The Relations between Students' Belongingness, Self-efficacy, and Response to Active Learning.

Abstract

In this study, we examined the relation between students' affective and behavioral response to active learning, the influence of students' belongingness and their self-efficacy on these responses, and the moderating influence of students' gender-identity. We found that, despite mean differences in value, positivity, and distraction, there were not gender differences in the pattern of relations between variables. For both groups, belongingness and self-efficacy independently predicted students' affective response and their evaluation of the class. Belongingness also predicted students' participation in class. These findings suggest that student-level factors play an important role in how students respond to active learning and that fostering an atmosphere that supports both self-efficacy and belongingness may be beneficial for all students.

1. Objectives

Post-secondary STEM education continues to focus on improving student outcomes through the use of instructional practices designed to increase student engagement (e.g., AAAS, 2009; NSF 2014). Of particular interest has been student-centered teaching practices that support students in constructing, rather than passively receiving, knowledge (Bada & Olusegun, 2015). Research has found that these "active learning" teaching practices (Bonwell & Eison, 1991) can be particularly effective in improving student-level outcomes (e.g., Prince, 2004), particularly as instructors support greater cognitive engagement through generative and interactive activities (Chi & Wylie, 2004).

Despite these benefits, students do not always respond positively to active learning (DeMonbrun et al., 2017). When confronted with what are often seen as novel teaching practices (Shekhar et al., 2020), students may experience a negative affective response, feeling less positive about the activity (e.g., Oakley et al., 2007) or perceiving it as lacking value (e.g., Machemer & Crawford, 2007). Additionally, students may behaviorally respond by being distracted (e.g., Seidel & Tanner, 2013), not participating in the activities (e.g., Cooper et al., 2012) or evaluating the course negatively as a result (e.g., Rein & Brookes, 2015). Although it has been theorized that students' affective response may be related to this behavioral response (e.g., Shekhar et al., 2020), this relation has yet to be empirically tested.

Research (e.g., Shekhar et al., 2020) has found several underlying reasons students may resist these student-centered teaching practices including limited time, logistical difficulties, and perceived lack of support. However, other student-level factors may also influence students' affective and behavioral response to active learning. Building on social cognitive theory of self-regulated learning (SRL; Zimmerman, 2000; Usher & Schunk, 2018), we examine the influence of two key factors on students' response to active learning – their self-efficacy for learning (Pintrich et al., 1993) and belongingness (Malone et al., 2012). Additionally, we examine the mediating role of students' affective response on the relation between these underlying factors and their behavioral responses. Finally, we examine the degree to which students' gender-identity moderate these relations. Specifically, we answer the following research questions:

RQ1: Does students' self-efficacy and belongingness predict their affective and behavioral response to active learning in STEM classrooms?

RQ2: Does students' affective response to active learning mediate the relation between their self-efficacy and belongingness to their behavioral response?

RQ3: Does students' gender identity moderate the relation between their self-efficacy and belongingness on their affective and behavioral response to active learning?

2. Theoretical Framework

This study is grounded in a social cognitive theory of self-regulated learning (SRL; Zimmerman; Usher & Schunk, 2018). According to SRL, students' ability to organize their thoughts, feelings, and actions in order to attain a goal is guided by both internal and external factors (Usher & Schunk, 2018). One key factor impacting students' self-regulation is their self-efficacy, or beliefs about their capability to accomplish a task or succeed in an activity (Bandura, 1986). Higher content-area self-efficacy has been found to relate both and increase in self-regulated learning behaviors (Zimmerman & Martinez-Pons, 199) and course engagement (Linnenbrink & Pintrich, 2003).

In addition to cognitive factors such as self-efficacy, social cognitive theory highlights the importance key social and environmental factors such as students' belongingness (Won et al., 2018). Human beings need to form and maintain lasting, positive, and significant interpersonal relations (Baumeister & Leary, 1995). In educational settings students' feelings of belongingness can impact performance (Sirin & Rogers-Sirin, 2004), mental health (Newman et al., 2007), and willingness to engage in classroom activities (Willms, 2003; Wilson et al., 2015). Research has

examined this belongingness within the university (e.g., Weiss, 2021) and discipline or major (e.g., Sankar et al., 2015). However, in post-secondary education instructors and researchers are interested in understanding belongingness at the classroom level (e.g., Booker, 2007) to address belongingness as part of instructional practice (e.g., Cheryan et al., 2009; Good et al., 2012).

Prior research has found that both self-efficacy and students' belongingness predict students' response in the classroom (e.g., Wilson et al., 2015). However, less is understood about the relation between these factors and their affective and behavioral response to active learning, specifically. Additionally, research has found that male- and female-identifying students often differ in both efficacy and belongingness (e.g., Tellhed et al., 2013). Given the equity gap in STEM participation and retention (e.g., Wang & Degol, 2017), it's important to understand how gender identity influences these factors and moderates their relation to students' affective and behavioral response to active learning in order to better support all students in engaging in these student-centered pedagogical practices.

3. Methods

All research questions were answered with latent indirect-effects structural equation models (Kline, 2016) using the *lavaan* package (Rosseel, 2012) in *R* open-source software (R Core Team, 2013). To answer our first two research questions, we used bootstrap standard errors (Bollen & Stine, 1990; Shrout & Bolger, 2002) to evaluate the indirect effect of students' belongingness and self-efficacy on their behavioral response to active learning through their affective response. To answer our third research question, we established measurement invariance in the structural model before constraining parameters of interest (i.e., regression and covariance of latent variables) to be invariant in order to test for gender differences (Putnick & Bornstein, 2016). We present our tested model in Figure 1.

4. Data sources, evidence, objects or materials:

Student participants (n = 579) were recruited from STEM classes taught by 25 faculty at 14 colleges and universities in the South Central and Pacific Northwest regions of the United States. Instructors distributed anonymous online surveys to students following a class in which faculty indicated they had used active learning. Both faculty and students reported demographic information, including race/ethnicity and gender-identity, with open-ended responses. We present demographic information for faculty in Table 1 and students in Table 2. Given their small n (<

2%), students who identified as "Gender Non-conforming", "Unsure", or "Other" were excluded from the present analysis due to methodological limitations.

We present all measures used in the present study in Table 3. In this study, we used measures of students' affective (value and positivity) and behavioral (participation, distraction, and evaluation) response to active learning using the Student Response to Instructional Practices (StRIP) instrument (DeMonbrun et al., 2017). Additionally, we measured self-efficacy for learning (MSLQ; Pintrich et al., 1993).

Course belongingness was assessed using six items adapted from the General Belongingness Scale (GBS; Malone et al., 2012). This scale was selected due to its correspondence with underlying theory (e.g., Baumeister & Leary, 1995). Items were adapted to ground achieved belongingness within the specific context of the classroom learning environment. The revised scale included three positively-worded (e.g., "I have a belongingness in this class.") and three reverse-coded negatively-worded items (e.g., "I feel like an outsider in this class"). We conducted a CFA on Self-Efficacy and Belongingness to test our revisions of the belongingness scale. The model achieved adequate fit (Hu & Bentler, 1999), $\chi^2(df)$ =283.02(75), $p < .01$; CFI = .96; RMSEA [90% CI] = .076 [.068, .075]. We present descriptive statistics and correlations between measures for all students in Table 4 and by students' gender identity in Table 5.

5. Results

To answer our first research question, we fit latent variable indirect-effect SEM using bootstrap standard errors. This model achieved adequate fit (Hu & Bentler, 1999); $\chi^2(df)$ = 1,226.97(411), $p < .01$; CFI = .92; RMSEA [90% CI] = .063 [.059, .067]. We present unstandardized parameter estimates for this model in Table 6 and the path diagram with standardized parameter estimates in Figure 2. To answer our second question, we fit separate models for female- and male-identifying students and systematically constrained parameters to be invariant across groups. We present fit statistics for our measurement invariance testing in Table 7. We were able to establish weak invariance for our model after constraining factor loadings to be invariant for male- and female-identifying students, but were unable to establish strict invariance by constraining the latent variable means to be invariant across both groups. However, we did not find significant differences in the latent variable covariances or regression parameters when compared to the strong invariant model. Therefore, we present the strong invariant model with the latent variable covariance and regression parameters constrained to be invariant as our best fitting model. We present

unstandardized parameter estimates for this model in Table 6 and a path diagram with standardized parameter estimates in Figure 3.

For our best fitting model, we found that male-identifying students were 0.39 *sd* below female-identifying students in their positivity affective response and 0.29 *sd* below female-identifying students in their value affective response. No differences were observed between male- and female-identifying students' self-efficacy, belongingness, or their participation and evaluation behavioral response. For both groups, belonging and self-efficacy each independently predicted both positivity and value affective response. Belongingness also predicted students' participation and self-efficacy related to students' evaluation. Students' positivity related to both evaluation and participation. The indirect effect of belonging on participation through positivity was significant, as was the indirect of effect of belongingness on evaluation through positivity. The indirect effect of self-efficacy on participation and evaluation through positivity was also significant. The total effect of belongingness on both participation and evaluation was significant, as was the total effect of self-efficacy on evaluation.

6. Significance of work

In this study, we examined the relation between students' self-efficacy and belongingness on their affective and behavioral response to active learning in STEM classrooms. We found that both self-efficacy and belongingness predicted students' affective response (their positivity and value) as well as their participation and evaluation. These findings support prior research on active learning (e.g., Shekhar et al., 2020), suggesting that student-level factors play an important role in how students respond to student-centered teaching practices.

Additionally, we tested the degree to which students' affective response to active learning mediated the influence of self-efficacy and belongingness on their behavioral response. Contrary to previous theoretical work (e.g., Shekhar et al., 2020), we did not find evidence to support this hypothesis. This suggest that students' behavioral response to active learning may be independent of their affective response. This finding may require additional research to better understand the relation between students' feelings of value and positivity for active learning and their participation, distraction, and evaluation of the activities.

Finally, we examined the degree to which students' gender-identity moderated these relations. We found that while the latent variable means were different for male- and female-identifying students, the pattern of relations between factors was the same. This suggests that fostering an

atmosphere that supports both self-efficacy and belongingness may be beneficial for all students. Together, our findings suggest that additional attention to both self-efficacy (e.g., Atanasov et al., 2013) and students' belongingness (e.g., Cheryan et al., 2009; Good et al., 2012) may support all students' willingness to engage in active learning, leading to improved academic outcomes.

References

American Association for the Advancement of Science. (2009). *Vision and change in undergraduate biology education*. Washington, DC: Author.

Atanasov, K. G., Dudnytska, N., Estes, T., & Marsh, J. (2013). Intervention strategies promoting academic self-efficacy in prospective first-generation college students: A literature review. *The William & Mary Educational Review*, *1*(1), 7.

Bada, S. O., & Olusegun, S. (2015). Constructivism learning theory: A paradigm for teaching and learning. *Journal of Research & Method in Education*, *5*(6), 66-70.

Bollen, K. A., & Stine, R. (1990). Direct and indirect effects: Classical and bootstrap estimates of variability. *Sociological methodology*, 115-140.

Bonwell, C., & Eison, J. (1991). Active Learning: Creating Excitement in the Classroom AEHE-ERIC Higher Education Report No. 1. Washington, D.C.: Jossey-Bass.

Booker, K. C. (2007). Perceptions of classroom belongingness among African American college students. *College Student Journal*, *41*(1), 178-187.

Cheryan, Plaut, Davies, & Steele. (2009). Ambient belonging: how stereotypical cues impact gender participation in computer science. Journal of Personality and Social Psychology, 97, 1045.

Cooper, T. E., Bailey, B., & Briggs, K. (2012). The impact of a modified Moore method on efficacy and performance in precalculus. *PRIMUS*, *22*(5), 386–410.

Linnenbrink, E. A., & Pintrich, P. R. (2003). The role of self-efficacy beliefs instudent engagement and learning intheclassroom. *Reading &Writing Quarterly*, *19*(2), 119-137.

Machemer, P. L., & Crawford, P. (2007). Student perceptions of active learning in a large cross-disciplinary classroom. *Active Learning in Higher Education*, *8*(1), 9–30.

Malone, G. P., Pillow, D. R., & Osman, A. (2012). The general belongingness scale (GBS): Assessing achieved belongingness. *Personality and individual differences*, *52*(3), 311-316.

National Science Foundation (NSF). (2013). *Common guidelines for education research and development.* National Science Foundation. https://doi.org/10.1080/00220973.2013.813364

Newman, B.M., Newman, P.R., Griffen, S., O'Connor, K., & Spas, J. (2007). The relationship of social support to depressive symptoms during the transition to high school. *Adolescence*, 42, 441–459.

Oakley, B. A., Hanna, D. M., Kuzmyn, Z., & Felder, R. M. (2007). Best practices involving teamwork in the classroom: Results from a survey of 6435 engineering student respondents. *IEEE Transactions on Education*, *50*(3), 266-272.

Pintrich, P. R., Smith, D. A., Garcia, T., & McKeachie, W. J. (1993). Reliability and predictive validity of the Motivated Strategies for Learning Questionnaire (MSLQ). *Educational and psychological measurement, 53*(3), 801-813.

Putnick, D. L., & Bornstein, M. H. (2016). Measurement invariance conventions and reporting: The state of the art and future directions for psychological research. *Developmental review*, 41, 71-90.

R Core Team (2017). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. URF https://www.R-project.org/

Rein, K. S., & Brookes, D. T. (2015). Student response to a partial inversion of an organic chemistry course for non-chemistry majors. *Journal of Chemical Education*, *92*(5), 797–802.

Rosseel, Y. (2012). Lavaan: An R package for structural equation modeling and more. Version 0.5–12 (BETA). *Journal of statistical software, 48*(2), 1-36.

Sankar, P., Gilmartin, J., & Sobel, M. (2015). An examination of belongingness and confidence among female computer science students. *Acm Sigcas Computers and Society*, *45*(2), 7-10.

Seidel, S. B., & Tanner, K. D. (2013). "What if students revolt?"—considering student resistance: origins, options, and opportunities for investigation. *CBE—Life Sciences Education*, *12*(4), 586-595.

Shekhar, P., Borrego, M., DeMonbrun, M., Finelli, C., Crockett, C., & Nguyen, K. (2020). Negative student response to active learning in STEM classrooms: A systematic review of underlying reasons. *Journal of College Science Teaching*, *49*(6), 45-54.

Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: new procedures and recommendations. *Psychological methods, 7*(4), 422.

Sirin, S.R., & Rogers-Sirin, L. (2004). Exploring school engagement of middle-class African American adolescents. Youth & Society, 35, 323–340. doi:10.1177/0044118X03255006

Tellhed, U., Bäckström, M., & Björklund, F. (2017). Will I fit in and do well? The importance of social belongingness and self-efficacy for explaining gender differences in interest in STEM and HEED majors. *Sex roles*, *77*(1), 86-96.

Wang, M. T., & Degol, J. L. (2017). Gender gap in science, technology, engineering, and mathematics (STEM): Current knowledge, implications for practice, policy, and future directions. *Educational psychology review*, *29*(1), 119-140.

Weiss, S. (2021). Fostering sense of belonging at universities. *European Journal of Education, 56*(1), 93–97. doi:10.1111/ejed.12439

Willms, J. D. (2003). *Student Engagement at School. A Sense of Belonging and Participation. Results from PISA 2000*. Paris, France: Organisation for Economic Co-operation and Development.

Wilson, D., Jones, D., Bocell, F., Crawford, J., Kim, M. J., Veilleux, N., ... & Plett, M. (2015). Belonging and academic engagement among undergraduate STEM students: A multi-institutional study. *Research in Higher Education*, *56*(7), 750-776.

Won, S., Wolters, C. A., & Mueller, S. A. (2018). Sense of belonging and self-regulated learning: Testing achievement goals as mediators. *The Journal of Experimental Education*, *86*(3), 402-418.

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In *Handbook of self-regulation* (pp. 13-39). Academic Press.

Zimmerman, B. J., & Martinez-Pons, M. (1990). Student differences in self-regulated learning: Relating grade, sex, and giftedness to self-efficacy and strategy use. *Journal of educational Psychology*, *82*(1), 51.

Table 1

Faculty Demographic Information.

	Race/Ethnicity Identity			Discipline				
Gender Identity	White Non-Hispanic	Hispanic	Asian	Science	Technology	Engineering	Math	Total
Male	5	1	2	3	1	4	0	8
Female	11	1	5	10	0	3	4	17
Total	16	2	7	13	1	7	4	25

Notes. All demographic data collected using open-ended self-report responses.

Table 2

Student Demographic Information.

Gender Identity	Race/Ethnicity Identity								
	White / Caucasian	African/ African American / Black	Asian	Latinx / Hispanic	Mixed Race / Multiracial	Pacific Islander	Other	Missing	Total
Female	81	20	43	42	8	0	3	3	200
Male	136	14	37	39	13	2	8	4	253
Gender Non-conforming	2	1	0	0	0	0	1	0	4
Unsure	1	0	1	0	0	0	0	2	4
Other	0	0	0	0	0	0	1	1	2
Missing	1	1	2	0	0	0	2	110	116
Total	221	36	83	81	21	2	15	120	579

Notes. All demographic data collected using open-ended self-report responses.

Table 3

Abbreviations, Citation, Sample Items, and Internal Consistence for Measures

Measure	Abbv.	Citation	Sample Item	# Items	α
Belongingness	B	Malone et al., 2012	"I have a sense of belongingness in this class."	6	.88
Self-efficacy	SE	Pintrich et al., 1993	"I expect I can do well in this course."	8	.90
Positivity	ARP	DeMonbrun et al., 2017	"I enjoyed the activities."	3	.83
Value	ARV	DeMonbrun et al., 2017	"I saw the value of today's activities."	3	.92
Participation	BRP	DeMonbrun et al., 2017	"I participated actively in the activities."	4	.79
Distraction	BRD	DeMonbrun et al., 2017	"I distracted my peers during the activities."	4	.81
Evaluation	BREV	DeMonbrun et al., 2017	"Overall, this is an excellent course."	3	.95

Notes. Abbv. Abbreviation

Table 4

Correlations, Means, & Standard Deviations for Complete Sample

	1	2	3	4	5	6	7
1. Belonging	1.00						
2. Self-efficacy	.36**	1.00					
3. Positivity	.38**	.45**	1.00				
4. Value	.36**	.39**	.75**	1.00			
5. Participation	.48**	.27**	.53**	.50**	1.00		
6. Distraction	-.22**	-.10*	-.38**	-.29**	-.53**	1.00	
7. Evaluation	.30**	.53**	.69**	.70**	.33**	-.14**	1.00
Mean	5.59	5.20	5.61	5.88	5.84	2.38	5.87
SD	1.23	1.30	1.11	1.05	1.04	1.16	1.37

Notes. * $p < .05$ ** $p < .01$. SD Standard Deviation

Table 5

Correlations, Means, and Standard Deviations by Gender Identity

		1	2	3	4	5	6	7
1. Belonging	Female	1.00						
	Male							
2. Self-efficacy	Female	.37**	1.00					
	Male	.39**						
3. Positivity	Female	.29**	.43**	1.00				
	Male	.43**	.51**					
4. Value	Female	.24**	.31**	.71**	1.00			
	Male	.42**	.47**	.76**				
5. Participation	Female	.44**	.30**	.49**	.45**	1.00		
	Male	.48**	.29**	.54**	.47**			
6. Distraction	Female	-.21**	-.20**	-.40**	-.30**	-.50**	1.00	
	Male	-.17**	-.06	-.31**	-.20**	-.54**		
7. Evaluation	Female	.27**	.53**	.66**	.59**	.36**	-.18*	1.00
	Male	.33**	.57**	.68**	.74**	.33**	-0.05	
Mean	Female	5.70	5.14	5.87	6.11	6.05	2.17	6.16
	Male	5.58	5.25	5.45	5.77	5.76	2.46	5.69
SD	Female	1.24	1.31	0.97	0.85	0.92	1.02	1.12
	Male	1.18	1.29	1.13	1.13	1.00	1.19	1.47

Notes. * $p < .05$ ** $p < .01$. SD Standard Deviation

Table 6.

Unstandardized Parameter Estimates for Baseline and Best-fitting Model

Parameter Estimate (SE)	Baseline Model	Best Fitting Model	
		Female	Male
Regressions			
Belonging → Positivity	0.35** (0.10)	0.27**	(0.10)
Belonging → Value	0.36** (0.08)	0.31**	(0.09)
Belonging → Participation	0.36** (0.10)	0.33**	(0.10)
Belonging → Distraction	-0.27^{T} (0.15)	-0.19	(0.14)
Belonging → Evaluation	-0.09 (0.08)	-0.07	(0.08)
Self-efficacy → Positivity	0.36** (0.06)	0.38**	(0.06)
Self-efficacy → Value	0.26** (0.06)	0.28**	(0.06)
Self-efficacy → Participation	-0.07 (0.05)	-0.06	(0.05)
Self-efficacy → Distraction	0.08 (0.07)	0.02	(0.06)
Self-efficacy → Evaluation	0.15** (0.05)	0.16**	(0.05)
Positivity → Participation	0.25^{T} (0.15)	0.32*	(0.15)
Positivity → Distraction	-0.18 (0.19)	-0.25	(0.17)
Positivity → Evaluation	0.75** (0.19)	0.60**	(0.19)
Value → Participation	0.04 (0.14)	-0.03	(0.12)
Value → Distraction	-0.07 (0.19)	0.06	(0.16)
Value → Evaluation	0.13 (0.18)	0.24	(0.18)
Indirect Effects			
Belonging → Positivity → Participation	0.09^{T} (0.05)	0.09*	(0.05)
Belonging → Positivity → Distraction	-0.06 (0.06)	-0.07	(0.05)
Belonging → Positivity → Evaluation	0.26** (0.10)	0.17*	(0.08)
Belonging → Value → Participation	0.01 (0.05)	-0.01	(0.04)
Belonging → Value → Distraction	-0.03 (0.06)	0.02	(0.05)
Belonging → Value → Evaluation	0.05 (0.06)	-0.08	(0.06)
Self-efficacy → Positivity → Participation	0.09^{T} (0.05)	0.12*	(0.06)
Self-efficacy → Positivity → Distraction	-0.06 (0.07)	-0.10	(0.06)
Self-efficacy → Positivity → Evaluation	0.27** (0.08)	0.23**	(0.08)
Self-efficacy → Value → Participation	0.01 (0.04)	-0.01	(0.03)

Self-efficacy → Value → Distraction	-0.02	(0.05)	0.02	(0.04)
Self-efficacy → Value → Evaluation	0.03	(0.05)	0.07	(0.05)
Total Effect				
Belonging → … → Participation	0.46**	(0.11)	0.41**	(0.11)
Belonging → … → Distraction	-0.36*	(0.16)	-0.24^{T}	(0.14)
Belonging → … → Evaluation	0.21*	(0.09)	0.17*	(0.17)
Self-efficacy → … → Participation	0.03	(0.06)	0.06	(0.07)
Self-efficacy → … → Distraction	< -0.01	(0.06)	-0.06	(0.06)
Self-efficacy → … → Evaluation	0.45**	(0.06)	0.48**	(0.06)
Covariances				
Belonging ↔ Self-efficacy	0.67**	(0.09)	0.68**	(0.12)
Positivity ↔ Value	0.67**	(0.09)	0.63**	(0.09)
Participation ↔ Distraction	-0.49**	(0.08)	0.44**	(0.07)
Participation ↔ Evaluation	-0.05	(0.05)	-0.03	(0.04)
Distraction ↔ Evaluation	0.07	(0.06)	0.08	(0.05)
Means				
Belonging	-		0	-0.11 (0.08)
Self-efficacy	-		0	0.13 (0.14)
Value	-		0	-0.30** (0.09)
Positivity	-		0	-0.46** (0.01)
Participation	-		0	-0.11 (0.08)
Distraction	-		0	0.21^{T} (0.12)
Evaluation	-		0	-0.13 (0.11)

Notes. * $p < .05$ ** $p < .01$. All significance test conducted using bootstrap standard errors (Bollen & Stine, 1990).

Table 7

Model Fit Indices and Model Comparison for Multiple Group Analysis by Gender

Model	χ^2 (*df*)	$\Delta\chi^2$ (Δdf)	CFI	ΔCFI	BIC	ΔBIC
Baseline	2,071.92** (882)		.894		38,713.21	
Weak Invariance	2,132.52** (907)	33.49 (25)	.891	.003	38,622.45	
Strong Invariance	2,169.37** (930)	34.60 (23)	.890	.001	38,520.05	
Strict Invariance[1]	2,205.32** (939)	36.86** (9)	.888	.002	38,501.51	
LV Covariance	2,174.63** (935)	2.51 (5)	.890	< .001	38,495.04	
Regression	2,205.12** (951)	20.56 (16)	.889	.001	38,428.66	

Notes. * $p < .05$ ** $p < .01$. CFI – comparative fit index. BIC – Bayesian Information Criterion. [1] model significantly worse than comparison, constraints not retained in subsequent model (LV Covariance model comparison to Strong Invariance model). Non-robust fit statistics reported in order to compare nested models.

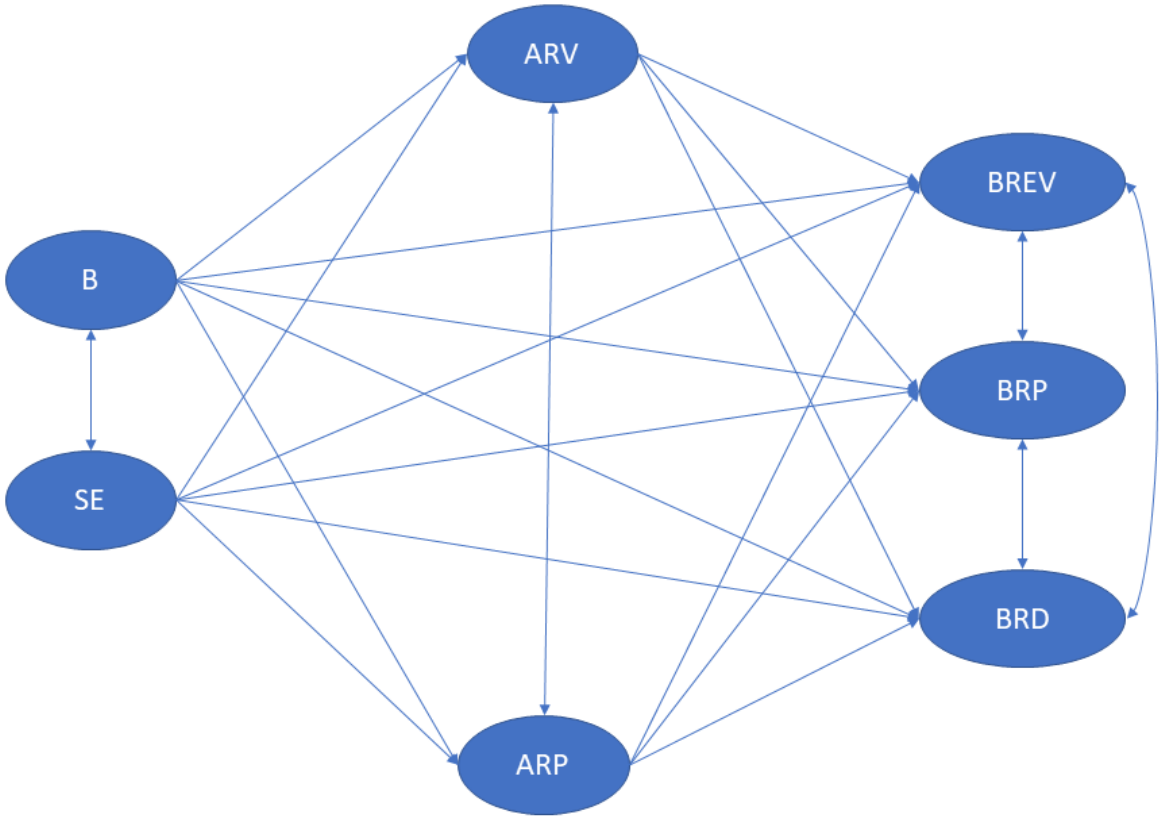

Figure 1. Tested Indirect Effect Model. B – belongingness, SE – self-efficacy for learning, ARV – affective response value, ARP – affective response positivity, BREV – behavioral response evaluation, BRP – behavioral response participation, BRD – behavioral response distraction. Manifest variables and factor loadings omitted for clarity.

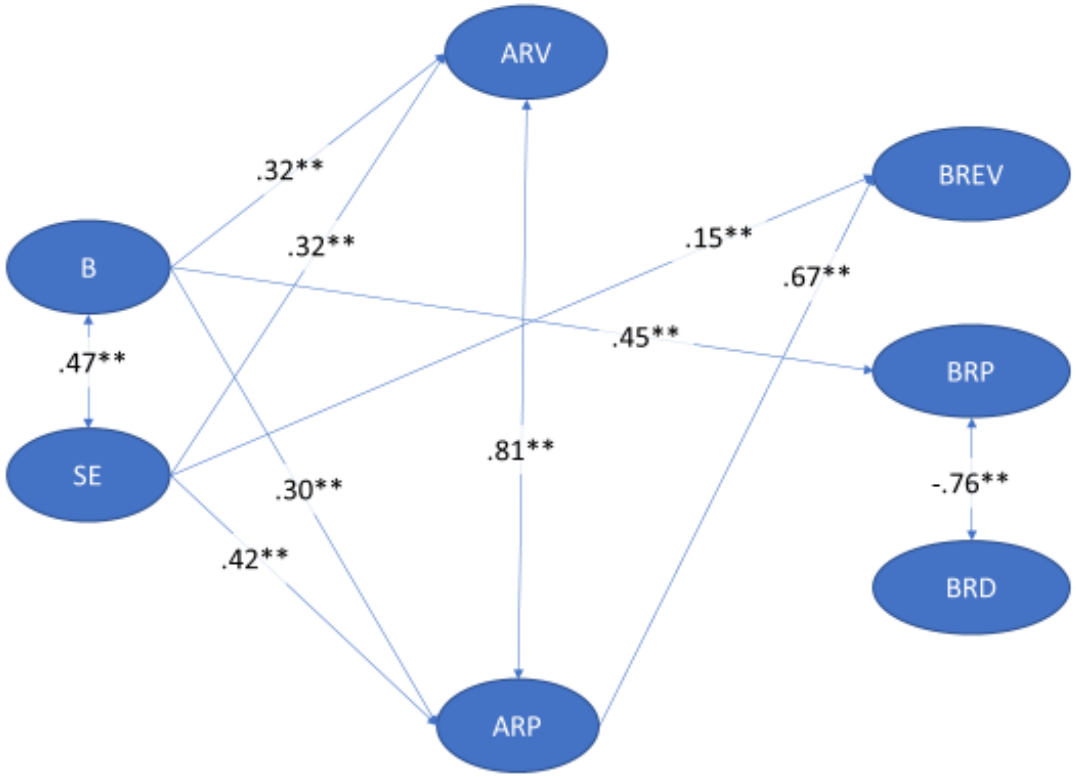

Figure 2. Structural model for indirect effect for all students with standardized parameter estimates. B – belongingness, SE – self-efficacy for learning, ARV – affective response value, ARP – affective response positivity, BREV – behavioral response evaluation, BRP – behavioral response participation, BRD – behavioral response distraction. Non-significant parameter estimates, manifest variables, and factor loadings omitted for clarity.

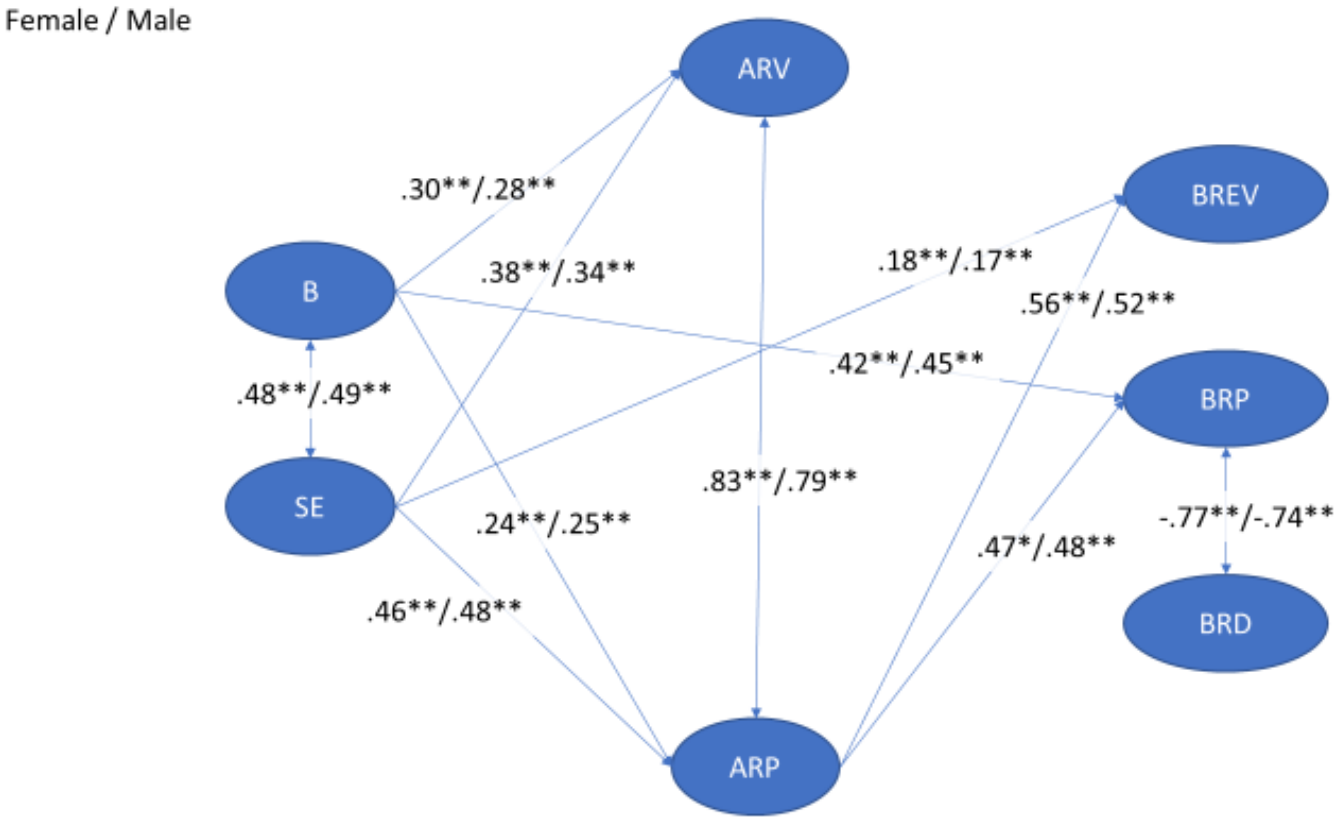

Figure 3. Structural model results for best fitting indirect effect analysis moderated by gender identity with standardized parameter estimates. B – belongingness, SE – self-efficacy for learning, ARV – affective response value, ARP – affective response positivity, BREV – behavioral response evaluation, BRP – behavioral response participation, BRD – behavioral response distraction. Non-significant parameter estimates, manifest variables, and factor loadings omitted for clarity. Variation in standardized parameter estimates constrained to be invariant across groups due to group differences in parameter variance.