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STUDENT ENGAGEMENT AND MATH TEACHERS SUPPORT

Tahani Salman Alrajeh[1], Beth Winfrey Shindel[2]

[1]Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia
[2]Saint Louis University, Missouri, United States
Email: tsalrajeh@iau.edu.sa

Abstract

This study aimed to investigate the factors that influence student engagement in mathematics classes. It explored the relationship among emotional, organizational, and instructional support and the impacts of characteristics of teacher, such as years of experience, and sexual orientation, on student engagement. Data were taken from the Consortium for Political and Social Research. The study was involved mathematics teachers and encompassed three years of data collection and observation. Data were collected first hand through classroom observations and student–teacher surveys. In this study, ANOVA, t-test, and partial correlation were employed to evaluate the relationships among the study variables based on participants' responses. The relationship between student engagement and instructional support weakened after controlling for emotional and organizational support. However, instructional support continued to significantly influence student engagement. In addition, results showed a significant difference in student engagement attributed to the teacher's gender. Results revealed the interaction between gender and years of experience significantly influenced student engagement, which was in favor of female teachers.

Keywords: Student engagement, Emotional support, Organizational support, Instructional support

Abstrak

Penelitian ini bertujuan untuk menyelidiki faktor-faktor yang mempengaruhi keterlibatan siswa di kelas matematika. Ini mengeksplorasi hubungan antara dukungan emosional, organisasi, dan instruksional dan dampak dari karakteristik guru, seperti pengalaman bertahun-tahun, dan gender, pada keterlibatan siswa. Data diambil dari Konsorsium untuk Penelitian Politik dan Sosial. Penelitian ini melibatkan guru matematika dan mencakup tiga tahun pengumpulan dan observasi data. Data dikumpulkan secara langsung melalui observasi kelas dan survei siswa-guru. Dalam penelitian ini, ANOVA, t-test, dan korelasi parsial digunakan untuk mengevaluasi hubungan antara variabel-variabel penelitian berdasarkan pada tanggapan peserta. Hubungan antara keterlibatan siswa dan dukungan pengajaran melemah setelah mengendalikan dukungan emosional dan organisasi. Namun, dukungan pengajaran terus secara signifikan mempengaruhi keterlibatan siswa. Selain itu, hasil menunjukkan perbedaan yang signifikan dalam keterlibatan siswa yang dikaitkan dengan jenis kelamin guru. Hasil mengungkapkan interaksi antara jenis kelamin dan pengalaman bertahun-tahun secara signifikan mempengaruhi keterlibatan siswa, yang mendukung guru perempuan.

Kata kunci: Keterlibatan siswa, Dukungan emosional, Dukungan organisasi, Dukungan pengajaran

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Student engagement has been studied in various populations and educational settings (Bear, Yang, Chen, He, Xie, & Huang, 2018). While student engagement has been examined across different disciplines, research determines that the relationship among emotional, organizational, and instructional support and student engagement in mathematics classes covers observation and student and teacher perspectives. Such a study involving a large sample has been a gap in the literature for a long time.

Student engagement is defined as the inside and outside classroom practices that lead to measurable results. Trowler (2010) defined student engagement as the willingness and effort of

students to effectively engage in school activities that contribute to successful outcomes. Student engagement is classified into behavioral, cognitive, and emotional engagement. Students' attention, completed work, participation in learning opportunities, and polite behaviors are considered behavioral engagement (Wimpenny & Savin-Baden, 2013). Emotional engagement includes feelings of connection to contents that students find interesting and enjoyable.

Cognitive engagement refers to students' willingness to exert effort to understand the content and focus on tasks (Rimm-Kaufman, Baroody, Larsen, Curby, & Abry, 2015; Makur, Prahmana, & Gunur, 2019). Student engagement is essential in the learning process. Moreover, the academic success of an entire school depends on the level of student engagement (Rimm-Kaufman et al., 2015). Engaged students exhibit active attention, participation, motivation, and interest to study, whereas their disengaged counterparts' manifest boredom, passiveness, poor motivation, and low grades. In addition, students with high engagement levels attend school routinely and attain higher grades than their colleagues with low engagement levels (Bear et al., 2018).

Academic achievement and engagement are not traits and attributes of an individual student; rather, they may depend on the teaching structure (Caranfil & Robu, 2017; Rimm-Kaufman et al., 2015; Makur et al., 2019). Proper student–teacher interactions stimulate learners to participate in class activities as they foster an emotionally favorable and supportive classroom environment (Ruzek, Hafen, Allen, Gregory, Mikami, & Pianta, 2016). Bear et al. (2018) investigated the differences in engagement and school climate in the US and China using confirmatory factor reviews; they reported that schools climate favors Chinese students in contrast to American students who are beyond elementary school. Conversely, American students have a high behavioral and cognitive engagement during elementary education in comparison with their Chinese counterparts (Bear et al., 2018).

Ansonga, Okumub, Bowena, Walkera, and Eisensmitha (2017) and Ruzek et al. (2016) found that students whose teachers provide considerable emotional support depict high levels of social, emotional, and cognitive engagement and vice versa. The purpose of the present study is to investigate the factors that influence student engagement in mathematics classes by exploring the following: (a) the relationship among emotional, organizational, and instructional support and (b) the impacts of characteristics of teacher, such as years of experience, and sexual orientation, on student engagement. To achieve the study objectives, the research questions were developed as follows: What is the relationship among emotional, organizational, and instructional support and student engagement? What is the relationship among years of teacher experience, sexual orientation, and student engagement? And After controlling for the effects of emotional and organizational support, to what extent does a significant relationship exist between instructional support and student engagement?

Ansonga et al. (2017) described emotional engagement as internal feelings that are difficult to measure. Emotional engagement can be observed through students' interactions with their peers and teachers as well as the levels of fear, anxiety, or enthusiasm that they show. In addition, emotional

engagement can be observed further through classmates because students freely express and share their feelings about school to each other. However, behavioral engagement is clearly observable through students' participations and their willingness to ask and answer questions. Questioning the teacher might lead to punishment, which may increase the level of fears and discourage students to participate freely and effectively. Therefore, providing emotional support is an essential element to raise behavioral engagement among students.

A teacher helps students improve academically and emotionally by initiating programs that cultivate how to make good decisions, handle emotions appropriately, curb negative behaviors, understand fellow students, practice empathy, relax, and focus on learning. By contrast, negative feelings, such as anger, anxiety and frustration, hinder learning and worsen school performance. Ruzek et al. (2016) claimed that the teacher is tasked to create a positive and safe environment that meets the unique behavioral and emotional needs of each student. The sense of connectedness and belonging to a school develops emotional engagement. Caranfil and Robu (2017) argued that a high-quality emotional tone of teachers increases the engagement levels of students, leading to improved academic performance. By contrast, Nor, Ismail, and Yusof (2016) conducted a study to investigate the emotional intelligence levels among secondary students by using an Emotional Intelligence questionnaire for adolescents (IKEM-R/MEQI) and their mathematical competency by using selected questions from PISA 2012. Although a positive relationship exists between positive emotions and high performance, the correlational value between both variables was low. They suggested examining students' EI during engagement in activities rather than doing pre-and post-tests (Nor, Ismail, & Yusof, 2016).

Mata, Monteiro, and Peixoto (2012) investigated how certain distinct but related variables, such as student background, motivation, and social support, affect student attitudes towards mathematics as a subject; results revealed that the majority of students held positive attitudes towards mathematics. No gender effect was identified, though girls showed a continuous decline in attitudes as they progressed further in school; their analyses showed that motivation-related factors are the main indicators of attitudes towards mathematics which teachers and the social support by peers are significant in clarifying these attitudes (Mata et al., 2012). Gunderson, Ramirez, Levine, and Beilock (2012) studied the role of parents and teachers in the development of gender-related mathematics attitudes. They tested the hypothesis that female students tend to have more negative attitude toward mathematics than male students. The study showed that the expectations and opinions of parents and teachers about their children's mathematics competency are often gender-biased and can influence children's mathematics attitudes and performance.

The instructional support developed during student–teacher interaction in a classroom setting determines the engagement level of a learner (Fatou & Kubiszewski, 2018). Rimm-Kaufman et al. (2015) used multilevel models to determine how instructional support affects the engagement of 5th-grade girls and boys learning mathematics (Fatou & Kubiszewski, 2018). High-quality student–

teacher interaction increased behavioral engagement levels during mathematics lessons (Parsons, Nuland, & Parsons, 2014). However, instructional support affects the engagement of girls and boys differently. Rimm-Kaufman et al. (2015) claimed that girls are less socially engaged than boys even when instructional support is high.

Lietaert, Roorda, Laevers, and Verschueren (2014) discussed the role of teacher's instructional support on student engagement based on gender and confirmed that boys showed less engagement in Dutch language classes and reported lower support from their teacher than girls. Amir, Saleha, Jelas, Ahmed, and Hutkemri (2014) explored the levels of student engagement at school based on gender and age, and they found that female students tended to have higher levels of school engagement than male students. Hartono, Umamah, and Sumarno (2019) analyzed student engagement level based on gender and grade scored in history by high school students in Jember; they conducted a two-way MANOVA using the variables behavioral, emotional, and cognitive engagement. Their results showed that student engagement varied significantly with gender and class level, and student engagement was lower for students in upper classes (decreased from grades X, XI, and XII) and higher for female students in all grades (Hartono et al., 2019). Strati, Schmidt, and Maier (2017) indicated that teachers should prepare instructions that suit each gender to increase engagement.

Florack (2012) determined the impact of teachers of different genders instructing students of different genders and confirmed the existence of preferential treatment and biases for genders of the opposite sex of the teacher. Lee, Rhee, and Rudolf (2019) identified the relationship among teacher gender, student gender, and student achievement. They found that female teacher increases the mathematics and reading performance of girls, but teacher gender has no effect on boys (Lee, Rhee, & Rudolf, 2019). Based on findings, Lee, Rhee, and Rudolf (2019) suggested hiring more female teachers to reduce educational gender gaps without hurting boys. Lam et al. (2010) investigated the role of teacher gender in the teaching of reading literacy and found that both girls and boys taught by female teachers significantly outperformed those taught by male teachers. In addition, students taught by female teachers showed more positive attitudes than those taught by male teachers (Lam et al., 2010).

Castro, Granlund, and Almqvist (2017) explored the relationship between student engagement and the quality of classrooms in Swedish preschools. Although engagement is stable, they agree that the levels of classroom organization, teacher support and emotional support increase over time (Parsons, Nuland, & Parsons, 2014). The engagement level of children in preschool predicts their overall development, learning, and entire wellbeing in later school years. The time spent by children on activities and social interactions is crucial for preschool admission (Adolfsson, Sjöman, & Björck-Åkesson, 2018). The years of experience of the teacher plays a role on student engagement levels. Gichuru and Ongus (2016) pointed out that the most important aspect for improving student performance and filling the achievement gaps is the quality of the teacher. They found that experienced teachers affect student performance more than novice teachers (Gichuru & Ongus, 2016).

However, Klassen and Chiu (2010) reported nonlinear correlations with factors of self-efficacy—increasing from early career to mid-career and after that falling a while later.

Blazar (2016) investigated the effects of teachers on students' attitudes, behaviors, and performance in school. He found that upper-elementary teachers significantly influence a range of students' attitudes and mannerisms besides their academic performance and that the estimates on teacher effect have a strong predictive validity (Blazar, 2016). Siddiqi (2018) investigated the mediating role of university students' engagement in their lectures and found that a significant relationship exists between teachers' efforts and the rate of students' academic progress. He advocated for improved instruction-based classroom learning (Siddiqi, 2018). Daher (2020) found the results showed the effectiveness of the instructional support using groups work and technology that led to positive impacts on students' emotions and communication abilities in learning geometry. However, he confirmed the importance of teachers' roles on providing learning environment full of activities and interactions among students, which help in maintaining a positive implication toward mathematics (Daher, 2020). In conjunction, teacher is required to be good observer to provide encouragement needed to all students equally to avoid any potentially negative impact. Teachers significantly affect the level of student engagement and student performance at all stages of learning, more so in tertiary school. Different teachers have various levels of understanding of what engages and interests' students in classroom settings, usually based on experience years and gender (Zepke, Leach, & Butler, 2014; Trowler, 2015).

Subramainan, Mahmoud, Ahmad, and Yusoff (2017) highlighted the reasons for poor students' engagement in classrooms by studying the attributes of environmental factors, such as the number of students, lecture length, type of subject, and the year of study. They also included emotional factors, such as the negative emotional states of student, including anger, anxiety, or boredom, and the emotional states of lecturers (Subramainan et al., 2017). The simulation outcome showed that an experienced lecturer may have ideas on new strategies and can inculcate them during lectures to promote student engagement. Consequently, student success was impacted by internal factors, such as their emotional well-being, and external factors, such as organizational and instructional support in the classroom (Strati, Schmidt, & Maier, 2017).

Previous studies on student engagement as described in the foregoing literature summary focused on general internal and external factors in the school environment that affect performance. Student engagement is a useful indicator of examining the effect of these factors on student success. However, the relationship among these factors with student engagement in mathematics classes is unclear, and the dominant factor remains unidentified. The roles of teacher gender and experience in student engagement levels are also yet to be determined. Mathematics is a core subject in most courses and is therefore a key determinant of the general academic performance in schools. The current study looked into how certain factors particularly influence the performance in schools by measuring the factors that influence the student engagement in mathematics classes. The current study

also identified the factors with the most statistically significant influence on student engagement in the mathematics classes with the conceptual framework in this research shown in Figure 1. Hopefully, the results help mathematics teachers recognize the most effective classroom factor in increasing student engagement.

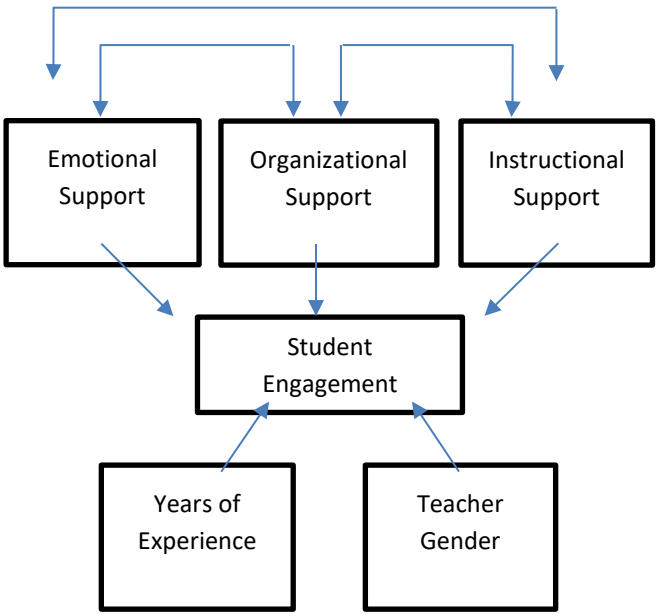

Figure 1. A conceptual framework identifying the concepts used in this research

METHOD

Data were obtained from the Inter-university Consortium for Political and Social Research: National Center for Teacher Effectiveness Main Study. The study is cross-sectional. It was conducted on 6,206 mathematics teachers and encompassed three years of data collection and observations of mathematics instruction in approximately 50 schools and 300 classrooms. Data were collected from classroom observations, student assessments, and teacher surveys. The observations data was coded quantitatively into three categories Low (1,2), Mid (3,4,5), and High (6,7) using a seven-point Likert scale (Kane, Hill, & Staiger, 2016).

Descriptive statistics were utilized to obtain information about mathematics teachers in terms of education level, years of experience, and sexual orientation. Data were coded using a 1–7 scale, with 1 being the lowest and 7 being the highest. The data were analyzed by using Statistical Package for Social Science (SPSS). Frequency comparison, correlation analysis, analysis of variance (ANOVA), and t-test were used to evaluate the relationship between the study variables and identify significant differences within and between groups.

For the first research question, three continuous variables were measured, namely, classroom emotional, organizational, and instructional support. Pearson correlation technique was applied to evaluate the relationships between variables. The second research question was answered by

analyzing three variables, namely, gender (categorical), student engagement (continuous), teacher years of experience (categorical) using descriptive statistics, ANOVA, t-tests, and Pearson's correlation. The third research question was addressed by performing partial correlation analysis on the variables of student engagement and classroom instructional support.

RESULTS AND DISCUSSION

The first research question aimed to explore the relationship among emotional, organizational, and instructional support and student engagement. Therefore, Pearson correlation coefficient was run. In classroom organizational support, r = 0.29, which is the lowest correlation value. In emotional support, r = 0.41, indicating a moderate positive correlation with student engagement. However, r = 0.5 in instructional support, which indicated the relationship between student engagement and instructional support variables were highly positively correlated. The positive relationship between the variables means that student engagement increases with emotional and instructional support. In addition, the p-values for the correlation among emotional, organizational, and instructional support and student engagement is less than the significance level of 0.01, which indicates the correlation among all variables were significant (see Table 1).

Table 1. Correlations between variables

		Student engagement	**Emotional support**	**Classroom organizational support**	**Instructional support**
Student engagement	Pearson Correlation	1	.		
	Sig. (2-tailed)				
	N	6187			
Emotional support	Pearson Correlation	.416**	1		
	Sig. (2-tailed)	.000			
	N	6158	6160		
Classroom organizational support	Pearson Correlation	.291**	.168**	1	
	Sig. (2-tailed)	.000	.000		
	N	6172	6147	6174	
Instructional support	Pearson Correlation	.498**	.696**	.198**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	6137	6112	6126	6139

To answer the second research question, an independent-samples t-test was conducted for comparing student engagement levels in terms of teacher's gender. A significant difference was observed in student engagement levels attributed to teacher gender, for males (*M = 5.08, SD = 1.0*) and for females (*M = 5.25, SD = 1.0*; t (5974) = -4.86, p < 0.05, two-tailed). The magnitude of the differences in the means (mean difference = -.16, 95% *CI:* -0.23 to -0.1) was very small (Cohen's d = 0.17) (see Table 2).

Table 2. Results of the independent samples T-test

		Levene's Test for Equality of Variances		**t-test for Equality of Means**			
		F	**Sig.**	**t**	**df**	**Sig. (2-tailed)**	**Mean Difference**
Student engagement	Equal variances assumed	6.166	.013	-4.863	5974	.000	-.165
	Equal variances not assumed			-4.858	1529.412	.000	-.165

To investigate the impact of years of experience on levels of student engagement, a one-way between groups analysis of variance was conducted. Participants were divided into four groups according to their years of experience (Group 1: 1 to 5 yrs; Group 2: 6 to 12 yrs; Group 3: 13 to 20 yrs; Group 4: 21 to 31 yrs). The results in Table 3 ($F(3, 5944) = 3.13$, $p < .05$) indicate that a significant difference exists in student engagement at the .05 level based on teacher experience years for the four groups (see Table 3). Despite reaching statistical significance, the actual difference in mean scores between the groups was insignificant. The effect size, calculated using eta squared, was .00. Post-hoc comparisons using the Tukey HSD test indicated that the mean scores for all groups were not significantly different.

Table 3. Analysis of variance for years of experience variable

Student engagement					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	9.378	3	3.126	3.130	.025
Within Groups	5935.763	5944	.999		
Total	5945.141	5947			

To explore the impact of gender and years of experience on the levels of student engagement, a two-way between-groups analysis of variance was conducted. Participants were divided into four groups according to their years of experience (Group 1: 1 to 5 yrs; Group 2: 6 to 12 yrs; Group 3: 13 to 20 yrs; Group 4: 21 to 31 yrs). The interaction effect between gender and years of experience was

significant, *F (3, 5856) = 12.02, p < .05.* A significant effect was observed for gender *F (1, 5856) = 42.91, p < .05* and years of experience *F (3, 5856) = 2.92, p < .05*. However, the effect size was small (partial eta squared = .01). Post-hoc comparison using the Tukey HSD test indicated that the mean score for the 6–12 years of experience group (M = 5.17, SD = 1) was significantly different from the 13–20 years of experience group (M = 5.27, SD = 1). The 1–5 and 21–31 years of experience groups did not differ significantly from either of the other groups.

The main effect for gender, *F (1, 5856) = 42.91, p < .05,* indicated significant difference between males and females (see Figure 2). The effect of the interaction between teacher's gender and years of experience on student engagement, F (3, 5856) = 12.02, p < .05, was statistically significant.

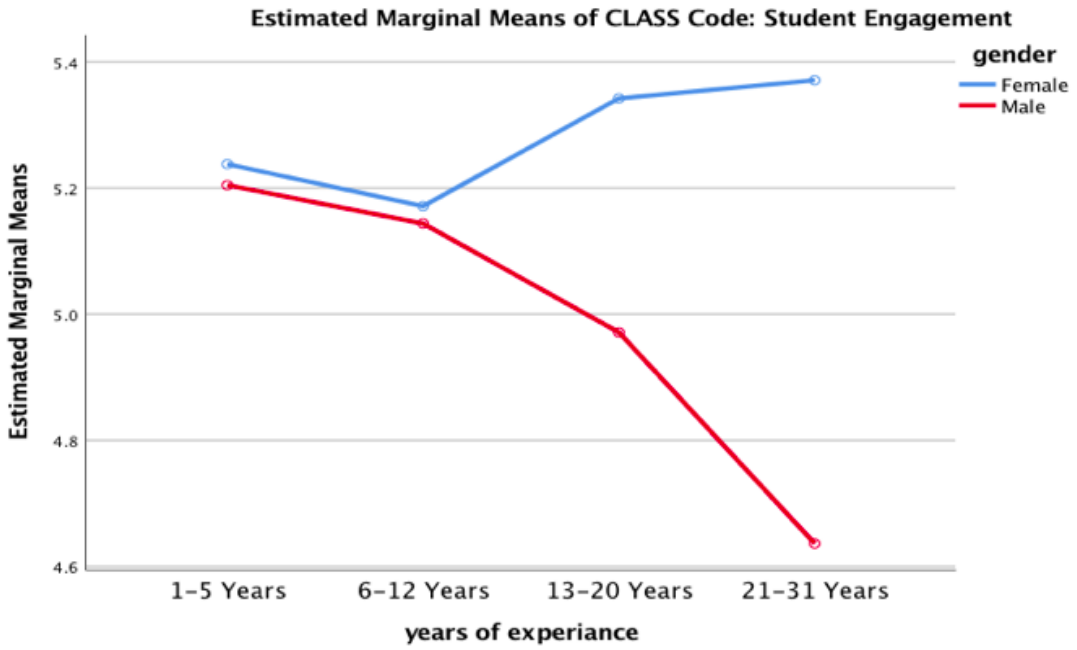

Figure 2. The interaction between years of experience and gender on student engagement

To answer the third research question, Partial correlation was used to explore the relationship between instructional support and student engagement, holding constant for emotional and organizational support. If emotional and organizational support are the principle determinant of student engagement, the partial correlation between instructional support and student engagement should not be significant. The results suggest that student engagement levels are related to instructional support, r = .3, p < .05, when controlling for emotional and organizational support. An inspection of the zero-order correlation (r = 0.5) suggested that controlling for emotional and organizational support significantly affected the strength of the relationship between these two variables. However, the relationship between instructional support and student engagement remained significant (see Table 4).

Table 4. Partial correlation for student engagement and instructional support

Control Variables			Student Engagement	Instructional support	Emotional support	Classroom organization
-none-[a]	Student Engagement	Correlation	1			
		Significance (2-tailed)	.			
		df	0			
	Instructional support	Correlation	.498	1		
		Significance (2-tailed)	.000	.		
		df	6135	0		
	Emotional support	Correlation	.416	.696	1	
		Significance (2-tailed)	.000	.000	.	
		df	6156	6110	0	
	Classroom organization	Correlation	.291	.198	.168	1
		Significance (2-tailed)	.000	.000	.000	.
		df	6170	6124	6145	0
Emotional support & Classroom organization	Student engagement	Correlation	1.000	.302		
		Significance (2-tailed)	.	.000		
		df	0	6108		
	Instructional support	Correlation	.302	1.000		
		Significance (2-tailed)	.000	.		
		df	6108	0		

This study aimed to investigate student engagement in mathematics classes by exploring the relationships between emotional, organizational, and instructional support; and teacher characteristics (years of experience, and sexual orientation). Several researchers found that students whose teachers provide considerable emotional support depict high levels of social, emotional, and cognitive engagement and vice versa (Bear et al., 2018; Ansonga et al., 2017; Ruzek et al., 2016; Muhtadi et al., 2018). In the present study, instructional support had the highest effect on student engagement

followed by emotional support. This finding can be consistent with Daher (2020), in which the effective instructional support led to positive impacts on students' emotions.

However, the relationship between student engagement and instructional support weakened over time after controlling for emotional and organizational support. This result supported the mentioned studies in terms of the interactions between types of support on student engagement. Yet, in the present study, instructional support remained significant even after controlling for emotional and organizational support. In addition, student engagement varied significantly with the teacher's gender. This result was consistent with those of Amir et al. (2014) and Lietaert et al. (2014) who reported significant differences in student engagement levels in favor of females. Additionally, the present study showed that the interaction effect between gender and years of experience significantly affected student engagement in favor of females.

A significant impact of the years of experience on student engagement by gender was noted from the 10th year. The influence increased for females but dropped among males (see Figure 1). A similar result for the years of experience variable was presented by Klassen and Chiu (2010) who reported nonlinear correlations with factors of self-efficacy—increasing from early career to mid-career and after that falling a while later. These similar results in terms of gender for teachers and students were attributed to the teacher tendency to interact, support, and understand the needs of the same gender more than the opposite gender. Female teachers showed their constant capabilities in making students highly engaged over the time more than male teachers. Thus, teacher engagement impacts student academic engagement.

Generally, the results were consistent with those of the majority of previous studies on the subject of student engagement. For example, Downer, Stuhlman, Schweig, Martínez, and Ruzek (2015) argued that most teacher–student interactions fall into three domains, namely emotional support, classroom organization, and instructional support. The current study also found these three factors significantly influence student engagement and academic performance in mathematics.

CONCLUSION

The results of this study demonstrate that instructional support was the most dominant factor determining student engagement. This association was apparent after controlling for the influence of emotional and organizational support on student engagement. Student engagement was remarkably impacted after approximately 10 years in teaching practice by the interaction of teacher's gender and years of experience in favor of females. This finding opens eyes to the need for investigating teacher engagement levels and the importance of measuring teachers' commitment to their careers. This finding could explain why students' EL was not highly correlated with their mathematical competency, as concluded in a previous research.

Establishing training programs for teachers to increase their awareness of understanding the differences to the needs of both genders and emphasizing differentiated strategies to meet their needs.

Future research should also seek to determine which types of instructional support increase student engagement. Such research will serve education practitioners in the process of reconfiguring strategies and intervention measures in the school population to increase and maintain motivation for learning among students.

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