

UC Davis

UC Davis Previously Published Works

Title

Prospective associations between peer support, academic competence, and anxiety in college students

Permalink

<https://escholarship.org/uc/item/3wv26125>

Journal

Social Psychology of Education, 26(4)

ISSN

1381-2890

Authors

Worley, Justin T

Meter, Diana J

Ramirez Hall, Alysha

et al.

Publication Date

2023-08-01

DOI

10.1007/s11218-023-09781-3

Peer reviewed



Prospective associations between peer support, academic competence, and anxiety in college students

Justin T. Worley¹  · Diana J. Meter¹ · Alysha Ramirez Hall² · Adrienne Nishina³ · Michael A. Medina⁴

Received: 15 September 2022 / Accepted: 13 March 2023
© The Author(s), under exclusive licence to Springer Nature B.V. 2023

Abstract

Previous literature has demonstrated that peer support is instrumental for the promotion of adaptive academic and mental health outcomes; however, limited research has examined prospective directional associations between peer support and adjustment within college settings. The purpose of this study was to investigate the longitudinal associations between peer support, academic competence, and anxiety among U.S. college students. U.S. students from a diverse 4-year university ($N=251$, 75% women, 24% men, and <1% a different gender) reported on peer support, academic competence, and anxiety using validated questionnaires at two time points (Fall term of sophomore year and Spring term of senior year). Results showed that peer support was positively associated with academic competence over time but was not significantly related to future anxiety. Academic competence did not significantly predict peer support or anxiety over time, but anxiety was associated with lower future academic competence. These findings offer insight into how types of social relationships link with academic motivation and anxiety over time within educational settings.

Keywords Peer relationships · Academic competence · Anxiety · Higher education · Longitudinal

✉ Justin T. Worley
justin.worley@usu.edu

¹ Department of Human Development and Family Studies, Utah State University, 2905 Old Main Hill, Logan 84321, UT, USA

² EdPlus, Arizona State University, Scottsdale, AZ, USA

³ Department of Human Ecology, University of California, Davis, CA, USA

⁴ Wheelock College of Education and Human Development, Boston University, Boston, MA, USA

1 Introduction

Theoretical and empirical research have documented the importance of social support for healthy functioning across various social domains. Educational settings are inherently social contexts in which college students interact with, and may receive support from, a variety of agents including administrators, peers, and teachers. As students negotiate the transition from high school to college, and for them to succeed across the years of their college education, the maintenance of peer support can be instrumental for promoting adaptive academic and mental health outcomes. For example, college students who reported feeling supported by their peers also reported more adaptive educational outcomes such as higher academic-self efficacy and motivation for learning (Altermatt, 2019; Marley & Wilcox, 2021). In addition, peer support has been identified as a factor that may improve mental health outcomes among young adults (Richard et al., 2022). Cross-sectional research has demonstrated that peer support has been associated with lower anxiety within college populations (Jones et al., 2018). Longitudinal research examining college students' peer social support, academic, and mental health outcomes is warranted to elucidate prospective changes across multiple domains of functioning.

Motivational theory that factors in perceptions of the social environment may be particularly useful for understanding college students' academic and mental health outcomes. Self-determination theory (Deci & Ryan, 1985) is one framework that has been used to integrate the study of social factors with psychological outcomes in educational contexts (Niemic & Ryan, 2009). Broadly, self-determination theory argues that socio-environmental factors can contribute to aspects of adaptive or maladaptive functioning through the satisfaction or thwarting of three basic psychological needs (Ryan & Deci, 2000). These include the basic needs of autonomy (i.e., volition or endorsement of one's behavior), competence (i.e., effectiveness or mastery), and relatedness (i.e., feeling connected and supported). Interactions and relationships within the social environment that support these needs are theorized to promote adaptive psychological and well-being outcomes, while interactions that actively undermine individuals' needs are posited to result in indices of maladaptive experiences and ill-being (Deci & Ryan, 2000).

In the current study, self-determination theory was used as a guiding theoretical framework to examine the interrelations among peer support, academic competence, and anxiety over time. Given the main theoretical interest centered on peer support and academic competence, our approach reflected a narrowed focus on the needs of relatedness and competence in the broader self-determination theory. Applying tenets of self-determination theory to educational settings, college student (1) perceptions of peer support and (2) self-perception of academic competence within the social environment may fulfill the needs of relatedness and competence, thus leading to more adaptive college student outcomes.

1.1 Peer support as a predictor

From the lens of self-determination theory, college students' perceptions of relatedness, or feelings of being supported, within the social educational environment should link with indicators of academic motivation and achievement (Niemic & Ryan, 2009). Though college students may derive support from various providers, peers become one of the most proximal sources of support for students who have moved away from home, forged new social connections, and spend a wealth of their time with peers in and out of the classroom (Kenny & Rice, 1995; Thompson, 2008). Peer support in college settings can be emotional (e.g., enhancing self-esteem), informational (e.g., sharing resources), motivational (e.g., encouragement) and venting (e.g., listening to problems; Thompson & Mazer, 2009). As such, support from peers, in comparison to other agents, may be more readily available and derive from sources more relatable to the individual (Thompson & Mazer, 2009). Perceptions of more social support from one's peers has been associated with markers of academic motivation including higher academic self-efficacy (Altermatt, 2019), critical thinking skills and job preparedness (Beachboard et al., 2011), mastery goal orientation and intrinsic motivation for learning (Marley & Wilcox, 2021), grade point average and retention (Richardson et al., 2012; Robbins et al., 2004), and satisfaction with one's major (Schenkenfelder et al., 2020).

Given the proximity and salience of peers for academic motivation, supportive peer relationships may also play an important role in the development of self-perceptions of competence within educational settings. A relatively understudied aspect of college students' academic motivation is how peer support may be related to self-perceptions of academic competence. Compared to other theoretically similar constructs, such as academic self-efficacy, academic competence is characterized by domain-specific views of the self that are formed through social interactions (Bong & Skaalvik, 2003). That is, academic competence refers to individuals' perceptions of their cognitive ability in the academic domain (Harter, 1982). An integral component to the formation of self-perceptions, such as academic competence, are social interactions that provide frames of reference to judge one's own ability, along with reflected appraisals from significant others (Marsh, 1987; Skaalvik, 1997). Considering the importance of peer relationships in educational settings, perceptions of peer support may serve important social comparative functions that promote the development of academic competence in college students. In accordance with this perspective, empirical evidence suggests perceived support from sources such as classmates make important contributions to students' perceptions of academic competence in adolescence (Danielsen et al., 2009) as well as in college student populations (Reason et al., 2006).

Beyond the impact on academic motivation, perceptions of support within the social environment are also theorized to make important contributions to individuals' psychological functioning (Ryan & Deci, 2000). The concern for college students' mental health is becoming increasingly prominent among college campuses. Considering that self-reported mental health diagnoses are increasing among college students (Oswalt et al., 2020), researchers have devoted increased attention to how social factors relate to mental health in educational contexts. Cross-sectional

studies have consistently situated social support as a protective factor from negative mental health outcomes. For instance, Jones et al. (2018) found that higher levels of perceived peer support were negatively related to anxiety in a nationally representative sample of college students. In a similar vein, higher levels of need support (i.e., behaviors that support autonomy, competence, and relatedness) from peers were associated with lower anxiety and depression, while need thwarting from peers was positively related (Gilbert et al., 2021). In comparison, college students' perception of lower social support, along with discrepancies between desired social support and received support, has been linked with higher levels of depressive symptoms (Hefner & Eisenberg, 2009; Rankin et al., 2018).

1.2 Academic competence as a predictor

To date, a wealth of studies examining the associations of peer support with academic and mental health outcomes have utilized cross-sectional study designs. Although these findings are generally aligned with self-determination theory (Deci & Ryan, 1985), they prevent researchers from making inferences about the directional nature between peer support with academic and mental health outcomes. It is likely that multiple domains of functioning (e.g., social, academic, mental health) impact one another across college students' academic careers. As social interactions constitute dynamic processes that unfold overtime, examining prospective associations of peer support, academic competence, and anxiety symptoms offer an avenue to better understand college student development in these multiple domains.

In line with this perspective, some longitudinal research has shown that aspects of academic achievement and motivation can also impact the formation of peer support networks, along with college students' mental health outcomes. For example, longitudinal social network studies have illustrated that individuals' academic achievement and ability (as measured by grades and academic self-efficacy) play an important role in the formation of help-seeking peer networks (e.g., Brouwer & Engels, 2021; Shin & Ryan, 2014). Over the course of two college semesters, students with higher reported levels of academic achievement were more likely to establish peer relationships and help-seeking networks compared to those with lower achievement (Brouwer & Engels, 2021). Based on the conceptual ties between academic achievement and competence (e.g., Bong & Skaalvik, 2003), individuals with higher self-perceptions of academic competence may be more likely to develop supportive peer networks and report higher degrees of support in such settings.

Theoretical perspectives also suggest that self-perceptions of competence play a functional role in the promotion of individuals' psychological functioning. From a motivational lens, individuals are theorized to function and develop effectively in environments that support psychological needs (e.g., competence; Ryan & Deci, 2000). This aligns with developmental models linking self-perceptions of competence across various life domains (e.g., social, academic) with depressive symptoms in childhood and adolescence (Cole, 1991). Because a robust body of literature has assumed that self-perceptions of competence play an important role in individuals' psychological functioning, perceived competence within educational settings may

protect against negative mental health outcomes. Empirical research has examined these theoretical propositions within academic settings specific to college students. For example, higher self-perceptions of academic competence prospectively predicted decreased depressive symptoms during a six-month period in a sample of college undergraduates (Uhrlass et al., 2009). Both theoretical and empirical literature therefore have linked perceptions of competence within the academic domain as an important buffer from deleterious mental health outcomes.

1.3 The current study

Examination of the prospective associations between peer support, academic competence, and mental health will elucidate prospective or bidirectional relationships between these variables and extend current literature on college students' social and academic wellness and mental health. The purpose of this study was to test a longitudinal path model examining the associations between peer support, academic competence, and anxiety at two time points (Fall of the sophomore year and Spring of the senior year). Based on self-determination theory (Deci & Ryan, 1985; Niemiec & Ryan, 2009) and peer support literature in college settings (e.g., Altermatt, 2019; Marley & Wilcox, 2021), we hypothesized that peer support at time one (T1) would be positively associated with academic competence and negatively associated with anxiety at time two (T2). We also hypothesized that academic competence at T1 would be positively associated with peer support and negatively associated with anxiety at T2. Finally, in the interest of exploring associations among multiple domains of functioning, we included anxiety at T1 as a predictor of peer support and academic competence at T2. Based on previous empirical literature (e.g., Jones et al., 2018), we expected that anxiety at T1 would be negatively associated with peer support and academic competence at T2. The hypothesized model is illustrated in Fig. 1.

2 Method

2.1 Sample

Participants were recruited from a larger longitudinal study examining the social and academic wellness of students across the transition to college (Ramirez Hall et al., 2017). Students who reported a declared or intended science, technology, engineering, or math (STEM) related major at one university in the Western United States were invited via email to take part in a separate, longitudinal, daily report study. There were 326 participants in the larger, 4-year daily diary study. We included only those participants who provided data on at least one variable included in the current model during at least one time point.

For the present study, the sample consisted of 251 college students who were, based on self-report, from diverse racial and ethnic backgrounds. At the first time point, participants self-identified as Hispanic/Latino/a (37%), White/Caucasian

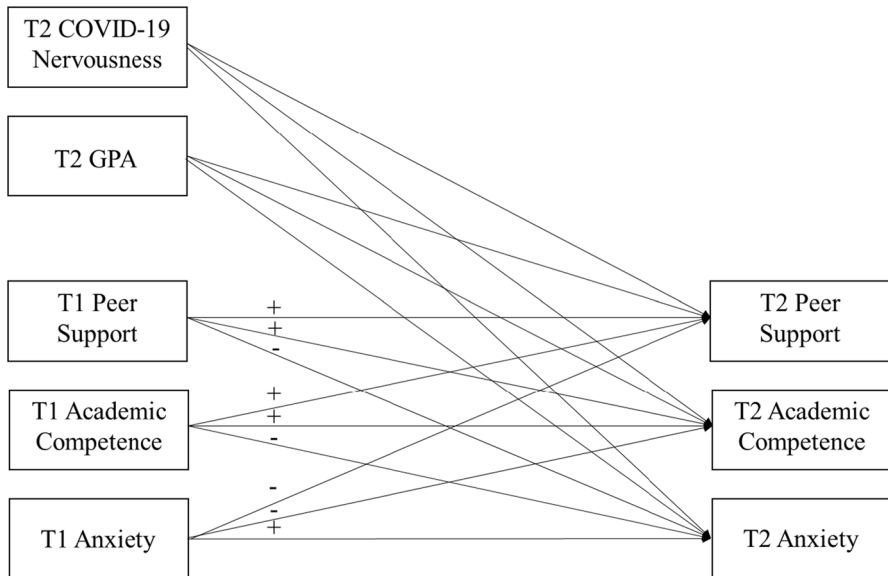


Fig. 1 Hypothesized path model. *Note.* T1 = Fall, 2017; T2 = Spring, 2020

(28%), Southeast Asian (13%), Multiethnic or Other (11%), Middle Eastern/South Asian (8%), and 3% did not report. At the first time point, of those who reported gender, 75% were women, 24% were men, and < 1% indicated a different gender.

2.2 Procedures

Surveys were reviewed and approved by the Institutional Review Board of University of California, Davis and were administered online in the evening. Data at T1 were collected during college students' Fall term of their sophomore year (November, 2017). Data at T2 were collected during the Spring term of participants' senior year (April, 2020). During T2, the state from which the sample was drawn had COVID-19-related active shelter-in-place orders and all students were engaged in online instruction only. Participants were paid a possible total of \$2 at T1 and a possible total of \$5 at T2 (Ramirez Hall & Nishina, 2019).

2.3 Measures

Peer support, academic competence, and anxiety were each measured at T1 and T2. As the data at T2 were collected during the onset of the COVID-19 pandemic, COVID-19 nervousness at T2 was included as a control variable, along with a self-reported measure of academic achievement (i.e., grade point average; GPA).

Peer support. Perceptions of peer support were measured using a 4-item peer support scale that was previously created for the Michigan Study of Adolescent Life Transitions (MSALT; Eccles & Barber, 1999). Participants were asked to report

how often they talked to their friends about how things were going in their lives, their plans for the future, and problems they were having in school. Responses were assessed on a scale from 1 (*Never*) to 4 (*Often*). The four items were aggregated to create a global score for peer support. The scale demonstrated adequate levels of internal consistency at T1 ($\alpha = .87$) and T2 ($\alpha = .89$).

Academic competence. Academic competence was measured using the scholastic competence subscale from Neemann and Harter's (2012) Self-Perception Profile for College Students. Participants responded to five statements organized in a structured-alternative format. Each statement posed two scenarios (e.g., "Some students feel like they are just as smart or smarter than other students BUT Other students wonder if they are as smart."). Participants first picked which student described them best, and then chose whether the description was *Sort of true* or *Really true* for them. Participant responses were scored from 1 to 4. Three items were reverse-coded so that higher scores reflected higher perceptions of academic competence. Items were then averaged to create a global score for self-perception of academic competence. The scale demonstrated an adequate level of internal consistency at T1 ($\alpha = .85$) and T2 ($\alpha = .89$).

Anxiety. Anxiety was measured using the Spielberger State-Trait Anxiety Inventory, short-form (Martean & Bekker, 1992). This 6-item measure required participants to indicate how much they agreed with different statements of how they felt "right now, at this moment." They responded whether they felt calm, tense, upset, relaxed, content, and worried on a scale from 1 (*Not at all*) to 4 (*Very much*). Three items were reverse-coded so that higher scores indicated higher anxiety. Responses for the measure were averaged to create a global score for anxiety, which yielded an adequate level of internal consistency at T1 ($\alpha = .86$) and T2 ($\alpha = .85$).

COVID-19 nervousness (researcher-developed). At T2, participants were asked to report how they currently felt about engaging in the following eight activities: Going to the store, on a walk, seeing friends they didn't live with, visiting loved ones they didn't live with, taking public transit/ride sharing, ordering food, wearing a mask in public, and receiving deliveries. Responses were measured on a scale from 1 (*Never nervous*) to 5 (*Almost always nervous*) and were aggregated to create a global score for COVID-19 nervousness. The scale demonstrated adequate internal consistency ($\alpha = .88$).

GPA. Participants self-reported their GPA at T2, which corresponded with a single cumulative number representing their academic achievement. Possible scores for participants' GPA ranged on a scale from 0 to 4 where higher scores indicated higher academic achievement (i.e., A = 4, B = 3, C = 2, D = 1, F = 0).

2.4 Plan of analysis

Analyses were conducted in R version 4.1.0 (R Core Team, 2021) using the lavaan package (Rosseel, 2012). Preliminary data screening was conducted to examine the

amount of missing data and for potential patterns of missing data. The percent missing data for each variable is presented in Table 1. The data were determined to be missing at random using Little's MCAR test, $\chi^2(46)=36.90, p=.829$. Of the participants who reported peer support, academic competence, or anxiety at the two time points, 111 participated at both time points, 90 participated at T1 only, and 34 participated at T2 only. The remaining 16 participants only reported at least one of the control variables. There were no differences in the number of times White and Non-White participants provided survey data ($\chi^2(2)=5.06, p=.079$), nor were there differences between men and women ($\chi^2(2)=1.10, p=.575$). To examine whether there were differences in any of the outcome variables between those who participated in one time point or two time points of data collection, we regressed each outcome variable onto a binary variable indicative of whether participants provided data at one of two time points. We did not find significant associations between the predictor variable and any of the outcomes of interest. These included: T1 peer support ($b=0.08, p=.554$), T2 peer support ($b=0.08, p=.687$), T1 academic competence ($b=-0.02, p=.879$), T2 academic competence ($b=0.06, p=.665$), T1 anxiety ($b=0.11, p=.278$), or T2 anxiety ($b=0.10, p=.449$).

Descriptive statistics including means, variances, and correlations were calculated within lavaan using a confirmatory factor analysis framework for full information maximum likelihood (FIML) to be used when estimating these statistics. FIML uses the available observed responses to supplement missing information (Little et al., 2013). This approach performs better than multiple imputation with small sample sizes (Jia et al., 2014) and is recommended when there are more than 10% missing values (Schlomer et al., 2010). A simulation study found that when a model estimated with FIML converged, the parameter estimates were accurate (Jia et al., 2014). The study hypotheses were tested using a path analysis. The hypothesized effects are shown in Fig. 1.

3 Results

Correlations between study variables are presented in Table 1. T1 variables were significantly correlated with themselves at T2 to a medium degree ($rs=.48-.56, p<.001$). At T2 only, peer support was negatively correlated with anxiety. Academic competence was negatively correlated with anxiety at both time points. The control variable for T2 GPA, was positively correlated with T1 and T2 academic competence, while T2 COVID-19 nervousness was not significantly associated with any study variables.

A summary of the standardized and unstandardized estimates from the path analysis are available in Table 2. First, autoregressive coefficients showed stability in perceptions of peer support, academic competence, and anxiety from T1 to T2 ($\beta s=0.35-0.55, p<.001$). The control variable, T2 GPA, was significantly and positively associated with T2 academic competence ($\beta=0.23, p=.003$), but was not associated with T2 peer support or anxiety.

Assessing the main hypotheses, above and beyond the effects of other predictors, T1 peer support significantly and positively predicted T2 academic competence

Table 1 Standardized covariances between model variables and unstandardized intercepts and variances

	1.	2.	3.	4.	5.	6.	7.	Unstandardized Intercept	Unstandardized Variance	% Missing
1. T1 Peer support	–							2.44	0.94	19.92
2. T1 Academic competence	.18*	–						2.68	0.49	20.32
3. T1 Anxiety	-.04	-.25**	–					2.35	0.44	19.92
4. T2 Peer support	.48***	.26**	-.25**	–				2.81	0.83	42.23
5. T2 Academic competence	.07	.56***	-.16*	.16*	–			2.53	0.49	42.63
6. T2 Anxiety	-.14	-.45***	.53***	-.21**	-.45***	–		2.42	0.50	42.23
7. T2 GPA	.04	.34***	.01	-.05	.31***	-.05	–	3.26	0.18	22.71
8. T2 COVID-19 nervousness	.06	.10	.12	.02	.06	-.02	.06	2.77	0.71	41.04

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 2 Standardized and unstandardized estimates for the longitudinal path model

	Standardized Estimate	Unstandardized Estimate	SE	<i>p</i>
<i>T2 Peer support</i>				
T1 Peer support	0.48	0.51	0.08	.000
T1 Academic competence	−0.06	−0.08	0.12	.523
T1 Anxiety	−0.06	−0.08	0.12	.514
T2 GPA	0.08	0.17	0.16	.275
T2 COVID-19 nervousness	0.05	0.05	0.10	.585
<i>T2 Academic competence</i>				
T1 Peer support	0.16	0.12	0.06	.039
T1 Academic competence	0.35	0.35	0.08	.000
T1 Anxiety	−0.25	−0.24	0.08	.003
T2 GPA	0.23	0.37	0.12	.003
T2 COVID-19 nervousness	0.06	0.05	0.06	.399
<i>T2 Anxiety</i>				
T1 Peer support	−0.15	−0.11	0.06	.058
T1 Academic competence	0.12	0.11	0.10	.263
T1 Anxiety	0.55	0.51	0.09	.000
T2 GPA	−0.02	−0.03	0.11	.814
T2 COVID-19 nervousness	0.11	0.09	0.06	.147

($\beta=0.16$, $p=.039$). Although there was a small, negative association between T1 peer support and T2 anxiety, this effect was not statistically significant ($\beta = -0.15$, $p=.058$). Academic competence did not significantly predict peer support or anxiety over time. T1 anxiety negatively predicted T2 academic competence ($\beta = -0.25$, $p=.003$), but did not predict T2 peer support. Together the results suggest that over time, prior peer support is related to greater academic competence during the COVID-19 pandemic while prior anxiety is related to less academic competence (see Fig. 2).

4 Discussion

The progression through college constitutes an important and substantial developmental period for students. Social relationships and adjustment (i.e., academic and mental health) are key characteristics that aid in the promotion of college students' development and retention. Yet, limited research has examined temporal associations between domains of college students' social, academic, and psychological functioning. The primary aim of this study was to examine the longitudinal associations between college students' perceptions of peer support, academic competence, and anxiety over a two-year period. First, we hypothesized that peer support at T1 would be positively associated with academic competence and negatively associated with anxiety over time when controlling for prior levels. This hypothesis was

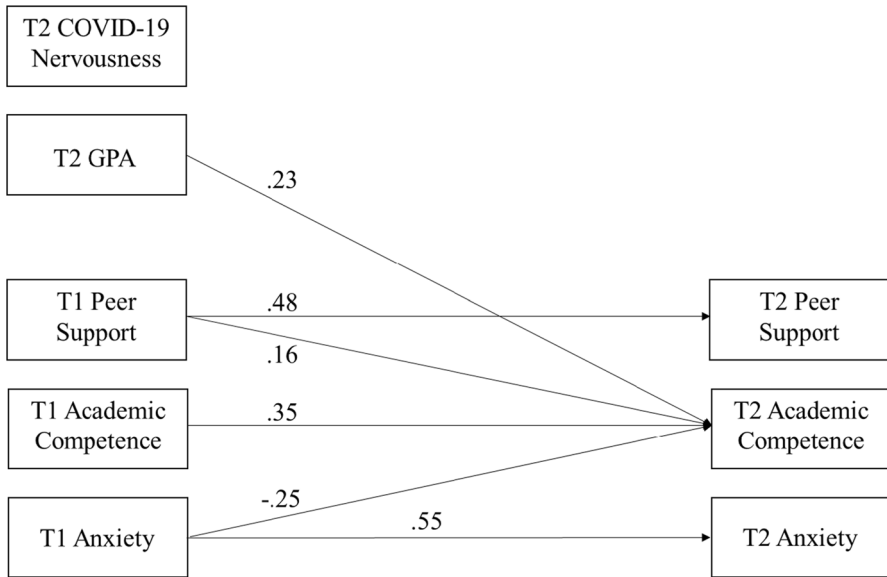


Fig. 2 Longitudinal path model for the study variables. *Note.* Only significant associations are shown. All estimates are standardized. T1 = Fall, 2017; T2 = Spring, 2020

partially supported, such that T1 peer support was positively associated with T2 academic competence but was not significantly related to T2 anxiety. Second, we hypothesized that academic competence at T1 would be positively associated with peer support and negatively associated with anxiety over time when controlling for prior levels. Contrary to our expectations, academic competence did not significantly predict peer support or anxiety over time. Finally, we hypothesized that T1 anxiety would be negatively associated with T2 peer support and academic competence. Anxiety at T1 was associated with lower academic competence at T2 when controlling for prior levels of academic competence, but was not associated with T2 peer support (Fig. 2).

4.1 Peer support as a predictor

The findings of the present study are partially in line with self-determination theory, which posits that supportive social contexts should promote more adaptive motivational and well-being outcomes (Deci & Ryan, 1985; Niemiec & Ryan, 2009). The results demonstrated that students who reported a higher frequency of talking to their peers (e.g., about challenges they had in school) during their sophomore year also reported higher self-perceptions of competence regarding their schoolwork during their senior year. This aligns with previous empirical literature which has illustrated similar associations between perceived peer support and motivationally salient outcomes for college students (e.g., Altermatt, 2019; Marley & Wilcox, 2021; Schenkenfelder et al., 2020). The study findings supplement this body of work

by examining the contribution of peer support to self-perceptions of academic competence. From a developmental perspective, this suggests peers may serve a salient functional role in the development of self-perceptions given their proximity and influence, particularly within the academic domain (Harter, 1982). Future work may benefit from examining longitudinal associations between peer support with a wider range of motivational constructs (e.g., need satisfaction, self-determined motivation) to further understand the nature of peer influence in diverse educational settings.

Contrary to expectations, perceived peer support did not significantly predict lower anxiety over time, though the relationship was in the theoretically expected direction. On one hand, this finding was unexpected given theoretical perspectives situating social support as a buffer from stressful life events (Lakey & Cohen, 2000). For instance, according to the stress-support matching hypothesis (Cohen & Willis, 1985), social support is expected to reduce stress-related effects on maladaptive experiences (e.g., anxiety, depression) to the extent that the form of support matches the stressor. A potential explanation for the lack of association between peer support and anxiety may be that anxiety was conceptualized as a subjective assessment of how the respondent was feeling at that moment (Marteau & Bekker, 1992). Stronger associations may have been observed with the examination of anxiety specific to school related functions.

Alternatively, self-determination theory researchers have argued that lower perceptions of support do not necessarily connote that support is being actively undermined or thwarted (Bartholomew et al., 2011; Deci & Ryan, 2000). From this lens, perceptions of controlling and/or pressuring behaviors from peers (as compared to supportive behaviors) may be more strongly tied to maladaptive experiences (Gilbert et al., 2021). The second time point also occurred during the COVID-19 pandemic. A growing body of literature has demonstrated that college students reported increased anxiety, among other negative mental health symptoms, during the onset of the COVID-19 pandemic (Haikalis et al., 2022; Liyanage et al., 2022), which may have distorted the association between prior peer support and anxiety. For instance, prior peer support may have been more strongly associated with generally reported anxiety that was not related to the COVID-19 pandemic. Or, the buffering effect of peer support may have dropped off somewhat when all students experienced educational disruptions due to the pandemic. That is, it may be difficult to obtain support from peers when those peers themselves are under stress. Continued research efforts examining positive and negative aspects of support in conjunction with indices of well-being and ill-being will better capture students' psychological functioning through college.

4.2 Academic competence as a predictor

A notable finding was the lack of reciprocal relationship between peer support and academic competence. While peer support predicted academic competence over time, perceptions of academic competence did not predict peer support. This is contrary to previous studies suggesting that aspects of academic achievement play an important role in the formation of friendships and help-seeking networks (e.g.,

Brouwer & Engels, 2022). In terms of college student development, a potential explanation may be that students who felt more competent in their academic ability earlier in their college career (i.e., during their sophomore year of college) were less reliant on peer support in later academic stages. Another consideration is that T2 data were collected during active shelter-in-place orders wherein all students were engaged in online instruction only due to COVID-19. Research has illustrated that shifts to online learning spaces and social distancing measures have been linked with aspects such as loneliness and declines in college belongingness (Birmingham et al., 2021; Pasupathi et al., 2022). The frequency and variety of peer interactions were reduced in the context of online learning, perhaps making it less likely that individuals would receive the same forms of peer support as they would within in-person learning contexts.

In addition, college students' self-perception of academic competence was not significantly related to anxiety over time. Again, this finding was unexpected given the tenets of self-determination theory linking individuals' perceptions of competence with more adaptive aspects of psychological functioning (Deci & Ryan, 1985; Ryan & Deci, 2000). For example, previous empirical work has shown that academic competence negatively predicted prospective changes in depressive symptoms over a six-month period in college undergraduates (Uhrlass et al., 2009). The current study, however, assessed student perceptions of academic competence and anxiety over a two-year period. It is possible that self-perceptions of academic competence may be more strongly related to anxiety symptoms in shorter time frames. Alternatively, some work has suggested that facets of mental health (e.g., depression) are more strongly predicted by overall self-concept (Friedlander et al., 2007). Domain specific self-perceptions, such as academic competence, may be more strongly tied to psychological outcomes pertaining specifically to the domain of the self-view (Friedlander et al., 2007). Accordingly, academic competence may be more strongly tied to school-specific forms of anxiety.

4.3 Stability in study constructs

It is also important to take notice of the stability in the study variables over time. In line with the descriptive patterns of correlations among the constructs over time, each of the study variables significantly predicted itself at the successive time point. This finding is noteworthy considering participant responses overlapped with the onset of the COVID-19 pandemic and a sudden shift to learning within digital spaces. Several recent studies have illustrated the challenges that students may have experienced due to COVID-19 (e.g., Molock & Parchem, 2020; Mucci-Ferris et al., 2021), including transitions to online learning, relocation and social isolation, and social distancing guidelines that may be impactful for students' academic and mental health outcomes. In the current study, however, individuals who reported higher levels of peer support and academic competence before the pandemic were also likely to report higher levels during the onset of the pandemic. Although the abrupt shift to online learning resulted in disruptive changes for college students (Molock & Parchem, 2020), participants in the current sample may have had the opportunity

to build adequate support networks that buffered the transition to online spaces. A different pattern of stability coefficients for peer support and academic competence may have been observed for students in younger developmental stages, such as first-year students that may have fewer social connections and less academic experience within the college context. Indeed, longitudinal examinations of first-year college students during the onset of the pandemic have showed increased perceptions of COVID-19 related loneliness (Mehus et al., 2021) and declines in areas of academic functioning, such as college self-efficacy and belongingness (Pasupathi et al., 2022). The results also showed stability in anxiety symptoms, indicating that college students reporting higher anxiety symptoms before the pandemic continued to report higher levels during the onset of COVID-19. Research efforts should therefore target both the maintenance and cultivation of social connections, as well as strategies that may buffer from negative mental health symptoms in college students.

4.4 Limitations and future directions

Considering the current study, there are limitations that should be noted. From a methodological perspective, study variables were assessed through self-report measures. The inclusion of objective measures, or measures reported by others, for different study variables would allow researchers to draw stronger conclusions from the data. For instance, though it is important to understand student perceptions of peer support, an ecologically informed approach could examine the type or amount of received support as rated by one's peers, along with other salient figures within the social environment (e.g., teachers). Additionally, the measurement of anxiety tapped daily perceptions of how individuals felt in the moment, which may be sensitive to contextual elements and timing of measurement during school terms. For example, state anxiety symptoms may be higher during heavy workload and exam periods. Future work would benefit from considering how normative variations in anxiety symptoms relate to students' social and academic outcomes. Finally, given the intensive nature of longitudinal data collection, complete data were not available from all participants in the study at either time points. Although full information maximum likelihood is a robust method commonly used to manage missing data (Jia et al., 2014), researchers should interpret the results with this limitation in mind.

From a conceptual lens, although the study investigated an important type of social support, peer support, there are multiple sources of support that students may receive during college, such as from family or teachers (e.g., Friedlander et al., 2007; Gilbert et al., 2021). Examining the relative contribution of multiple support providers would afford a more accurate representation of socially complex college student experiences. In a similar vein, peers can provide different types of support functions, such as esteem or informational support (Thompson & Mazer, 2009). The functional significance of different types of peer social support may vary for students' academic and mental health outcomes, especially for older STEM students in the current study who may have cultivated more effective support networks. Although we tapped perceptions of support which constitute positive social exchanges, negative interactions are also important for health outcomes and are argued to be more

consistently related to aspects of ill-being (Bartholomew et al., 2011). For example, longitudinal research investigating the transition to college has shown that increased negative exchanges (e.g., failure to provide help, neglect) were associated with increased negative but not positive emotional well-being, while positive exchanges were related to positive, but not negative, emotional well-being (Fiori & Consedine, 2013). Research efforts should examine positive and negative interactions in their link with college students' academic and mental health outcomes.

Another limitation of this study was that it was conducted during a time when students' classes moved to digital spaces. Whether the same (or sufficient) amounts and quality of social support were proffered in this setting is unknown, but could have affected the observed associations between variables. Considering the sample in this study was comprised of students in STEM majors, researchers may also benefit from examining these associations in college students from a more diverse array of academic majors. Last, although the longitudinal nature of the current study is a strength, the inclusion of additional time points would allow for a better understanding of the directionality and potentially bidirectionality of effects. Future research should collect data over longer periods of time, and perhaps at shorter intervals, to better understand the associations between study variables.

4.5 Conclusion

With the acknowledgement of these limitations, this study adds a meaningful contribution to the higher education literature base and may have practical implications for those working in educational settings. The adoption of a longitudinal research design builds from existing cross-sectional work examining the associations between peer support with academic and mental health outcomes in college undergraduates. The results offer preliminary directional support for the relationship between peer support and academic competence and highlight the socializing role of peers for academic self-perceptions of competence. From a practical lens, these findings may provide valuable insight for intervention efforts which aim to increase adaptive academic outcomes over the course of college students' development. In addition to the emphasis on supportive practices from teachers in educational contexts (Niemic & Ryan, 2009), stakeholders may also consider the implementation of peer-specific interventions which have demonstrated success in promoting adaptive adjustment outcomes during the transition to college such as decreased loneliness (e.g., Matanah et al., 2010). This study also devoted attention to interrelations among support and academic and mental health factors during the COVID-19 pandemic. While recent literature has demonstrated the deleterious effects of distancing and social isolation for college students' academic and mental health (Molock & Parchem, 2020; Mucci-Ferris et al., 2021), our findings highlight the stability in peer support and academic competence from before to during the onset of the pandemic.

Acknowledgements This work was supported by the National Science Foundation, Grant Award Number: 2028034.

Declarations

Conflict of interest The authors have no known conflict of interest, financial or otherwise, to disclose.

References

- Altermatt, E. R. (2019). Academic support from peers as a predictor of academic self-efficacy among college students. *Journal of College Student Retention: Research Theory & Practice*, 21(1), 21–37. <https://doi.org/10.1177/1521025116686588>
- Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., Bosch, J. A., & Thøgersen-Ntoumani, C. (2011). Self-determination theory and diminished functioning: The role of interpersonal control and psychological need thwarting. *Personality and Social Psychology Bulletin*, 37(11), 1459–1473. <https://doi.org/10.1177/0146167211413125>
- Beachboard, M. R., Beachboard, J. C., Li, W., & Adkison, S. R. (2011). Cohorts and relatedness: Self-determination theory as an explanation of how learning communities affect educational outcomes. *Research in Higher Education*, 52(8), 853–874. <https://doi.org/10.1007/s11162-011-9221-8>
- Birmingham, W. C., Wadsworth, L. L., Lassetter, J. H., Graff, T. C., Lauren, E., & Hung, M. (2021). COVID-19 lockdown: Impact on college students' lives. *Journal of American College Health*. <https://doi.org/10.1080/07448481.2021.1909041>
- Bong, M., & Skaalvik, E. M. (2003). Academic self-concept and self-efficacy: How different are they really? *Educational Psychology Review*, 15(1), 1–40. <https://doi.org/10.1023/A:1021302408382>
- Brouwer, J., & Engels, M. C. (2021). The role of prosocial attitudes and academic achievement in peer networks in higher education. *European Journal of Psychology of Education*, 37(2), 567–584. <https://doi.org/10.1007/s10212-020-00526-w>
- Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin*, 98(2), 310–357. <https://doi.org/10.1037/0033-2909.98.2.310>
- Cole, D. A. (1991). Preliminary support for a competency-based model of depression in children. *Journal of Abnormal Psychology*, 100(2), 181–190. <https://doi.org/10.1037/0021-843X.100.2.181>
- Danielsen, A. G., Samdal, O., Hetland, J., & Wold, B. (2009). School-related social support and students' perceived life satisfaction. *The Journal of Educational Research*, 102(4), 303–320. <https://doi.org/10.3200/JOER.102.4.303-320>
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. Plenum Press.
- Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227–268. https://doi.org/10.1207/S15327965PL11104_01
- Eccles, J. S., & Barber, B. L. (1999). Student council, volunteering, basketball, or marching band: What kind of extracurricular involvement matters? *Journal of Adolescent Research*, 14(1), 10–43. <https://doi.org/10.1177/0743558499141003>
- Fiori, K. L., & Consedine, N. S. (2013). Positive and negative social exchanges and mental health across the transition to college: Loneliness as a mediator. *Journal of Social and Personal Relationships*, 30(7), 920–941. <https://doi.org/10.1177/0265407512473863>
- Friedlander, L. J., Reid, G. J., Shupak, N., & Cribbie, R. (2007). Social support, self-esteem, and stress as predictors of adjustment to university among first-year undergraduates. *Journal of College Student Development*, 48(3), 259–274. <https://doi.org/10.1353/csd.2007.0024>
- Gilbert, W., Bureau, J. S., Poellhuber, B., & Guay, F. (2021). Predicting college students' psychological distress through basic psychological need-relevant practices by teachers, peers, and the academic program. *Motivation and Emotion*, 45(4), 436–455. <https://doi.org/10.1007/s11031-021-09892-4>
- Haikalis, M., Doucette, H., Meisel, M. K., Birch, K., & Barnett, N. P. (2022). Changes in college student anxiety and depression from pre-to during-COVID-19: Perceived stress, academic challenges, loneliness, and positive perceptions. *Emerging Adulthood*, 10(2), 534–545. <https://doi.org/10.1177/2167696821105851>

- Harter, S. (1982). The perceived competence scale for children. *Child Development*, 53(1), 87–97. <https://doi.org/10.2307/1129640>
- Hefner, J., & Eisenberg, D. (2009). Social support and mental health among college students. *American Journal of Orthopsychiatry*, 79(4), 491–499. <https://doi.org/10.1037/a0016918>
- Jia, F., Moore, E. W. G., Kinai, R., Crowe, K. S., Schoemann, A. M., & Little, T. D. (2014). Planned missing data designs with small sample sizes: How small is too small? *International Journal of Behavioral Development*, 38(5), 435–452. <https://doi.org/10.1177/0165025414531095>
- Jones, P. J., Park, S. Y., & Lefevor, G. T. (2018). Contemporary college student anxiety: The role of academic distress, financial stress, and support. *Journal of College Counseling*, 21(3), 252–264. <https://doi.org/10.1002/jocc.12107>
- Kenny, M. E., & Rice, K. G. (1995). Attachment to parents and adjustment in late adolescent college students: Current status, applications, and future considerations. *The Counseling Psychologist*, 23(3), 433–456. <https://doi.org/10.1177/0011000095233003>
- Lakey, B., & Cohen, S. (2000). Social support theory and measurement. In S. Cohen, L. G. Underwood, & B. H. Gottlieb (Eds.), *Social support measurement and intervention: A guide for health and social scientists* (pp. 29–52). Oxford University Press. <https://doi.org/10.1093/med:psych/9780195126709.003.0002>
- Little, T. D., Jorgensen, T. D., Lang, K. M., & Moore, E. W. G. (2013). On the joys of missing data. *Journal of Pediatric Psychology*, 39(2), 151–162. <https://doi.org/10.1093/jpepsy/jst048>
- Liyanae, S., Saqib, K., Khan, A. F., Thobani, T. R., Tang, W. C., Chiarot, C. B., & Butt, Z. A. (2022). Prevalence of anxiety in university students during the COVID-19 pandemic: A systematic review. *International Journal of Environmental Research and Public Health*, 19(1), 62. <https://doi.org/10.3390/ijerph19010062>
- Marley, S. C., & Wilcox, M. J. (2021). Do family and peer academic social supports predict academic motivations and achievement of first-year college students? *Journal of Applied Research in Higher Education*, 14(3), 958–973. <https://doi.org/10.1108/JARHE-06-2020-0158>
- Marsh, H. W. (1987). The big-fish-little-pond effect on academic self-concept. *Journal of Educational Psychology*, 79(3), 280–295. <https://doi.org/10.1037/0022-0663.79.3.280>
- Marteau, T. M., & Bekker, H. (1992). The development of a six-item short-form of the state scale of the Spielberger state–trait anxiety inventory (STAI). *British Journal of Clinical Psychology*, 31(3), 301–306. <https://doi.org/10.1111/j.2044-8260.1992.tb00997.x>
- Mattanah, J. F., Ayers, J. F., Brand, B. L., Brooks, L. J., Quimby, J. L., & McNary, S. W. (2010). A social support intervention to ease the college transition: Exploring main effects and moderators. *Journal of College Student Development*, 51(1), 93–108. <https://doi.org/10.1353/csd.0.0116>
- Mehus, C. J., Lyden, G. R., Bonar, E. E., Gunlicks-Stoessel, M., Morrell, N., Parks, M. J., & Patrick, M. E. (2021). Association between COVID-19-related loneliness or worry and symptoms of anxiety and depression among first-year college students. *Journal of American College Health*. <https://doi.org/10.1080/07448481.2021.1942009>
- Molock, S. D., & Parchem, B. (2022). The impact of COVID-19 on college students from communities of color. *Journal of American College Health*, 70(8), 2399–2405. <https://doi.org/10.1080/07448481.2020.1865380>
- Mucci-Ferris, M., Grabsch, D. K., & Bobo, A. (2021). Positives, negatives, and opportunities arising in the undergraduate experience during the COVID-19 pandemic. *Journal of College Student Development*, 62(2), 203–218. <https://doi.org/10.1353/csd.2021.0017>
- Neemann, J., & Harter, S. (2012). *Self-perception profile for college students: Manual and questionnaires*. University of Denver.
- Niemiec, C. P., & Ryan, R. M. (2009). Autonomy, competence, and relatedness in the classroom: Applying self-determination theory to educational practice. *Theory and Research in Education*, 7(2), 133–144. <https://doi.org/10.1177/1477878509104318>
- Oswalt, S. B., Lederer, A. M., Chestnut-Steich, K., Day, C., Halbritter, A., & Ortiz, D. (2020). Trends in college students' mental health diagnoses and utilization of services, 2009–2015. *Journal of American College Health*, 68(1), 41–51. <https://doi.org/10.1080/07448481.2018.1515748>
- Pasupathi, M., Booker, J., Ell, M., Follmer Greenhoot, A., McLean, K. C., Wainryb, C., & Fivush, R. (2022). College, interrupted: Profiles in first-year college students responses to the COVID-19 pandemic across one year. *Emerging Adulthood*, 10(6), 1574–1590. <https://doi.org/10.1177/21676968221119945>
- R Core Team. (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>.

- Ramirez Hall, A., & Nishina, A. (2019). Daily compensation can improve college students' participation and retention rates in daily report studies. *Emerging Adulthood, 7*(1), 66–73. <https://doi.org/10.1177/2167696817752177>
- Ramirez Hall, A., Nishina, A., & Lewis, J. (2017). Discrimination, friendship group diversity, and STEM-related outcomes for ethnic minority college students. *Journal of Vocational Behavior, 103*, 76–87. <https://doi.org/10.1016/j.jvb.2017.08.010>
- Rankin, J. A., Paisley, C. A., Mulla, M. M., & Tomeny, T. S. (2018). Unmet social support needs among college students: Relations between social support discrepancy and depressive and anxiety symptoms. *Journal of Counseling Psychology, 65*(4), 474–489. <https://doi.org/10.1037/cou0000269>
- Reason, R. D., Terenzini, P. T., & Domingo, R. J. (2006). First things first: Developing academic competence in the first year of college. *Research in Higher Education, 47*(2), 149–175. <https://doi.org/10.1007/s11162-005-8884-4>
- Richard, J., Rebinsky, R., Suresh, R., Kubic, S., Carter, A., Cunningham, J. E. A., & Sorin, M. (2022). Scoping review to evaluate the effects of peer support on the mental health of young adults. *British Medical Journal Open, 12*(8), e061336. <https://doi.org/10.1136/bmjopen-2022-061336>
- Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological Bulletin, 138*(2), 353–387. <https://doi.org/10.1037/a0026838>
- Robbins, S. B., Lauver, K., Le, H., Davis, D., Langley, R., & Carlstrom, A. (2004). Do psychosocial and study skill factors predict college outcomes? A meta-analysis. *Psychological Bulletin, 130*(2), 261–288. <https://doi.org/10.1037/0033-2909.130.2.261>
- Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software, 48*(2), 1–36. <https://doi.org/10.18637/jss.v048.i02>
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68–78. <https://doi.org/10.1037/0003-066X.55.1.68>
- Schenkenfelder, M., Frickey, E. A., & Larson, L. M. (2020). College environment and basic psychological needs: Predicting academic major satisfaction. *Journal of Counseling Psychology, 67*(2), 265–273. <https://doi.org/10.1037/cou0000380>
- Schlomer, G. L., Bauman, S., & Card, N. A. (2010). Best practices for missing data management in counseling psychology. *Journal of Counseling Psychology, 57*(1), 1–10. <https://doi.org/10.1037/a0018082>
- Shin, H., & Ryan, A. M. (2014). Early adolescent friendships and academic adjustment: Examining selection and influence processes with longitudinal social network analysis. *Developmental Psychology, 50*(11), 2462–2472. <https://doi.org/10.1037/a0037922>
- Skaalvik, E. M. (1997). Issues in research on self-concept. In M. Maehr & P. R. Pintrich (Eds.), *Advances in motivation and achievement* (Vol. 10, pp. 51–97). JAI Press.
- Thompson, B. (2008). How college freshmen communicate student academic support: A grounded theory study. *Communication Education, 57*(1), 123–144. <https://doi.org/10.1080/03634520701576147>
- Thompson, B., & Mazer, J. P. (2009). College student ratings of student academic support: Frequency, importance, and modes of communication. *Communication Education, 58*(3), 433–458. <https://doi.org/10.1080/03634520902930440>
- Uhrlass, D. J., Schofield, C. A., Coles, M. E., & Gibb, B. E. (2009). Self-perceived competence and prospective changes in symptoms of depression and social anxiety. *Journal of Behavior Therapy and Experimental Psychiatry, 40*(2), 329–337. <https://doi.org/10.1016/j.jbtep.2009.01.001>

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.

Justin T. Worley is a Doctoral Student in the Human Development and Family Studies Department at

Utah State University. His research focuses on social and motivational processes within interpersonal settings, such as education and sport and physical activity.

Diana J. Meter is an Assistant Professor in the Human Development and Family Studies Department at Utah State University. Her research focuses on peer relations among adolescents and young adults, particularly in the school context.

Alysha Ramirez Hall is a Senior Research Scientist at Arizona State University EdPlus. Her research interests revolve around the recruitment and retention of underrepresented populations in higher education.

Adrienne Nishina is a Professor in the Department of Human Ecology at the University of California, Davis. Her research focuses on peer relationships during adolescence and emerging adulthood along with the contextual factors (e.g., schools, diversity, physical space) that may shape them.

Michael A. Medina is an Assistant Professor of applied human development in the Wheelock College of Education and Human Development at Boston University. His research centers on ethnic identity, socialization, and academic success among students of color.