

Mentor Type, Mentoring Support, and STEM Undergraduate Student Challenges During the COVID-19 Pandemic

Chi-Ning Chang ^{a*}, Guan K. Saw ^b, Laura J. Malagon-Palacios ^c, and Ryan Culbertson ^d

^a School of Education, Virginia Commonwealth University. Email: changc10@vcu.edu

^b School of Educational Studies, Claremont Graduate University. Email: guan.saw@cgu.edu

^c Applied Behavioral Science and Psychology, The University of Kansas. Email: lalauragon@gmail.com

^d School of Educational Studies, Claremont Graduate University. Email: ryan.culbertson@cgu.edu

* Corresponding author. Address: VCU School of Education, Box 842020, 1015 West Main Street, Richmond, VA 23284-2020

Citation:

Chang, C. N., Saw, G. K., Malagon-Palacios, L., & Culbertson, R. (2022, Apr.). *Mentor type, mentoring support, and STEM undergraduate student challenges during the COVID19 pandemic*. Paper presented at the 2022 American Educational Research Association (AERA) Annual Meeting: Cultivating Equitable Education Systems for the 21st Century. Friday, April 22 –Monday, April 25, 2022, San Diego, CA.

Mentor Type, Mentoring Support, and STEM Undergraduate Student Challenges during the COVID-19 Pandemic

Abstract

The COVID-19 pandemic has severely affected postsecondary education in STEM fields. Before and during the pandemic, mentoring provided critical academic and socio-emotional support for undergraduate students. Little is known about the mentoring patterns across different types of mentors (faculty, staff, and peer), and whether various mentor-mentee interactions can mitigate negative pandemic impacts for STEM undergraduates. This study employed Structural Equational Modeling (SEM) to examine the interrelationships among mentor type, mentoring support, and student outcomes during the COVID-19 outbreak with a diverse, nationwide sample (N=2,352). The findings provided implications on how mentors from different positions can help students tackle the academic, career, and mental health challenges during the crisis.

Mentor Type, Mentoring Support, and STEM Undergraduate Student Challenges during the COVID-19 Pandemic

I. Objectives

The coronavirus disease 2019 (COVID-19) outbreak has severely affected postsecondary education in science, technology, engineering, and mathematics (STEM) fields. It disrupted the learning and career development of STEM undergraduate students (Author, 2020; Forakis et al., 2020; Wester et al., 2021) and caused mental health problems such as anxiety and depression (Author, 2021; Son et al., 2020; Tasso et al., 2021). Before and during the pandemic, mentoring provided critical academic and socio-emotional support for undergraduate students. Universities rely on faculty to provide plans, commitment, and guidance to inspire and support student learning and career development (McKinsey, 2016; Rapley et al., 2008). Staff mentoring and peer mentoring are emerging forms of mentorship taking place between staff and students and among students (Lane, 2020; Smith et al., 2019). While research on college students mentoring experiences and outcomes during the pandemic has started to emerge (e.g., Author, 2021; Krause & Moore, 2021), little is known about the mentoring patterns across different types of mentors, and whether various mentor-mentee interactions can mitigate negative pandemic impacts for STEM undergraduates. This study presents some of the first evidence on the interrelationships among mentor type, mentoring support, and student outcomes (i.e., academic, career, mental health) during the COVID-19 pandemic.

II. Relevant Literature and Theoretical Perspectives

Mentoring has been shown to positively affect the learning, personal, and career development of college students. Faculty mentors are professors who connect, collaborate, and commit to provide full support for school related activities and student success (McKinsey, 2016). Staff mentors offer students personal links to university processes and support services outside the faculty-student relationships (Rapley et al., 2008; Smith et al., 2019). Peer mentoring is offered through an upper-class student, considered a “natural mentor”, providing continuous support to improve sense of belonging, self-confidence, academic progression, and mental health (Asgari & Carter, 2016; Le et al., 2021; Yomtov et al., 2017). Although mentoring has been shown to promote college student success, there are calls for more studies to further investigate the effectiveness and uniqueness of these mentor types, specifically (e.g., Collier, 2017; Crisp, 2010). It also remains unclear how these types of mentorships continually support undergraduate students during the COVID-19 pandemic.

A well-established mentoring input-process-output model (MIPO; Curtin et al., 2016; Eby et al., 2013) offers a useful theoretical framework for studying the interrelationships among mentor type, mentoring support, and student challenges during the pandemic. As posited by the MIPO model, perceived deep-level mentor-mentee similarity and mentoring interaction frequency (i.e., Inputs) are expected to influence the quality of mentoring (i.e., Processes), which

are in turn expected to affect mentee outputs (i.e., Outcomes; see Figure 1). Mentor type and mentee's background characteristics are functioning throughout the entire process. Several meta-analytic reviews analyzing empirical studies on mentoring suggested that perceived deep-level mentor-mentee similarity, mentoring interaction frequency, and perceptions of mentoring support—both instrumental and psychosocial support—relate to mentoring satisfaction, which in turn link to a wide range of mentee outcomes (Allen et al., 2004; DuBois et al., 2002; Eby et al., 2013; Underhill, 2006). Based on this theoretical framework (Figure 1), this study not only examined how mentoring could support STEM undergraduate students facing challenges during the COVID-19 pandemic, but also investigated how the interrelationships in the model may differ based on mentor type.

III & IV Data & Methods

Data/Sample

The data for this study was collected as part of a nationwide survey using an online platform—Qualtrics—in June 2020. Survey invitations were emailed to undergraduate students through deans and associate deans from colleges of science and engineering (S&E) across the US. Informed consent was obtained from participants electronically prior to their participation in the survey. The final analytic sample consisted of 2,352 STEM undergraduates (from 43 higher education institutions in 25 states) who reported having at least one mentor/advisor on campus in the spring of 2020. Our survey sample included a demographically diverse group of participants (Table 1).

Measures

Guided by the MIPO model, our survey collected an array of measures on students' primary mentor type, perceptions and satisfaction of mentoring after the COVID-19 outbreak occurred in March 2020 (inputs and processes), academic, career, and mental health outcomes (outputs), in addition to demographic characteristics. Table 2 reports descriptive statistics for all the variables included in this study.

Survey respondents were asked to report their mentoring experience with their primary mentor whom they learn/work most closely with during the COVID-19 pandemic. Concerning the type of primary mentor, 57.4% were faculty members, 12.7% were staff members, 22.9% were peers (senior students or graduate students), and 7.0% were others. *Perceived deep-level mentor-mentee similarity* was constructed by four indicators (Ortiz-Walters & Gilson, 2005), as shown in Table 2. All items were formatted in a 4-point Likert scale ranging from 1 ("strongly disagree") to 4 ("strongly agree"). The Cronbach's alpha is 0.87. To capture the *mentor-mentee interaction frequency*, students were asked to compare the changes in interaction frequency with their primary mentor from prior to during the COVID-19 outbreak via: (1) face-to face; (2) video conferencing; (3) email; (4) phone; and (5) social media. The options include "much less hours (-2)," "less hours (-1)," "about the same hours (0)," "more hours (1)," and "much more hours (2)."

The sum of the scores for those five types of interaction were defined as changes in mentoring interaction frequency during the COVID-19 pandemic.

Perceived instrumental mentoring support and *perceived psychosocial mentoring support* were respectively measured by two sets of four indicators (Marie Taylor & Neimeyer, 2009; Ortiz-Walters & Gilson, 2005; Tenenbaum et al., 2001), as shown in Table 2. Based on the experience before and during the pandemic, students rated their support on a 5-point Likert scale that ranged from -2 (much less support) to 2 much (much more support). The Cronbach's alphas for these two measures are both .91. *Mentoring satisfaction* was the mentoring outcome assessed with a single-item (i.e., "How satisfied were you with the support you received from your primary mentor during this past spring 2020 semester?"). The response options ranged from 1 ("extremely dissatisfied") to 9 ("extremely satisfied").

Three student outcomes were examined, including delayed graduation, career pessimism, and mental health problems. For *delayed graduation*, students estimated the increase in their expected graduation date due to the pandemic. Their answers were calculated into number of months, ranging from 0 to 14 months. *Career pessimism* was measured by two items (shown in Table 2) on a scale from 1 ("strongly disagree") to 5 ("strongly agree") (Rottinghaus et al., 2005). The Cronbach's alpha is 0.84. *Mental health problems* consist of the symptoms of depression and anxiety in the past 7 days they experienced (U.S. Census Bureau, 2020; see Table 2). The response options include: "not at all (1)," "several days (2)," "more than half the days (3)," and "nearly every day (4)." The Cronbach's alpha is 0.89. In the model, the mental health latent variable was constructed by a second order confirmatory factor analysis (CFA) with two first-order factors (depression and anxiety) and two indicators of each first-order factor.

The *background characteristics* of students, including gender, race/ethnicity, socioeconomic status (SES), disability status, citizenship status, age, household experienced a loss of employment income since the COVID-19 outbreak, were collected and treated as covariates in the statistical models. To measure student's SES, we employed the MacArthur Scale of Subjective Social Status (Adler et al., 2000), which is a self-reported scale from 1 (people who have the least money, least education, and worst jobs or no job) to 10 (people who have the most money, most education, and best jobs). Another type of SES measure, household member experienced a loss of income during the COVID-19 pandemic (U.S. Census Bureau, 2020), was also collected to reflect on student's financial hardship affected by the crisis of COVID-19 pandemic. Disability status included six disability types: hearing, vision, cognition, mobility, self-care, and independent living (Centers for Disease Control and Prevention, 2020). Students with any of these difficulties were considered disabled for this study. Except for the SES measure and age, all remaining of background characteristics were coded as categorical covariates.

Analytic Strategy

We tested the hypothesized model (Figure 1) by using structural equation modeling (SEM). SEM allows for identifying the interrelationships among observed and latent variables simultaneously, while accounting for the measurement errors of observed items. The analysis

was performed in *Mplus* 8.6 using the maximum likelihood estimator (Muthén & Muthén, 1998-2017). While estimating the interrelationships among mentoring and student challenges, each measure was also predicted by the mentor type and controlled for the background characteristics listed in Table 1. A series of multiple-group SEM analysis were performed to examine how the interrelationships vary by mentor type. Chi-square difference testing was used for constrained and unconstrained model comparisons. Missing data ranged from zero to a high of 13.8%. We utilized the full information maximum likelihood (FIML) approach to handle the missing data and improve the estimation (Mazza et al., 2015).

V. Results

The theoretical model in SEM showed a good fit with empirical data, RMSEA = .03, CFI = .97, and SRMR = .03. Figure 2 presents the model with statistically significant paths (solid lines). The color of each variable highlights the disparities of mentor type in mentoring support and student outcomes. The bottom panel illustrated the potentially varying effects across mentor type.

Disparities in Mentoring Support and Student Outcomes by Mentor Type

The SEM results indicated mentees reported a higher level of deep-level similarity with their peer mentors than those whose mentors were faculty and staff mentors. Compared with those mentored by peers and staff, STEM college students mentored by faculty reported interacting with their mentors more frequently. Students mentored by faculty and staff perceived higher levels of instrumental mentoring support and psychosocial mentoring support during the pandemic. There were no significant differences across various mentor types in student's mentoring satisfaction and academic, career, and mental health outcomes.

Interrelationships among Mentoring Inputs, Processes, and Outcomes

As predicted in the hypothesized model, the deep-level mentor-mentee similarity and mentoring interaction frequency were positively related to the perceptions of instrumental support and psychosocial support during the COVID-19 outbreak. Students' perceptions of instrumental and psychosocial support and deep-level similarity with mentors were positively associated with mentoring satisfaction. Importantly, mentoring satisfaction is negatively associated with delayed graduation, career pessimism, and mental health problems, implying that the higher level the mentorship quality, the fewer academic, career, and mental health challenges occurred during the COVID-19 pandemic. We also found that students' perceptions of instrumental mentoring support had a direct negative relationship with the expected months of delayed graduation and mental health problems.

Varying Effects across Mentor Type

Overall, the multiple-group SEM results indicated the proposed theoretical framework held well and was stable across mentor type, with only a few effects differing by mentor type in magnitude found. For peer mentoring, interaction frequency during the pandemic may have a

stronger association with perceived instrumental support. Staff mentoring showed a stronger effect of perceived instrumental support on mentoring satisfaction.

VI. Significance of the Study

This study makes several theoretical, methodological, and practical contributions to the literature on mentoring, STEM education, and crisis response. At the theoretical level, it builds upon the literature on vocational psychology and career development to develop a novel theoretical framework that links mentor type, mentoring support, and student outcomes during the COVID-19 pandemic. Our comprehensive, theory-driven model was largely supported by empirical evidence. At the methodological level, this study is one of the first to measure and analyze the linkages of the mentor type with various dimensions of mentoring and student outcomes with a diverse, nationwide sample of STEM undergraduate students. Our findings have greater generalizability, improving on most prior work on mentoring that relied largely on a small sample from a single program or institution (see review by Hernandez, 2019). At the practical level, this study presents mentoring patterns across different types of mentors during the pandemic. Traditionally, universities rely on faculty to provide students with formal and informal mentoring plans. Our empirical evidence showed that even with staff and peer mentoring, STEM undergraduates benefited from their mentorship during the COVID-19 crisis. This finding underscores the importance of supporting mentors from different positions to provide quality mentoring experience for STEM college students.

References

- Adler, N. E., Epel, E. S., Castellazzo, G., & Ickovics, J. R. (2000). Relationship of subjective and objective social status with psychological and physiological functioning: Preliminary data in healthy, White women. *Health Psychology, 19*(6), 586–592. <https://doi.org/10.1037/0278-6133.19.6.586>
- Allen, T. D., Eby, L. T., Poteet, M. L., Lentz, E., & Lima, L. (2004). Career benefits associated with mentoring for proteges: A Meta-Analysis. *Journal of Applied Psychology, 89*(1), 127–136. <https://doi.org/10.1037/0021-9010.89.1.127>
- Asgari, S., & Carter, F. (2016). Peer mentors can improve academic performance: a quasi-experimental study of peer mentorship in introductory courses. *Teaching of Psychology, 43*(2), 131–135. <https://doi.org/10.1177/0098628316636288>
- Centers for Disease Control and Prevention. (2020). *Disability Datasets*. <https://www.cdc.gov/ncbddd/disabilityandhealth/datasets.html>
- Collier, P. (2017). Why peer mentoring is an effective approach for promoting college student success. *Metropolitan Universities, 28*(3), 9–19.
- Crisp, G. (2010). The impact of mentoring on the success of community college students. *Review of Higher Education, 34*(1), 39–+.
- Curtin, N., Malley, J., & Stewart, A. J. (2016). Mentoring the next generation of faculty: supporting academic career aspirations among doctoral students. *Research in Higher Education, 57*(6), 714–738. <https://doi.org/10.1007/s11162-015-9403-x>
- DuBois, D. L., Holloway, B. E., Valentine, J. C., & Cooper, H. (2002). Effectiveness of mentoring programs for youth: A meta-analytic review. *American Journal of Community Psychology, 30*(2), 157–197. <https://doi.org/10.1023/A:1014628810714>
- Eby, L. T. de T., Allen, T. D., Hoffman, B. J., Baranik, L. E., Sauer, J. B., Baldwin, S., Morrison, M. A., Kinkade, K. M., Maher, C. P., Curtis, S., & Evans, S. C. (2013). An interdisciplinary meta-analysis of the potential antecedents, correlates, and consequences of protégé perceptions of mentoring. *Psychological Bulletin, 139*(2), 441–476. <https://doi.org/10.1037/a0029279>
- Forakis, J., March, J. L., & Erdmann, M. (2020). The impact of COVID-19 on the academic plans and career intentions of future STEM professionals. *Journal of Chemical Education, 97*(9), 3336–3340. <https://doi.org/10.1021/acs.jchemed.0c00646>
- Hernandez, P. R. (2019). Landscape of assessments of mentoring relationship processes in postsecondary STEM contexts: A synthesis of validity evidence from mentee, mentor, institutional/programmatic perspectives. *Paper Commissioned by the National Academies of Sciences Engineering & Medicine Committee on The Science of Effective Mentorship in STEM, 10*, 24918.
- Krause, A. J., & Moore, S. Y. (2021). Creating an online peer-to-peer mentoring program: promoting student relationships, engagement, and satisfaction during the era of COVID-19. *College Teaching, 1*–13.
- Lane, S. R. (2020). Addressing the stressful first year in college: Could peer mentoring be a critical strategy? *Journal of College Student Retention: Research, Theory & Practice, 22*(3), 481–496.
- Le, T. P., Hsu, T., & Raposa, E. B. (2021). Effects of natural mentoring relationships on college students' mental health: The role of emotion regulation. *American Journal of Community Psychology. https://doi.org/10.1002/ajcp.12504*

- Marie Taylor, J., & Neimeyer, G. J. (2009). Graduate school mentoring in clinical, counselling, and experimental academic training programs: An exploratory study. *Counselling Psychology Quarterly*, 22(2), 257–266. <https://doi.org/10.1080/09515070903157289>
- Mazza, G. L., Enders, C. K., & Ruehlman, L. S. (2015). Addressing item-level missing data: a comparison of proration and full information maximum likelihood estimation. *Multivariate Behavioral Research*, 50(5), 504–519. <https://doi.org/10.1080/00273171.2015.1068157>
- McKinsey, E. (2016). Faculty Mentoring Undergraduates: The nature, development, and benefits of mentoring relationships. *Teaching & Learning Inquiry-the Issotl Journal*, 4(1). <https://doi.org/10.20343/teachlearninqu.4.1.5>
- Muthén, L. K., & Muthén, B. O. (1998-2017). *Mplus user's guide* (Eighth). Muthén & Muthén. https://www.statmodel.com/HTML_UG/introV8.htm
- Ortiz-Walters, R., & Gilson, L. L. (2005). Mentoring in academia: An examination of the experiences of protégés of color. *Journal of Vocational Behavior*, 67(3), 459–475. <https://doi.org/10.1016/j.jvb.2004.09.004>
- Rapley, P., Davidson, L., Nathan, P., & Dhaliwal, S. S. (2008). Enrolled nurse to registered nurse: Is there a link between initial educational preparation and course completion? *Nurse Education Today*, 28(1), 115–119.
- Rottinghaus, P. J., Day, S. X., & Borgen, F. H. (2005). The career futures inventory: A measure of career-related adaptability and optimism. *Journal of Career Assessment*, 13(1), 3–24.
- Smith, C. A., Beltman, S., Dobinson, T., Dinham, J., Bailey, J., & Pullella, T. (2019). An instrumental mentoring program to support student engagement and academic success. *STARS 2019 Conference Proceedings*. <https://unistars.org/papers/STARS2019/06B.pdf>
- Son, C., Hegde, S., Smith, A., Wang, X., & Sasangohar, F. (2020). Effects of COVID-19 on college students' mental health in the United States: Interview survey study. *Journal of Medical Internet Research*, 22(9), e21279. <https://doi.org/10.2196/21279>
- Tasso, A. F., Hisli Sahin, N., & San Roman, G. J. (2021). COVID-19 disruption on college students: Academic and socioemotional implications. *Psychological Trauma*, 13(1), 9–15. <https://doi.org/10.1037/tra0000996>
- Tenenbaum, H. R., Crosby, F. J., & Gliner, M. D. (2001). Mentoring relationships in graduate school. *Journal of Vocational Behavior*, 59(3), 326–341. <https://doi.org/10.1006/jvbe.2001.1804>
- Underhill, C. M. (2006). The effectiveness of mentoring programs in corporate settings: A meta-analytical review of the literature. *Journal of Vocational Behavior*, 68(2), 292–307. <https://doi.org/10.1016/j.jvb.2005.05.003>
- U.S. Census Bureau. (2020). *Household pulse survey (COVID-19)*. The United States Census Bureau. <https://www.census.gov/householdpulse>
- Wester, E. R., Walsh, L. L., Arango-Caro, S., & Callis-Duehl, K. L. (2021). Student engagement declines in stem undergraduates during COVID-19–driven remote learning. *Journal of Microbiology & Biology Education*, 22(1), ev22i1.2385. <https://doi.org/10.1128/jmbe.v22i1.2385>
- Yomtov, D., Plunkett, S. W., Efrat, R., & Marin, A. G. (2017). Can peer mentors improve first-year experiences of university students? *Journal of College Student Retention: Research, Theory & Practice*, 19(1), 25–44. <https://doi.org/10.1177/1521025115611398>

Table 1. Background characteristics of survey participants (N=2,352).

	<i>n</i>	%
<i>Gender</i>		
Man*	991	42.1
Woman	1,097	46.6
Other gender/did not report	264	11.2
<i>Race/ethnicity</i>		
White*	1,221	51.9
Black/Hispanic/Native American	395	16.8
Asian	359	15.3
Other race/did not report	377	16.0
<i>Socioeconomic status (SES)</i>		
High SES (8-10)	516	21.9
Mid SES (6-7)	984	41.8
Low SES (1-5)	620	26.4
Did not report	232	9.9
<i>Disabilities</i>		
Non-disabled*	1,760	74.8
Disabled	360	15.3
Did not report	232	9.9
<i>Citizenship status</i>		
US citizen/permanent resident*	2,041	86.8
International student	67	2.8
Did not report	244	10.4
<i>Age</i>		
18-22	1,763	75.0
23 +	352	15.0
Did not report	237	10.1
<i>Household member experienced a loss of income</i>		
Yes	1,083	46.0
No*	1,016	43.2
Did not report	253	10.8
<i>Mentor Type</i>		
Faculty*	1,350	57.4
Staff	299	12.7
Peer (senior students or graduate students)	539	22.9
Other	164	7.0

Note. SES (Mean=6.34; SD=1.71) and age (Mean=21.36; SD=3.05) are continuous covariates, while other background characteristics are categorical covariates. * represents the reference group in each categorical covariate.

Table 2. Summary Statistics for Primary Measures (N=2,352).

Variables	Mean	SD	Min.	Max.	Miss. (%)
<i>Perceived deep-level mentor-mentee similarity</i>					
Share similar interests	2.93	0.82	1.00	4.00	0.00
Look at things in much the same way	2.89	0.79	1.00	4.00	0.00
Hold similar values	3.06	0.80	1.00	4.00	0.00
Analyze problems in a similar way	2.85	0.81	1.00	4.00	0.00
<i>Mentoring interaction frequency</i>					
Face-to-face	-1.32	0.94	-2.00	2.00	0.00
Video conferencing	-0.15	1.28	-2.00	2.00	0.00
Email	-0.14	1.09	-2.00	2.00	0.00
Phone	-0.31	0.95	-2.00	2.00	0.00
Social media	-0.30	0.85	-2.00	2.00	0.00
<i>Perceived instrumental support</i>					
Finish my assignments/projects	-0.12	0.85	-2.00	2.00	0.00
Improve my writing skills	-0.26	0.76	-2.00	2.00	0.00
Prepare for my presentations	-0.25	0.79	-2.00	2.00	0.00
Explore my career options	-0.15	0.88	-2.00	2.00	0.00
<i>Perceived psychosocial support</i>					
Discuss my concerns about academic projects	0.01	0.87	-2.00	2.00	0.00
Pursue my learning interests	-0.03	0.82	-2.00	2.00	0.00
Work toward my career goals	-0.01	0.86	-2.00	2.00	0.00
Talk about my anxiety in career outlook	-0.03	0.90	-2.00	2.00	0.00
<i>Mentoring satisfaction</i>	6.93	2.14	1.00	9.00	13.69
<i>Delayed graduation (months)</i>	0.41	1.76	0.00	14.00	0.04
<i>Career Pessimism</i>					
Less certain when setting my career goals	3.46	1.09	1.00	5.00	2.25
Less sure of my future career success	3.42	1.19	1.00	5.00	2.25
<i>Mental health problems</i>					
Depression					
Feeling down, depressed, or hopeless	2.11	1.05	1.00	4.00	10.97
Having little interest or pleasure in doing things	2.00	1.01	1.00	4.00	11.01
Anxiety					
Not being able to stop or control worrying	2.32	1.07	1.00	4.00	10.93
Feeling nervous, anxious, or on edge	1.99	1.05	1.00	4.00	10.97

Note. Min. = minimum; Max. = maximum; Miss. = missing data.

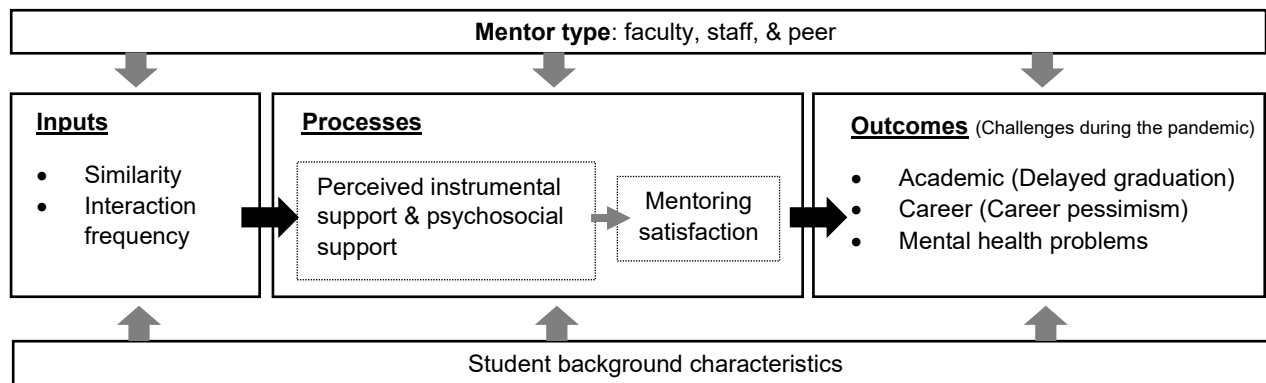


Figure 1. A hypothesized model linking the inputs, processes, and outcomes of mentoring for STEM undergraduates during the COVID-19 pandemic.

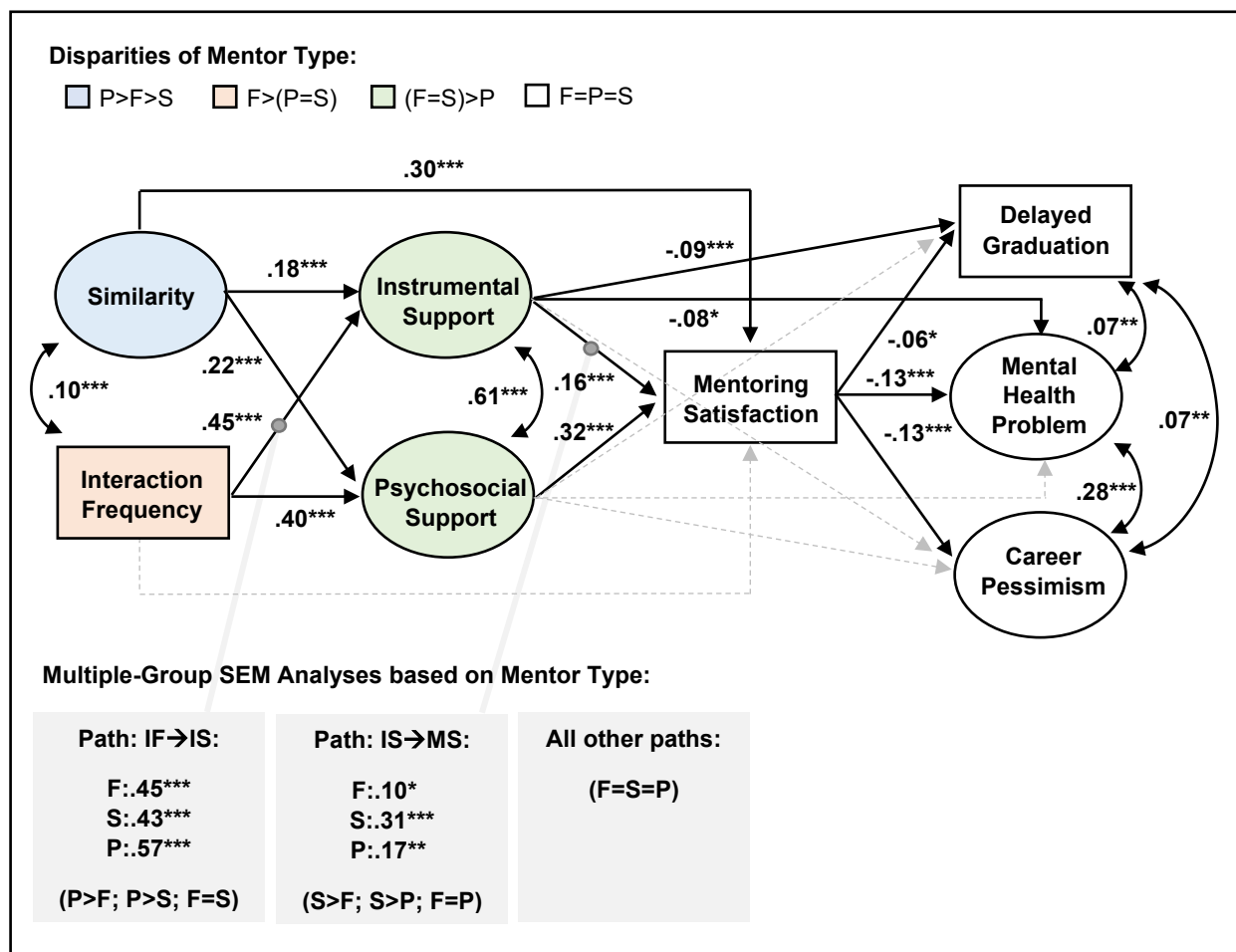


Figure 2. Structural model results of interrelationships between mentoring and student outcomes for STEM undergraduates during the COVID-19 pandemic ($N=2,352$).

Note. Latent construct = oval; observed variable = rectangle. IF = Interaction frequency. IS = Perceived instrumental support. MS = Mentoring satisfaction. All variables were simultaneously predicted by mentor type and controlled for the covariates including gender, race and ethnicity, SES, disability, age, citizenship status, loss of income during the pandemic. The reference group of each categorical covariate was stated in Table 1. Mentor type includes faculty (F), staff (S), and peer (P); other type of mentor was listed as a controlled variable. To compare the disparities of mentor type, we tested two models where the reference groups of Mentor type were faculty and peers, respectively. For reasons of clarity, all the background characteristics, factor loadings for each latent construct, and uniquenesses were not shown in the figure. Values are standardized path coefficients. Dashed paths are not statistically significant. R^2 for similarity = .07; R^2 for interaction frequency = .03; R^2 for instrumental support = .29; R^2 for psychosocial support = .24; R^2 for mentoring satisfaction = .41; R^2 for mental health = .24; R^2 for delayed graduation = .08; R^2 for career pessimism = .10. * $p < .05$, ** $p < .01$, *** $p < .001$.