to indicate whether or not they had a paid job (or jobs) during term-time, and if so, approximately how many hours they worked in this job (or these jobs) each week.

Self-control. Self-control was assessed using Tangney et al.'s (2004) 13-item Brief Self-Control Scale (e.g., "I am good at resisting temptation"). Responses were made using Likert scales ranging from *not at all* [1] to *very much* [5]. A mean score was calculated for each participant, with higher scores indicating greater self-control ($\alpha = .84$).

Self-regulation. Self-regulation was assessed using Schwarzer, Diehl, and Schmitz's (1999) 10-item Self-Regulation Scale (e.g., "I can concentrate on one activity for a long time, if necessary"). Responses were made using Likert scales ranging from *not at all true* [1] to *exactly true* [4]. A mean score was calculated for each participant with higher scores indicating greater self-regulation ($\alpha = .83$).

Academic performance. Participants were asked to indicate the average percentage mark awarded for assessments completed in the current academic year. Meta-analysis indicates that self-reported performance correlates highly with actual performance among university students (Kuncel, Credé, & Thomas, 2005).

Socio-demographic information. Participants were asked to indicate their gender (dummy coded; 0 = male, 1 = female), age, year of study, ethnicity, whether or not they were a UK or international student (dummy coded; 0 = UK, 1 = international), which university they attended. Socioeconomic status was measured using an adaptation of The MacArthur Scale of Subjective Social Status (Adler & Stewart, 2007). Scores could range from 1-10, with higher scores indicating relatively higher subjective socioeconomic status.

Additional indicators of financial circumstances. The following measures were administered in order to attain further descriptive information about participants' financial circumstances.

Total current debt. Participants were asked to indicate how much overall debt they currently had. Responses were made using a drop-down list with options ranging from “No debt” to “£60,000 +” in increments of £1000.

Debt from individual sources. Participants were asked to indicate how much debt they currently had from each the following sources: tuition fee and maintenance loans; credit cards; bank overdrafts; and loans from partners, family and friends. Responses were requested in Pounds Sterling.

Anticipated graduate debt. Participants were asked to indicate how much overall debt they anticipate they would have when graduating from university. Responses were made using a drop-down list with options ranging from “No debt” to “£60,000+” in increments of £1000.

Discretionary income. Participants were asked to indicate how much money they had left over each month after accounting for all of their essential expenses (e.g., rent, bills). Responses were requested in Pounds Sterling.

Statistical Analyses

Path analysis was conducted using full-information maximum likelihood estimation in AMOS 23.0 (Arbuckle, 2014). Model fit was evaluated using the Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), and the Tucker-Lewis Index (TLI). RMSEA values $\geq .10$ are considered to indicate unacceptable fit, whereas values $\leq .05$ indicate good fit (Browne & Cudeck, 1993). CFI and TLI values $\geq .95$ indicate good fit (Hu & Bentler, 1999).

The process of model respecification was conducted in accordance with published guidelines (e.g., Byrne, 2010; Kenny, 2011; Kline, 2011), and was based on theoretical concerns, the statistical significance of path estimates, and modification indices. Modification indices highlight paths that, if included, would improve the overall fit of the model (based on a reduction in the value of the chi-square statistic; Kline, 2011).

Indirect effects were estimated using bootstrapping (with 2000 samples) and bias-corrected 95% confidence intervals. Estimates of specific indirect effects were obtained using the ‘phantom model’ approach described by Macho and Ledermann (2011).

Results

Bivariate correlations coefficients, means, and standard deviations for all variables included in the path analyses are reported in Table 1. Descriptive data pertaining to additional indicators of financial circumstance are available as supplemental material.

Initial Model

In the initial model, the following variables were specified as mediating the effect of financial concern on academic performance: stress, mental health, physical health, sense of belonging, social identification, hours in paid employment, and working memory. Indirect effects of stress and working memory on academic performance were specified via self-control and self-regulation. A direct effect of financial concern on academic performance

was also specified. Paths were specified from the socio-demographic control variables (socioeconomic status, gender, age, year of study, and UK or international status) to all other variables in the model. Covariances were specified between all control variables.

Figure 1 shows a path diagram for the initial model, including standardized coefficients. To preserve clarity, Figure 1 does not show the control variables.

The initial model was found to represent a poor fit to the data, as indicated by an RMSEA value of .238, a CFI value of .493, and a TLI value of -.790. Further, there were a number of large standardized residual covariances, indicating that specific relationships between certain variables were modeled poorly.

Model Respecification

The first stage in model respecification was the inclusion of additional paths. The modification indices were addressed in order of magnitude, starting with the modification that would make the largest improvement to the model. If a given path was not justifiable based on previous research and theoretical concerns, or an alternative path involving the same variables was considered more substantively meaningful, then it was not included and the next largest modification index was examined. The modifications made to the model are described below in chronological order.

The first modification allowed the residuals of sense of belonging and social identification to covary. This was justified by the conceptual similarity of these two variables, which meant that unmeasured factors affecting one variable were likely to also affect the other. Next, a path from stress to mental health was specified (for a review of evidence concerning the influence of stress on mental health, see Juster, McEwen, and Lupien [2010]). Following, the residuals of self-control and self-regulation were allowed to covary, again justified by the conceptual similarity of these two variables. Subsequently, a path was included from sense of belonging to self-regulation, as based on experimental

evidence indicating that the experience of social exclusion (which may arguably result from a low sense of belonging) may impair the capacity for self-regulation (Baumeister, DeWall, Ciarocco, & Twenge, 2005). Next, a path was included from sense of belonging to stress (for previous research concerning the link between students' sense of belonging and stress, see Grobecker [2016]). Finally, a path from sense of belonging to self-control was specified. This was justified by experimental evidence highlighting a link between the fulfillment of belonging-needs and the capacity for self-control (Baumeister et al., 2005), and reflects the argument that managing concerns about a lack of belonging at university constitutes a psychological burden, which in turn reduces the capacity for effective self-regulation (Johnson, Richeson, & Finkel, 2011).

The next stage of respecification involved removing all non-significant paths, which achieved a more parsimonious model. Non-significant paths were removed in order of the magnitude of the standardized coefficients, beginning with the smallest.

After having removed all non-significant paths, modification indices highlighted that including a path from stress to working memory would significantly improve the fit of the model. This path is consistent with much previous research supporting that stress can impair cognitive ability, including working memory specifically (e.g., Shields, Bonners, & Moons, 2015), and was therefore included in the model. Subsequently, the path from gender to working memory was no longer significant, and so was removed from the model.

At this stage, the following variables no longer mediated the effect of financial concern on academic performance within the model: mental health, physical health, self-regulation, hours in paid employment, and social identification. As such, these variables were considered redundant in terms of the present research focus, and were therefore removed from the model. Age and year of study were also removed, as neither of these control variables predicted any other variables in the model.

Respecified Model

The respecified model is presented in Figure 2, showing standardized path estimates. Direct, specific indirect, total indirect, and total effects for the respecified model are given in Table 2. As shown, the total indirect effect of financial concern on academic performance was statistically significant. The specific indirect effects of financial concern on academic performance via belonging, stress, self-control, and working memory were also all statistically significant.

The respecified model was able to account for 32.6% of the variance in stress, 11.0% of the variance in sense of belonging, 1.5% of the variance in working memory, 23.5% of the variance in self-control, and 10.2% of the variance in academic performance.

The RMSEA value for the respecified model was .021, the upper 90% confidence interval for the RMSEA value was .048, the CFI value was .992, and the TLI value was .984, all indicating that the respecified model represented a good fit to the data.

Discussion

Study 1 used cross-sectional data to identify mediators of the relation between students' financial concern and academic performance. Controlling for background variables, path analysis – alongside supplementary mediation analysis – revealed that sense of belonging at university, stress, self-control, and working memory mediated the impact of financial concern on academic performance. Further, the analysis indicated that mental and physical health, social identification with other students, hours in paid employment, and ability to self-regulate did *not* mediate the link between financial concern and academic performance.

It is important to note that the process of model respecification used in Study 1 was of a partially exploratory nature. That is, while each modification was guided by theoretical concerns and justifiable based on previous research, the respecification process was also

guided by the data. It is therefore possible that paths within the respecified model may reflect idiosyncrasies of the sample, rather than more general patterns (see Schreiber, Nora, Stage, Barlow, & King, 2006). Accordingly, in Study 2 we conduct a confirmatory test of the respecified model with a different sample of undergraduate students.

A further limitation of Study 1 concerns the use of a cross-sectional design. While path analysis using cross-sectional data is able to indicate support for certain causal paths over alternatives (Kline, 2011), it is unable to provide firm indications of causality. In contrast, within the context of assessing mediation, longitudinal designs confer many advantages over cross-sectional research. For example, apart from under certain restrictive conditions, estimates of indirect effects are likely to be more accurate when calculated using longitudinal data (Cole & Maxwell, 2003). Further, longitudinal designs allow one to control for prior levels of the dependent variables, which would otherwise confound analyses and inflate estimates of effect sizes. Accordingly, longitudinal designs can permit one to make stronger (albeit not definitive) claims regarding the potential existence of causal paths (Cole & Maxwell, 2003). Thus, in Study 2 we additionally utilize longitudinal data to examine mediators of the link between financial concern and academic outcomes among undergraduate students.

Study 2

The first aim of Study 2 was to provide a confirmatory test of the respecified model developed in Study 1. We used data from the first wave of measurement as an independent sample to validate the respecified model.

A second aim of Study 2 was to use longitudinal data to examine whether the relationships between students' financial concern and academic outcomes (in terms of both average marks and intrinsic academic motivation) were mediated by the same potential variables as were assessed in Study 1, these being: stress, sense of belonging at university,

social identification with other students, mental health, physical health, working memory (as an indicator of cognitive function), hours in paid employment, self-control, and self-regulation.

We were primarily interested in identifying mediators of the link between financial concern and academic performance, as measured in terms of students' self-reported average marks. However, we found that financial concern was *not* able to account for any changes in academic performance over time. Consequently, we sought to additionally assess whether the potential mediating variables could account for the link between financial concern and intrinsic academic motivation. Not only is intrinsic academic motivation an important outcome in its own right, it is considered to provide a foundation for success within academic settings and predicts academic performance among university students (Kusurkar et al., 2013; Richardson et al., 2012). Further, while it has been suggested that experiencing financial difficulties could impair intrinsic academic motivation (Dupuis & Newby-Clark, 2016), and qualitative findings indicate a connection between students' finances and academic motivation (Reed & Hurd, 2016), no previous research appeared to have assessed the link between finances and intrinsic academic motivation using quantitative methods.

Method

Design and Procedure

The study employed a longitudinal correlational design. Three waves of data were collected via online questionnaires. The first wave of data was collected in November and December 2016, the second wave in February 2017, and the third wave in May 2017. Recruitment emails were sent to approximately 660 academic departments at 50 universities, with a request that the emails be forwarded to students. In the second and third waves of data collection participants were emailed directly. Participants were contacted at the third wave irrespective of whether or not they completed the second wave. Recruitment emails for each

wave of data collection indicated the study was concerned with student wellbeing. The first page of each questionnaire informed participants that the study would include questions about their background, personality, experience of university, and financial circumstances, along with a short ‘brain training’-type task. Participants were incentivized with a £100 (approximately US\$130) cash prize draw for completing each questionnaire, and a prize draw for an iPad Mini for completing all three questionnaires. In line with Kline’s (2011) recommendation regarding the number of cases typically required to achieve accurate parameter estimates within structural equation modeling, we decided to recruit a minimum of 200 participants. Data collection for each wave was ended when responses to the questionnaire had become infrequent. The study was pre-registered at <https://osf.io/xwv7c/>.

Participants

Participants were undergraduate students studying in the UK. Two thousand seven hundred and ninety-four students completed the questionnaire at wave one (comprising the sample used for validation of the respecified model developed in Study 1), 834 completed the questionnaire at wave two, and 671 completed the questionnaire at wave three. Only students who completed all three waves of data collection were included in the longitudinal analyses ($N = 453$).

Socio-demographic information for the validation and longitudinal samples is presented in Tables 3 and 4, respectively. While there was evidence of differential dropout for a number of variables, the effect sizes for these differences were small (all $d_s \leq .21$, all Cramer’s $V_s \leq .12$; analyses revealing significant differences are reported in full as supplemental material).

The validation sample appeared to be representative of the UK undergraduate population in terms of age, ethnicity, and whether participants were UK or international students (Higher Education Statistics Agency, 2018). However, the sample comprised a

substantially larger proportion of female and full-time students (who in the 2016/17 academic year made up 55.71% and 89.51% of the UK undergraduate population, respectively; Higher Education Statistics Agency, 2018).

In terms of age and whether participants were UK or international students, the longitudinal sample was representative of the UK undergraduate population (Higher Education Statistics Agency, 2018). However, the sample did appear to comprise a substantially larger proportion of female, full-time, and white students (who in the 2016/17 academic year made up 55.71%, 89.51% and 76.14% of the UK undergraduate population, respectively; Higher Education Statistics Agency, 2018).

Materials

Socio-demographic information was requested only in the first wave of data collection. All other measures were administered in all waves. Where appropriate, the range of Cronbach's alpha across the three waves is given. As in Study 1, we administered a measure of personality in the first wave of data collection (Rammstedt & John, 2007), the results of which were fed back to students at the end of the questionnaire. The personality measure was intended solely as an incentive for participation, and is therefore not reported below.

The following variables were assessed using the same measures as in Study 1: financial concern (*as*: .89 to .91), stress (*as*: .91 to .92), sense of belonging (*as*: .90 to .91), social identification (*as*: .86 to .89), mental health (*as*: .82 to .83), physical health (*as*: .64 to .71), working memory, hours in paid employment, self-control (*as*: .82 to .85), self-regulation (*as*: .85 to .86), socioeconomic status, and additional indicators of financial circumstances.

Alongside the socio-demographic information that was requested in Study 1, we additionally asked students to indicate whether they studied full- or part-time (dummy coded; 0 = part-time, 1 = full-time).

Academic performance. Participants were asked to indicate the average percentage mark awarded for assessments over the previous three months.

Intrinsic academic motivation. Intrinsic academic motivation was assessed using a measure adapted from the intrinsic motivation subscale of the Motivation At Work Scale (Gagné et al., 2010). The adapted measure had three items (e.g., “One of the reasons why I am doing my degree is because I enjoy my studies very much”). Responses were made using Likert scales with options ranging from *strongly disagree* [1] to *strongly agree* [7]. A mean score was calculated for each participant, with higher scores indicating greater intrinsic academic motivation (*as*: .89 to .92).

Statistical Analyses

Analyses were conducted using full-information maximum likelihood estimation in AMOS 23.0 (Arbuckle, 2014). Indirect effects were estimated using bootstrapping (with 2000 samples) and bias-corrected 95% confidence intervals. All endogenous variables were regressed on the control variables, and all exogenous variables were allowed to covary with the control variables. Estimates of specific indirect effects were obtained using the ‘phantom model’ approach described by Macho and Ledermann (2011). Missing data was addressed using regression-based imputation within AMOS.

Results

Validation of the Respecified Model

Bivariate correlations coefficients, means, and standard deviations for the validation sample are reported in Table 5. Descriptive data pertaining to financial circumstances for the validation sample are available as supplemental material.

The RMSEA value for the model was .053, the upper 90% confidence interval for the RMSEA value was .061, the CFI value was .954, and the TLI value was .902. Thus, the

respecified model appeared to have an acceptable degree of fit in relation to the data from the validation sample.

Direct, specific indirect, total indirect, and total effects for the respecified model with the validation sample are presented in Table 6. The total indirect effect of financial concern on academic performance – along with the specific indirect effects of financial concern on academic performance via stress, belonging, working memory, and self-control – were all statistically significant, thus replicating the findings from Study 1.

The model accounted for 32.9% of the variance in stress, 5.5% of the variance in sense of belonging, 0.9% of the variance in working memory, 22.3% of the variance in self-control, and 9.3% of the variance in academic performance in the validation sample. These were mostly similar to the amounts of variance accounted for in Study 1, yet only half the amount of variance in sense of belonging was accounted for presently in comparison to in Study 1.

Together, the respecified model had an acceptable fit to data of the validation sample, the total and indirect effects of financial concern on academic performance were again found to be significant, and the model accounted for mostly comparable proportions of variance. Therefore, the analysis represents a successful validation of the respecified model developed in Study 1.

Longitudinal Analyses

Bivariate correlation coefficients between variables included in the same models are reported in Table 7, along with means and standard deviations. Descriptive data pertaining to financial circumstance for the longitudinal sample are available as supplemental material.

Effects of financial concern on academic outcomes. All of the following path models – including those assessing mediation – controlled for socioeconomic status, age,

gender, year of study, whether participants studied full- or part-time, and whether participants were UK or international students.

Initially we assessed the total effect of financial concern on change in academic performance over the course of the study. Specifically, we examined the effect of financial concern at wave one on academic performance at wave three, controlling for academic performance at wave one (Figure 3). We found that initial levels of financial concern did not have a significant effect on change in academic performance over the course of the study ($\beta = -0.06, p = .18$). Thus, while we replicate the cross-sectional association between financial concern and academic performance observed in previous research and in Study 1 (see previous analyses on validation of the respecified model), we failed to observe any effect of financial concern on subsequent change in academic performance.

In the absence of any apparent effect of financial concern on subsequent change in academic performance over the course of the study, we explored whether financial concern had any effect on change in intrinsic academic motivation. Again, we specifically examined the effect of financial concern at wave one on intrinsic academic motivation at wave three, controlling for intrinsic academic motivation at wave one (Figure 4). We found that initial levels of financial concern did have a significant effect on change in intrinsic academic motivation, with greater initial levels of financial concern leading to a reduction in intrinsic academic motivation over the course of the study ($\beta = -0.07, p = .049$).

Given there was no evidence of an effect of financial concern on change in academic performance, no further analyses concerning this outcome are reported, and the following mediation analyses concern only intrinsic academic motivation.

Individual mediation. A series of autoregressive models examined whether the effect of financial concern on intrinsic academic motivation was mediated by stress, sense of belonging, social identification, mental health, physical health, working memory, hours in

paid employment, self-control, and self-regulation. In each model the potential mediator at wave two was regressed on financial concern at wave one, and on the potential mediator at wave one. Additionally, intrinsic academic motivation at wave three was regressed on the potential mediator at wave two, and on intrinsic academic motivation at wave one. This allowed us to examine whether financial concern led to changes in the potential mediating variables over time, and whether this led to subsequent changes in intrinsic academic motivation.

Evidence of significant mediation effects was observed for stress, sense of belonging, and mental health. Mediation analyses for these variables are reported in full below. By contrast, there was no evidence of significant mediation for social identification, physical health, working memory, hours in paid employment, self-control, or self-regulation, (all indirect effect $ps > .05$). Accordingly, mediation analyses for these variables are not reported below, but are available in the supplemental materials.

Stress. The path model assessing mediation via stress is presented in Figure 5. Initial levels of financial concern had a significant effect on stress, such that greater financial concern predicted increased stress ($\beta = 0.13, p < .001$). Further, levels of stress had a significant negative effect on intrinsic academic motivation ($\beta = -0.14, p < .001$). Bootstrapping analysis revealed the indirect effect of financial concern on intrinsic academic motivation via stress was significant ($\beta = -0.02, p = .001, 95\% \text{ CIs } [-0.031, -0.007]$).

Sense of belonging. As may be seen in Figure 6, initial levels of financial concern significantly influenced sense of belonging, with greater financial concern leading to a reduced sense of belonging ($\beta = -0.08, p = .010$). In turn, sense of belonging had a significant positive effect on intrinsic academic motivation ($\beta = 0.15, p < .001$). Additionally, the indirect effect of financial concern on intrinsic academic motivation via sense of belonging was significant ($\beta = -0.01, p = .008, 95\% \text{ CIs } [-0.032, -0.003]$).

Mental health. The path model in Figure 7 assessed mediation via mental health. Initial levels of financial concern had a significant negative effect on mental health ($\beta = -0.14, p < .001$). Additionally, there was a significant positive effect of mental health on intrinsic academic motivation ($\beta = 0.10, p = .002$). The indirect effect of financial concern on intrinsic academic motivation via mental health was found to be statistically significant ($\beta = -0.02, p = .001, 95\% \text{ CIs } [-0.031, -0.004]$).

Relative mediation. To assess relative mediation we specified an autoregressive model including all variables for which significant indirect effects (of $p < .05$) were found in the preceding individual mediation analyses. That is, we specified a model examining the effects of financial concern on intrinsic academic motivation via stress, sense of belonging, and mental health (Figure 8).

Within this model, stress had a significant negative effect on intrinsic academic motivation ($\beta = -0.11, p = .003$). The effect of sense of belonging on intrinsic academic motivation was also found to be significant ($\beta = 0.11, p = .002$). However, there was no effect of mental health on intrinsic academic motivation ($\beta = -0.03, p = .468$).

The total indirect effect of financial concern on intrinsic academic motivation via stress, sense of belonging, and mental health was statistically significant ($\beta = -0.02, p = .006, 95\% \text{ CIs } [-0.038, -0.005]$).

The specific indirect effect of financial concern on intrinsic academic motivation via stress was statistically significant ($\beta = -0.01, p = .039, 95\% \text{ CIs } [-0.035, -0.001]$). The specific indirect effect via sense of belonging was also significant ($\beta = -0.01, p = .022, 95\% \text{ CIs } [-0.025, -0.001]$). However, the specific indirect effect via mental health was not significant ($\beta = 0.00, p = .567, 95\% \text{ CIs } [-0.011, 0.024]$).

Discussion

The dual aims of Study 2 were to (a) provide a confirmatory test of the respecified model developed in Study 1, and (b) utilize longitudinal data to identify mediators of the relationships between financial concern and changes in academic outcomes over time, focusing on students' academic performance and intrinsic academic motivation.

We found the respecified model developed in Study 1 had an acceptable fit to the data of the validation sample. This confirmatory test suggests that the process of model respecification resulted in replicable findings about the relationships between financial concern, academic performance, and mediating variables.

In terms of the second aim we found that – controlling for students' socioeconomic status, age, gender, year of study, full- or part-time status, and whether participants were UK or international students – greater levels of financial concern significantly predicted detrimental changes in intrinsic academic motivation over time. Further, we found that this relation was partially mediated by increased stress and a reduced sense of belonging at university. In contrast we found that levels of social identification with other students, mental and physical health, working memory, hours in paid employment, self-control, and self-regulation were not significant mediators of the link between financial concern and intrinsic academic motivation. Further, we found that financial concern was not able to account for changes in academic performance over time.

Our findings in Study 2 serve to extend previous research within the area. For instance, while qualitative research had previously suggested a link between university students' finances and their academic motivation (Reed & Hurd, 2016), and theoretical arguments had been made proposing that financial hardship could undermine students' intrinsic motivation (Dupuis & Newby-Clark, 2016), no existing research appeared to have used quantitative methods to examine the relation between students' subjective appraisals of

their financial circumstances and their academic motivation. Accordingly, that levels of financial concern were presently found to account for subsequent changes in intrinsic academic motivation affirms the findings of the aforementioned research.

The longitudinal design of Study 2 represents a valuable extension over much preceding research within the area, which has instead been of a predominantly cross-sectional nature. In controlling for prior levels of the dependent variables our analyses were able to account for many potentially confounding factors, thus providing stronger indications of potential causal pathways. Yet, our findings do not represent definitive evidence of causality. For example, it remains that an unmeasured variable could have exerted a causal influence on levels of financial concern *and* changes in the dependent variables over time, thus resulting in a non-causal (or ‘spurious’) association between financial concern and the dependent variables. Accordingly, future research should aim to utilize experimental designs in order to determine whether the relationships identified in the Study 2 are of a causal nature.

General Discussion

Stress and sense of belonging at university consistently emerged as mediators of the relation between financial concern and academic outcomes. These findings serve to integrate a number of formerly separate strands of research. For instance, while there were prior indications that finances affected university students’ stress and sense of belonging, and that these variables in turn influenced academic outcomes (Engle & Tinto, 2008; Freeman et al., 2007; Huang et al., 2016; Richardson et al., 2017), no existing research appeared to have directly examined whether these variables mediated the influence of finances on academic outcomes. Accordingly, the present research affords a more complete understanding of how students’ finances exert their influence on academic outcomes, and through utilizing both cross-sectional and longitudinal designs is able to provide convincing evidence of mediation.

While we found that financial concern predicted academic performance cross-sectionally in both studies, we found no evidence for the previously untested hypothesis that financial concern would predict subsequent changes in academic performance over time. One potential explanation for this null finding is that the time taken for financial concern to optimally affect academic performance could be substantially shorter than the six month time period between the first and final waves of measurement. If this was the case, the influence of financial concern on changes in academic performance over time would have been presently underestimated. Accordingly, a longitudinal design with shorter waves of measurement could be more successful in detecting a relation between financial concern and subsequent changes in performance. Given the consistent evidence provided for the association between financial concern and academic performance, further research in to the dynamic relationship between these variables certainly appears warranted.

Our findings have a number of important implications. The systems of higher education funding that are currently in place in many countries impose large financial burdens on university students (Kirby, 2016). For example, it is estimated that current undergraduate students in England will leave university having accrued debt in excess of £50,000 (Britton, Crawford, & Dearden, 2015). Our findings suggest that this financial burden could be undermining students' ability to succeed within academic settings. Moreover, in controlling for socioeconomic status, our analyses indicate that the apparent influence of students' finances on academic outcomes is not simply an artifact of socioeconomic disparities that exist prior to university.

Our findings also have the potential to inform interventions aiming to mitigate any negative influence of students' financial concern on academic outcomes. For instance, that stress was presently identified as a mediating variable indicates that interventions could attempt to reduce stress levels as a means of improving academic outcomes among students

experiencing high financial concern. Indeed, stress-management training has previously been found to enhance academic success (Lumley & Provenzano, 2003), and our findings suggest this type of intervention may be particularly beneficial for students experiencing poor financial circumstances. Additionally, our findings suggest that interventions aiming to increase students' sense of belonging at university – such as those employed by Walton and colleagues (Walton & Cohen, 2007; Walton & Cohen, 2011; Walton, Logel, Peach, Spencer, & Zanna, 2015) – could attenuate the negative relations between financial concern and academic outcomes.

However, an important caveat to the aforementioned interventions is that they would not be addressing what could be considered the root cause of the problem, i.e., the financial burden often placed on university students. Accordingly, structural changes that reduce the degree of financial concern experienced by students – such as reductions in tuition fees, and increased grants to help with living costs – present themselves as more direct interventions, and would likely have more pervasive benefits to students. Indeed, experimental and quasi-experimental studies indicate that changes in the amount of financial aid received impacts outcomes such as attendance, dropout rates, and average marks (Brock & Richburg-Hayes, 2006; Dynarski, 2000; Dynarski, 2002; Dynarski, 2003)

It is possible that different mediating variables could be implicated, depending on the specific academic outcome under consideration. Indeed, this could account for why working memory ability and self-control were identified as mediators in regard to academic performance in Study 1, but were *not* identified as mediators in regard to intrinsic academic motivation in Study 2. Further, it remains that potential mediators for which no evidence was found in either of the present studies could still account for the influence of finances on other academic outcomes, such as the likelihood of dropping out (Joo et al., 2008) and the time taken to graduate from university (Letkiewicz et al., 2014). Similarly, prior research

indicates financial concern may have detrimental effects on many aspects of cognitive function (Mani et al., 2013; Mullainathan & Shafir, 2013; but see Reid, Jessop, and Miles [2018]), yet present constraints on data collection meant we were able to assess only working memory. Following, it remains that presently unmeasured aspects of cognitive function – such as, for example, inhibitory control – could prove to mediate the influence of financial concern on academic outcomes. Accordingly, future research should aim to assess mediation using different operationalisations of both academic outcomes and cognitive function.

One notable limitation of the present research is the reliance on self-report measures, particularly for our assessment of academic performance. However, while subject to measurement error, meta-analysis indicates that self-reported academic performance correlates very highly with actual performance among university students (Kuncel et al., 2005). Indeed, the association between self-reported and actual marks can be as high as $r = .97$ (Crocker & Luhtanen, 2003). Nevertheless, it would be beneficial for future research to utilize more objective measures of performance in attempts to replicate the present findings.

Conclusion

In conclusion, we present both cross-sectional and longitudinal evidence indicating the relations between undergraduate students' financial concern and academic outcomes are mediated by increased levels of stress and a reduced sense of belonging at university. These findings serve to integrate much previous research within the area, and in doing so help to provide a more complete account of how financial concerns may affect students' experience at university. Further, our findings could be used to help inform interventions attempting to mitigate the apparent negative influence of financial concern on academic outcomes. More broadly, our findings contribute to a growing body of literature highlighting the negative consequences of financial pressures on students (e.g., Harding, 2011; Hixenbaugh et al., 2012; Richardson et al., 2017), and additionally draw attention to the possibility that systems

of higher education funding that place a large financial burden upon students – such as those systems presently found in many countries (Kirby, 2016) – could be undermining students' ability to perform well in academic settings.

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Table 1

Correlations, means, and standard deviations for variables included in the path analysis in Study 1

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	<i>M</i>	<i>SD</i>
1. Financial concern	.41***	-.29***	-.09*	-.30***	-.13**	-.24***	.13**	-.24***	-.28***	-.16***	.04	-.31***	-.05	.14**	-.04	3.47	1.62
2. Stress	-	-.42***	-.16***	-.77***	-.03	-.45***	.03	-.45***	-.61***	-.26***	.05	-.23***	.01	.26***	-.03	3.04	0.72
3. Belonging	-	-	.69***	.40***	.03	.06	-.01	.29***	.39***	.22***	-.06	.15***	.04	-.02	-.13**	3.62	0.52
4. Social identification	-	-	-	.16***	.02	.02	-.03	.13**	.18***	-.01	-.13**	.10*	-.03	.08†	-.13**	5.33	1.14
5. Mental health	-	-	-	-	-.15**	.05	.01	.39***	.56***	.18***	-.07	.20***	-.04	-.16***	.10*	41.85	11.39
6. Physical health	-	-	-	-	-	.04	.01	.04	.03	.08†	-.06	-.11*	-.05	.02	-.10*	53.72	6.60
7. Working memory	-	-	-	-	-	-	-.01	.01	.07	.11**	.01	.07†	.02	-.09*	.06	9.53	2.55
8. Hours in paid employment	-	-	-	-	-	-	-	-.03	-.01	-.01	.10*	-.15**	.01	.03	-.08†	4.59	7.22
9. Self-control	-	-	-	-	-	-	-	-	.57***	.26***	.02	.13**	.02	.03	.03	3.19	0.68
10. Self-regulation	-	-	-	-	-	-	-	-	-	.23***	.06	.18***	.06	-.15**	.08†	2.67	0.48
11. Academic performance	-	-	-	-	-	-	-	-	-	-	.00	.09*	.06	-.04	.09*	64.78	7.56
12. Age	-	-	-	-	-	-	-	-	-	-	-	-.04	.48***	-.04	.12**	20.51	1.78
13. Socioeconomic status	-	-	-	-	-	-	-	-	-	-	-	-	.04	-.03	.17***	5.81	1.62
14. Year of study	-	-	-	-	-	-	-	-	-	-	-	-	-	-.07	.02	2.08	0.94
15. Gender	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.01	-	-
16. UK or International	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note. *** $p < .001$, ** $p < .01$, * $p < .05$, † $p < .10$.

Table 2

Unstandardised estimates, standard errors, bias-corrected 95% CIs, and standardized estimates of effects in the respecified model in Study 1

Type of effect	<i>b</i> ^a	<i>SE</i> ^b	BC 95% CIs ^c	β ^d
<i>Direct effects</i>				
FC → BLG	-0.08***	0.01	[-0.11, -0.06]	-0.26
FC → STR	0.12***	0.02	[0.08, 0.15]	0.26
BLG → STR	-0.46***	0.05	[-0.57, -0.36]	-0.33
BLG → SC	0.14*	0.06	[0.02, 0.25]	0.11
BLG → AP	2.14***	0.64	[0.87, 3.46]	0.15
STR → SC	-0.42***	0.04	[-0.50, -0.33]	-0.45
STR → WM	-0.43**	0.15	[-0.73, -0.15]	-0.12
SC → AP	2.44***	0.49	[1.39, 3.49]	0.22
WM → AP	0.31*	0.12	[0.04, 0.56]	0.10
GND → FC	0.49**	0.15	[0.19, 0.80]	0.13
GND → STR	0.35***	0.06	[0.23, 0.46]	0.21
GND → SC	0.22***	0.06	[0.10, 0.34]	0.15
SES → FC	-0.30***	0.04	[-0.38, -0.22]	-0.30
SES → STR	-0.04*	0.02	[-0.08, -0.01]	-0.10
SES → BLG	0.03*	0.01	[0.00, 0.06]	0.10
INT → BLG	-0.22***	0.06	[-0.35, -0.09]	-0.15
<i>Specific indirect effects</i>				
FC → BLG → STR	0.04**	0.01	[0.03, 0.06]	0.09
FC → BLG → SC	-0.01*	0.01	[-0.02, 0.00]	-0.03
FC → BLG → AP	-0.18**	0.07	[-0.33, -0.07]	-0.04
FC → STR → SC	-0.05**	0.01	[-0.07, -0.03]	-0.09
FC → STR → WM	-0.05**	0.02	[-0.09, -0.02]	-0.03
FC → BLG → SC → AP	-0.03**	0.02	[-0.06, -0.01]	-0.01
FC → BLG → STR → SC	-0.02***	0.00	[-0.02, -0.01]	-0.03
FC → BLG → STR → WM	-0.02**	0.01	[-0.03, -0.01]	-0.01
FC → STR → SC → AP	-0.12***	0.04	[-0.21, -0.06]	-0.02
FC → STR → WM → AP	-0.02*	0.01	[-0.04, 0.00]	0.00
FC → BLG → STR → SC → AP	-0.04***	0.01	[-0.07, -0.02]	-0.01
FC → BLG → STR → WM → AP	-0.01*	0.00	[-0.02, 0.00]	0.00
BLG → STR → SC	0.19***	0.03	[0.14, 0.26]	0.11
BLG → STR → WM	0.20**	0.07	[0.07, 0.36]	0.04
BLG → SC → AP	0.34*	0.17	[0.07, 0.72]	0.02
BLG → STR → SC → AP	0.47***	0.13	[0.26, 0.78]	0.03
BLG → STR → WM → AP	0.06*	0.04	[0.01, 0.17]	0.00
STR → SC → AP	-1.01**	0.26	[-1.58, -0.57]	-0.09
STR → WM → AP	-0.13*	0.08	[-0.35, -0.02]	-0.01
<i>Total indirect effects</i>				
FC → BLG, STR → SC	-0.08**	0.01	[-0.12, -0.06]	-0.18
FC → BLG, STR → WM	-0.07**	0.02	[-0.12, -0.02]	-0.04
FC → BLG, STR, SC, WM → AP	-0.39**	0.07	[-0.53, -0.26]	-0.08
BLG → STR, SC, WM → AP	0.86**	0.24	[0.47, 1.42]	0.06
STR → SC, WM → AP	-1.15**	0.26	[-1.71, -0.68]	-0.11
<i>Total effects</i>				
FC → BLG → STR, FC → STR	0.16**	0.02	[0.12, 0.19]	0.35
BLG → STR → SC, BLG → SC	0.33**	0.06	[0.21, 0.44]	0.25
BLG → STR, SC, WM → AP, BLG → AP	3.00**	0.62	[1.85, 4.19]	0.21

Note. ^aUnstandardized coefficients; ^bStandard errors; ^cLower and upper bound of bias-corrected 95% confidence intervals; ^dStandardized coefficients; FC = Financial concern; BLG = Belonging; STR = Stress; SC = Self-control; AP = Academic performance; WM = Working memory; GND = Gender; SES = Socioeconomic status; INT = UK or international status †*p* < .1; **p* < .05; ***p* < .01; ****p* < .001.

Table 3

Socio-demographic information for the validation sample in Study 2

Measure	
Age, <i>M</i> (<i>SD</i>)	20.44 (3.32)
Gender, <i>n</i> (%)	
Female	1811 (64.82%)
Male	951 (34.04%)
Year of study, <i>n</i> (%)	
First-year	1059 (37.90%)
Second-year	768 (27.45%)
Third-year	672 (24.05%)
Fourth-year	265 (9.48%)
UK or international status, <i>n</i> (%)	
UK	2202 (78.81%)
International	586 (20.97%)
Full- or part-time status, <i>n</i> (%)	
Full-time	2754 (98.57%)
Part-time	40 (1.43%)
Ethnicity, <i>n</i> (%)	
White	2199 (78.80%)
Asian / Asian British	318 (11.38%)
Mixed / multiple ethnic groups	131 (4.69%)
Black / African / Caribbean / Black British	80 (2.86%)
Other ethnic group	66 (2.36%)
Socioeconomic status	6.14 (1.67)

Table 4

Socio-demographic information for the longitudinal sample in Study 2

Measure	
Age, <i>M</i> (<i>SD</i>)	20.52 (3.65)
Gender, <i>n</i> (%)	
Female	308 (67.99%)
Male	134 (29.58%)
Year of study, <i>n</i> (%)	
First-year	164 (36.20%)
Second-year	111 (24.50%)
Third-year	118 (26.05%)
Fourth-year	55 (12.14%)
UK or international status, <i>n</i> (%)	
UK	373 (82.34%)
International	80 (17.66%)
Full- or part-time status, <i>n</i> (%)	
Full-time	446 (98.45%)
Part-time	7 (1.55%)
Ethnicity, <i>n</i> (%)	
White	404 (89.18%)
Asian / Asian British	31 (6.84%)
Mixed / multiple ethnic groups	10 (2.21%)
Other ethnic group	6 (1.32%)
Black / African / Caribbean / Black British	2 (0.44%)
Socioeconomic status, <i>M</i> (<i>SD</i>)	5.95 (1.67)

Table 5

Correlations, means, and standard deviations for variables included in the path analysis for the validation sample in Study 2

	2	3	4	5	6	7	8	9	<i>M</i>	<i>SD</i>
1. Financial concern	.35***	-.20***	-.11***	-.16***	-.16***	-.32***	.15***	-.12***	3.37	1.57
2. Stress	-	-.48***	-.09***	-.42***	-.21***	-.16***	.23***	-.10***	3.10	0.76
3. Belonging	-	-	.03	.33***	.19***	.15***	-.04*	-.04†	3.54	0.56
4. Working memory	-	-	-	-.04†	.13***	.06**	-.09***	.10***	9.50	2.56
5. Self-control	-	-	-	-	.18***	.06**	.07***	.09***	3.16	0.69
6. Academic performance	-	-	-	-	-	.09***	-.10***	.07**	68.32	11.82
7. Socioeconomic status	-	-	-	-	-	-	-.01	.22***	6.14	1.67
8. Gender	-	-	-	-	-	-	-	.04*	-	-
9. UK or International	-	-	-	-	-	-	-	-	-	-

Note. *** $p < .001$, ** $p < .01$, * $p < .05$, † $p < .10$.

Table 6

Unstandardised estimates, standard errors, bias-corrected 95% CIs, and standardized estimates of effects in the respecified model for the validation sample in Study 2

Type of effect	<i>b</i> ^a	<i>SE</i> ^b	BC 95% CIs ^c	β ^d
<i>Direct effects</i>				
FC → BLG	-0.06***	0.01	[-0.08, -0.05]	-0.17
FC → STR	0.11***	0.01	[0.10, 0.13]	0.23
BLG → STR	-0.57***	0.02	[-0.64, -0.55]	-0.43
BLG → SC	0.18***	0.02	[0.13, 0.23]	0.15
BLG → AP	2.99***	0.35	[2.26, 3.76]	0.16
STR → SC	-0.35***	0.02	[-0.38, -0.31]	-0.39
STR → WM	-0.30***	0.06	[-0.43, -0.18]	-0.10
SC → AP	2.20***	0.28	[1.66, 2.75]	0.15
WM → AP	0.65***	0.08	[0.51, 0.80]	0.16
GND → FC	0.46***	0.06	[0.35, 0.57]	0.14
GND → STR	0.28***	0.03	[0.23, 0.33]	0.18
GND → SC	0.24***	0.02	[0.19, 0.28]	0.17
SES → FC	-0.30***	0.02	[-0.33, -0.26]	-0.32
SES → STR	-0.01	0.01	[-0.03, 0.01]	-0.02
SES → BLG	0.04***	0.06	[0.02, 0.05]	0.11
INT → BLG	-0.11***	0.03	[-0.16, -0.06]	-0.08
<i>Specific indirect effects</i>				
FC → BLG → STR	0.04**	0.01	[0.03, 0.05]	0.06
FC → BLG → SC	-0.01**	0.02	[-0.02, -0.01]	-0.02
FC → BLG → AP	-0.18**	0.03	[-0.26, -0.12]	-0.03
FC → STR → SC	-0.04**	0.00	[-0.05, -0.03]	-0.07
FC → STR → WM	-0.03**	0.01	[-0.05, -0.02]	-0.02
FC → BLG → SC → AP	-0.02***	0.01	[-0.04, -0.02]	0.00
FC → BLG → STR → SC	-0.01**	0.00	[-0.02, -0.01]	-0.02
FC → BLG → STR → WM	-0.01**	0.00	[-0.02, -0.01]	-0.01
FC → STR → SC → AP	-0.09**	0.01	[-0.12, -0.06]	-0.01
FC → STR → WM → AP	-0.02**	0.01	[-0.04, -0.01]	0.00
FC → BLG → STR → SC → AP	-0.03***	0.01	[-0.04, -0.02]	0.00
FC → BLG → STR → WM → AP	-0.01**	0.00	[-0.01, 0.00]	0.00
BLG → STR → SC	0.21**	0.01	[0.18, 0.23]	0.13
BLG → STR → WM	0.18**	0.04	[0.11, 0.25]	0.04
BLG → SC → AP	0.40***	0.07	[0.27, 0.56]	0.02
BLG → STR → SC → AP	0.41**	0.06	[0.31, 0.51]	0.02
BLG → STR → WM → AP	0.12**	0.03	[0.07, 0.18]	0.01
STR → SC → AP	-0.77**	0.11	[-0.99, -0.57]	-0.06
STR → WM → AP	-0.20**	0.05	[-0.30, -0.11]	-0.01
<i>Total indirect effects</i>				
FC → BLG, STR → SC	-0.06**	0.01	[-0.07, -0.05]	-0.14
FC → BLG, STR → WM	-0.05**	0.01	[-0.07, -0.03]	-0.03
FC → BLG, STR, SC, WM → AP	-0.35**	0.04	[-0.44, -0.28]	-0.05
BLG → STR, SC, WM → AP	0.96***	0.12	[0.75, 1.22]	0.05
STR → SC, WM → AP	-0.97**	0.12	[-1.22, -0.76]	-0.07
<i>Total effects</i>				
FC → BLG → STR, FC → STR	0.15**	0.01	[0.13, 0.17]	0.30
BLG → STR → SC, BLG → SC	0.38**	0.02	[0.34, 0.43]	0.31
BLG → STR, SC, WM → AP, BLG → AP	3.95**	0.35	[3.24, 4.61]	0.22

Note. ^aUnstandardized coefficients; ^bStandard errors; ^cLower and upper bound of bias-corrected 95% confidence intervals; ^dStandardized coefficients; FC = Financial concern; BLG = Belonging; STR = Stress; SC = Self-control; AP = Academic performance; WM = Working memory; GND = Gender; SES = Socioeconomic status; INT = UK or international status †*p* < .1; **p* < .05; ***p* < .01; ****p* < .001.

Table 7

Correlations, means, and standard deviations for the longitudinal sample in Study 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Socioeconomic status	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2. Age	-.14**	-	-	-	-	-	-	-	-	-	-	-	-	-
3. Gender	-.03	-.04	-	-	-	-	-	-	-	-	-	-	-	-
4. Year of study	.07	.28***	-.03	-	-	-	-	-	-	-	-	-	-	-
5. Full- vs. part-time	.01	-.22***	-.07	-.04	-	-	-	-	-	-	-	-	-	-
6. UK vs. international	.20***	-.03	.00	-.01	.06	-	-	-	-	-	-	-	-	-
7. Financial concern (W1)	-.31***	.10*	.20***	.00	-.09†	-.06	-	-	-	-	-	-	-	-
8. Self-reported marks (W1)	.10†	.12*	-.13*	-.09†	.03	.12*	-.22***	-	-	-	-	-	-	-
9. Self-reported marks (W3)	.10*	.00	-.06	.08	-.04	.13**	-.19***	.55***	-	-	-	-	-	-
10. Intrinsic motivation (W1)	.03	-.05	.06	-.11*	-.01	.08	-.05	-	-	-	-	-	-	-
11. Intrinsic motivation (W3)	.01	-.02	.09†	-.15**	-.02	.08	-.08†	-	-	.72***	-	-	-	-
12. Stress (W1)	-.12*	-.06	.27***	.05	-.01	-.08	.34***	-	-	-.21***	-.21***	-	-	-
13. Stress (W2)	-.08†	-.05	.25***	.06	-.03	-.04	.35***	-	-	-.18***	-.24***	.70***	-	-
14. Belonging (W1)	.16**	-.05	-.08†	.06	.01	.02	-.19***	-	-	.43***	.30***	-.51***	-.40***	-
15. Belonging (W2)	.13**	-.01	-.06	.01	.01	-.02	-.22***	-	-	.42***	.41***	-.48***	-.49***	.76***
16. Social identification (W1)	.16***	-.14**	-.01	-.08†	.04	.00	-.14**	-	-	.45***	.35***	-	-	-
17. Social identification (W2)	.16**	-.11*	-.03	-.13**	.03	.00	-.17***	-	-	.38***	.36***	-	-	-
18. Mental health (W1)	.13**	.03	-.20***	-.06	.02	.07	-.29***	-	-	.21***	.21***	-	-	-
19. Mental health (W2)	.10*	.01	-.20***	-.03	.03	.08	-.32***	-	-	.19***	.22***	-	-	-
20. Physical health (W1)	.15**	-.06	-.02	.07	-.01	.05	-.16**	-	-	-.08†	-.05	-	-	-
21. Physical health (W2)	.17***	-.16**	-.03	.00	.03	.01	-.11*	-	-	-.10*	-.02	-	-	-
22. Working memory (W1)	.14**	-.13**	-.15**	-.03	.04	.14**	-.23***	-	-	-.02	-.02	-	-	-
23. Working memory (W2)	.04	-.04	-.09†	-.01	.03	.09†	-.11*	-	-	.00	-.02	-	-	-
24. Working hours (W1)	-.03	.11*	.05	.11*	-.22***	.02	.13**	-	-	-.05	-.01	-	-	-
25. Working hours (W2)	-.07	.18***	.03	.07	-.27***	.06	.12**	-	-	-.03	.02	-	-	-
26. Self-control (W1)	-.04	.03	-.02	.04	-.02	.05	-.18***	-	-	.23***	.17***	-	-	-
27. Self-control (W2)	-.04	.04	-.04	.05	.01	.04	-.12*	-	-	.26***	.25***	-	-	-
28. Self-regulation (W1)	.05	.04	-.15**	.01	.03	.06	-.25***	-	-	.24***	.20***	-	-	-
29. Self-regulation (W2)	.09†	.06	-.15**	.02	.04	.06	-.27***	-	-	.23***	.23***	-	-	-

Note. *** $p < .001$, ** $p < .01$, * $p < .05$, † $p < .10$.

Table 7 (continued)

	15	16	17	18	19	20	21	22	23	24	25	26	27	28	<i>M</i>	<i>SD</i>
1. Socioeconomic status	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.95	1.67
2. Age	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20.52	3.65
3. Gender	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4. Year of study	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.14	1.05
5. Full- vs. part-time	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6. UK vs. international	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7. Financial concern (W1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.30	1.54
8. Self-reported marks (W1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	69.83	11.45
9. Self-reported marks (W3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	67.36	10.04
10. Intrinsic motivation (W1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.23	1.35
11. Intrinsic motivation (W3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.18	1.43
12. Stress (W1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.32	1.19
13. Stress (W2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.26	1.22
14. Sense of belonging (W1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.59	0.56
15. Sense of belonging (W2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.60	0.53
16. Social identification (W1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.32	1.19
17. Social identification (W2)	-	.81***	-	-	-	-	-	-	-	-	-	-	-	-	5.26	1.22
18. Mental health (W1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	39.63	12.35
19. Mental health (W2)	-	-	-	.65***	-	-	-	-	-	-	-	-	-	-	40.16	12.24
20. Physical health (W1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	52.98	7.73
21. Physical health (W2)	-	-	-	-	-	.57***	-	-	-	-	-	-	-	-	53.73	6.96
22. Working memory (W1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.90	2.31
23. Working memory (W2)	-	-	-	-	-	-	-	.51***	-	-	-	-	-	-	10.41	2.30
24. Working hours (W1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.41	7.05
25. Working hours (W2)	-	-	-	-	-	-	-	-	-	.75***	-	-	-	-	3.12	6.39
26. Self-control (W1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.21	0.66
27. Self-control (W2)	-	-	-	-	-	-	-	-	-	-	-	.79***	-	-	3.21	0.62
28. Self-regulation (W1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.63	0.52
29. Self-regulation (W2)	-	-	-	-	-	-	-	-	-	-	-	-	-	.76***	2.67	0.49

Note. *** $p < .001$, ** $p < .01$, * $p < .05$, † $p < .10$.

Figure 1. *Initial model from Study 1, showing standardized estimates. Control variables are not shown. *** $p < .001$, * $p < .05$, † $p < .10$.*

Figure 2. *Respecified model from Study 1, showing standardized estimates. Control variables are not shown. *** $p < .001$, ** $p < .01$, * $p < .05$.*

Figure 3. *Path model of the total effect of financial concern on academic performance, showing correlation and standardized estimates. Control variables are not shown. *** $p < .001$.*

Figure 4. *Path model of the total effect of financial concern on intrinsic academic motivation, showing correlation and standardized estimates. Control variables are not shown. *** $p < .001$, * $p < .05$.*

Figure 5. Path model assessing the effect of financial concern on intrinsic academic motivation via stress, showing correlations and standardized estimates. Control variables are not shown. *** $p < .001$.

Figure 6. Path model assessing the effect of financial concern on intrinsic academic motivation via sense of belonging, showing correlations and standardized estimates. Control variables are not shown. *** $p < .001$, * $p < .05$.

Figure 7. Path model assessing the effect of financial concern on intrinsic academic motivation via mental health, showing correlations and standardized estimates. Control variables are not shown. *** $p < .001$, ** $p < .01$.

Figure 8. Path model assessing the effect of financial concern on intrinsic academic motivation via mental health, showing correlations and standardized estimates. Control variables are not shown. $*** p < .001$, $** p < .01$, $* p < .05$.