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Early Childhood Preservice Teachers' Mathematics Teaching Efficacy: Effects of Passion and Teacher Efficacy

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Abstract

This study examined mathematics teaching efficacy and its association with preservice teachers' passion for teacher preparation and their overall teacher efficacy. In order to understand the impacts of preservice teachers' passion for teaching and teaching efficacy on their subject-specific teaching efficacy, mathematics teaching efficacy, this study analyzed the data collected from 193 early childhood preservice teachers at a university in the Midwestern United States. Pearson's correlation and hierarchical regression analyses were performed using SPSS 25. The results revealed that the preservice teachers were highly efficacious about their mathematics teaching, showing a positive relationship to harmonious passion and personal teacher efficacy. Harmonious passion for teacher preparation was the most significant predictors of their personal mathematics teaching efficacy. The results implied that harmonious passion had a significant influence on early childhood preservice teachers' mathematics teaching efficacy, with low and high teacher efficacy leading to a higher mathematics teaching efficacy. This study discusses implications to enhance preservice teachers' mathematic teaching efficacy.

***Keywords*:** mathematics teaching efficacy, passion, preservice teachers, efficacy

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Introduction

The National Center for Education Statistics (NCES) reported that between 2009 and 2012 teenagers in the US dropped from 25th to 31st in mathematics in a 65 country comparison completed by the Program for International Student Assessment (PISA) (Snyder & Dillow, 2013). This result alerts the early childhood educators and teacher education programs in the US to be more effective in planning effective mathematics education in the early years for better learning and teaching of mathematics in the school years as early mathematical experiences provide academic building blocks (Aunio & Niemivirta, 2010; Duncan et al., 2007; Duncan & Magnuson, 2011). In fact, a considerable body of research in teachers' efficacy has speculated the critical role of early childhood teachers' mathematics teaching efficacy in students' attitude towards mathematics and their mathematical knowledge and skill construction (e.g., Bandura, 1977; Pajares, 1992; Palenzuela, 1987; Rotter, Chance, & Phares, 1972).

In addition to the theoretical underpinning of the influence of teachers' mathematics teaching efficacy on a child's experience of mathematics learning, the recent emphasis on the importance of STEM courses, in an attempt to better prepare the future workforce in the US, has highlighted the need for efficacious teaching mathematics, especially in the early years, which knowledge forms the basis for all later mathematics learning. Standards-based teaching and learning have also contributed to making preschool and kindergarten curricula more academic, focusing on content areas of mathematics and science (i.e., Common Core State Standards Initiatives [CCSSI], 2011; McClure et al., 2017; National Council of Teachers of Mathematics [NCTM], 2000). Due to the increasing emphasis on academics in the early childhood education curricula especially for PreK-3, how to effectively apply the best theories for subject matter knowledge, especially in mathematics education, into practices, became an additional challenge for teachers in the field of early childhood education, where play-based practices, cognitively guided instruction, and informal mathematics learning approaches are considered as best practices (e.g., Berkowitz et al., 2016; National Association of Education for Young Children [NAEYC]/NCTM, 2010; Siegler & Ramani, 2009).

It has been well documented that teachers' efficacy beliefs have a strong relationship to

their attitudes and behaviors in the classroom (Bandura, 1982; Fives, Hamman, & Olivarez, 2007; Tschannen-Moran & Hoy, 2001; Woolfolk & Hoy, 1990). Therefore, understanding preservice teachers' psychological factors such as teaching efficacy and confidence in specific subject matter knowledge may be a significant way to enhance teacher education programs for effective teacher preparation for teaching subject areas. A study showed that subject-specific teachers' beliefs and efficacy influence their attitudes, perspectives, and efficacy beliefs related to subject-specific teaching beliefs and ultimately relate to their instructional practices and student learning (Brown, 2005).

In addition to the effects of efficacy on a wide range of adaptive outcomes, the positive effects of passion on teachers' teaching skills have been reported (Kim, 2013, 2017; Smoot, 2015). Although these limited studies cannot generalize the role of teachers' passion and its impact on their teaching efficacy, the existing literature supports that passionate teachers well manage to achieve a state of harmony between teaching and other activities producing adaptive outcomes in their teaching and personal lives (Dlugos & Friedlander, 2001).

In the literature, despite the inconclusive effects of passion on teacher efficacy and on other teaching-related adaptive psychological outcomes, harmonious passion aligns with general adaptive outcomes (Day, 2004; Patrick, Hisley, Kempler, & College, 2000) while obsessive passion aligns with negative outcomes (Carbonneau, Vallerand, Fernet, & Guay, 2008; Coulehan, 2002; Dlugos & Friedlander, 2001). However, with regard to mathematics teaching efficacy, the association of preservice teachers' passion for teacher preparation and its interactional effects with self-efficacy on mathematics teaching efficacy remains ambiguous. Thus, this study examined how early childhood preservice teachers' passion for teacher preparation and their overall teaching efficacy are associated with their mathematics teaching efficacy, which is one of the hottest subjects in contemporary early childhood teacher education in the US and elsewhere. The specific research questions were as follows:

1. How does preservice teachers' mathematics teaching efficacy relate to their passion for teacher preparation and their overall teaching efficacy?
2. How do preservice teachers' passion for teacher preparation and their overall teaching efficacy predict their mathematics teaching efficacy?

Literature Review

Theoretical background. In order to understand preservice teachers' mathematics teaching efficacy in connection with their overall teaching efficacy and their passion for the teacher preparation program, this study applied Bandura (1977)'s social learning theory. Social behavior research has provided a deep understanding of teachers' abilities in a situation, specifically an understanding of the determining relationship between a teacher's experiences in their preservice program and their behavior in response to that specific situation. As teachers' self-efficacy is dependent on the particular teaching situation (Bandura, 1977), preservice teachers' self-efficacy in mathematics teaching may be dependent on their progress in courses taken and field experience pertaining to the subject, mathematics, in their teacher education program (Brady & Bowd, 2005; Burns, Eichen, & Gasteiger, 2017). According to Bandura's theory of social learning, teachers develop "a generalized expectancy concerning action-outcome contingencies" (Enochs & Riggs, 1990, p. 2) based upon their teaching-related experience. In turn, it is conceivable that early childhood preservice teachers develop their mathematical skills and knowledge in order to efficaciously teach young children using best practices based upon their experience in teacher education program that ultimately influences their educational perspectives and attitudes.

Mathematics teaching self-efficacy. Teachers' efficacy in teaching has been considered one of the most critical attributes for successful teaching, and consequently, student learning. Grounded in Bandura's social learning theory, a plethora of research studies have reported that teachers' beliefs in their teaching abilities produce desirable outcomes, mastery skills, for their classroom teaching and students learning in general and in subject areas as well (e.g., Bandura, 1997; Riggs & Enochs, 1990; Tschannen-Moran & Hoy, 2001). It has been well documented that teachers' self-efficacy beliefs may determine their abilities in teaching and consequently student performances (e.g., Berman & McLaughlin, 1977; Brophy & Evertson, 1981). Studies in teacher self-efficacy have focused on overall teaching efficacy beliefs, not on subject-specific teaching efficacy beliefs. It has been reported that a majority of studies in teaching efficacy showed that overall teaching efficacy

beliefs may not be associated with subject-specific teaching efficacy (e.g., Enochs, Smith, & Huninker, 2000; Riggs & Enochs, 1990). This is partially because of the influence of teachers' pedagogical efficacy on their perception of their skills and subject-specific teaching abilities in content areas (Hamlin & Wisneski, 2012). Pajares (1992) demonstrated that a global construct of teacher efficacy does not effectively depict a teacher's teaching beliefs and efficacy in subject areas such as mathematics, science, literacy, etc. Teachers' content area teaching efficacy should be associated with teachers' content knowledge and content-specific teaching strategies and skills that may produce optimal student performances in the content areas.

Research on teachers' mathematics teaching self-efficacy has been facilitated by the development of a Mathematics Teaching Efficacy Belief Instrument (MTEBI) comprising two scales representing personal mathematics teaching efficacy and mathematics teaching outcome expectancy (Enochs et al., 2000). The MTEBI was developed from the Science Teaching Efficacy Belief Instrument (STEBI). Personal Mathematics Teaching Efficacy (PMTE) has been defined as a belief in one's ability to teach effectively and Mathematics Teaching Outcomes Expectancy (MTOE) as the belief that effective teaching will positively impact student learning outcomes. Thus, PMTE presents a teacher's sense of mathematics teaching efficacy, while MTOE presents a belief about a person's mathematics performance (student outcomes in mathematics) (Enochs et al., 2000; Enochs & Riggs, 1990).

According to Guvora (2010), teacher self-efficacy goes beyond just having professional knowledge and skills, which means that teachers' mathematics self-efficacy is teachers' confidence in mathematical knowledge and skills, while mathematics teaching self-efficacy is an active term directly related to teaching effectiveness.

Passion and teachers' efficacy. In the literature, passion, confidence, motivation, affect, and other psychological natures of a teacher have been studied based on the self-determinant theory. The role of passion among preservice teachers has not been focused on the understanding of teachers' teaching efficacy, especially for content specific areas like mathematics and science in early childhood education. Research studies on the role of passion and its impact on desirable outcomes have implied that a person's abilities and

performances in other professions are influenced by their passion in their profession (Carbonneau et al., 2008; Rousseau, Vallerand, Ratelle, Mageau, & Provencher, 2002; Vallerand et al., 2003). However, compared to studies on the impacts of psychological factors on teaching efficacy, the impacts of passion on teaching efficacy have not been actively studied. Of the scarcity, recent studies from preservice teachers have reported that passionate preservice teachers show higher levels of teaching efficacy beliefs and positive perspectives on teacher preparation than their counterparts (Kim, 2013, 2017).

In sum, a considerable body of research has focused on preservice teachers' sense of efficacy and its association with both contextual and psychological factors, especially with teachers' beliefs and best teaching practices (Alger, 2009; Barcelos, 2003; Brown, 2005; Day, 2004; Lim & Chan, 2007; Patrick et al., 2000; Thomas & Pedersen, 2003). However, there is limited research focused on early childhood teachers' beliefs about mathematics and its association with teaching efficacy in association with their passion for teacher preparation in the field. Therefore, the relationship between preservice teachers' mathematics teaching efficacy beliefs and general teaching efficacy and joint effects of their teaching efficacy and passion for teacher preparation on mathematics teaching efficacy remains uncertain, awaiting more empirical evidence to support the positive effects of harmonious passion and teaching efficacy on mathematics teaching efficacy and outcome expectancy.

Method

Sample

Participants in this research study were 193 preservice teachers in an early childhood education program at a state university in the US Midwest. We included preservice teachers in the junior and senior levels as they were all fully admitted to the professional education program and considered official teacher candidates according to the designated program. The average age of the participants was 21.6 years (*SD* = 1.40, range = 20 - 31 years); 93.8% were Caucasian White; 80.5% were single.

Instruments

Mathematics teaching efficacy beliefs (dependent variables). We used Enochs et al. (2000)'s Mathematics Teaching Efficacy Beliefs Instrument (MTEBI), which was developed from the preservice Science Teaching Efficacy Beliefs Instrument (STEBI) to gauge preservice teachers' sense of mathematics teaching efficacy beliefs. This instrument included two sub-constructs, Personal Mathematics Teaching Efficacy (PMTE) and Mathematics Teaching Outcome Expectation (MTOE), with 13 items and 8 items, respectively. A sample item for PMTE is, "I know how to teach mathematics concepts effectively." A sample item for MTOE is, "When a student does better than usual in mathematics, it is often because the teacher exerted a little extra effort." The MTOE is related to causal attributions on students' mathematics learning outcomes. For the final analysis on the variabilities in preservice teachers' mathematics teaching efficacy, therefore, we considered PMTE for the preservice teachers' mathematics teaching efficacy. The Cronbach's alpha values for these two subscales were .91 and .76, respectively. Our sample showed good internal reliability in both sub-constructs (see Table 1).

Preservice teachers' passion. We used the Passion Scale (Vallerand et al., 2003) which contains two sections: harmonious and obsessive passion, with six-items each. To fit the sample, we used the modified scale for preservice teachers used in Kim (2013)'s study. We made modifications in some words to make items more meaningfully reflective of preservice teachers' preparation process. A sample item for harmonious passion is, "My status and work as a teacher candidate allows me to live a variety of experiences." A sample item for obsessive passion is, "I have the impression that being a teacher candidate controls me." The Cronbach's alpha values for these two subscales were .90 and .66, respectively. Our sample showed a better internal reliability in harmonious passion and a lower one in obsessive passion than Vallerand et al. (2003)'s study, with .87 and .67, respectively.

Table 1. *Range, Minimum, Maximum, Mean, and Standard Deviation Mathematics Teaching Efficacy (N = 193)*

	Items	*M*	*SD*
Personal Mathematics Teaching Efficacy (13 Items) (a = .91)	I will continually find better ways to teach mathematics.	5.93	1.00
	Even if I try very hard, I will not teach mathematics as well as I will do most subjects.*	5.43	1.45
	I know how to teach mathematics concepts effectively.	5.10	1.12
	I will not be very effective in monitoring mathematics activities.*	5.39	1.66
	I will generally teach mathematics ineffectively.*	5.98	1.37
	I understand mathematics concepts well enough to be effective in teaching elementary mathematics	5.40	1.29
	I will find it difficult to use manipulative to explain to students why mathematics works.*	5.73	1.19
	I will typically be able to answer students' mathematics questions	5.90	1.12
	I wonder whether I will have the necessary skills to teach mathematics.*	5.00	1.69
	Given a choice, I will not invite the principal to evaluate my mathematics teaching.*	5.58	1.42
	When a student has difficulty understanding a mathematics concept, I will usually be at a loss as to how to help the student understand it better.*	5.68	1.48
	When teaching mathematics, I will usually welcome student questions.	6.14	1.18
	I do not know what to do to turn students on to mathematics.*	5.70	1.28
Mathematics Teaching Outcome Expectancy (8 Items) (a = .76)	When a student does better than usual in mathematics, it is often because the teacher exerted a little extra effort.	3.99	1.40
	When the mathematics grades of students improve, it is often due to their teacher having found a more effective teaching approach.	5.21	1.12
	If students are underachieving in mathematics, it is most likely due to ineffective mathematics teaching.	3.93	1.40
	The inadequacy of a student's mathematics background can be overcome by good teaching.	5.36	1.03
	When a low-achieving child progresses in mathematics, it is usually due to extra attention given by the teacher.	4.98	.97
	The teacher is generally responsible for the achievement of students in mathematics.	4.67	1.16
	Students' achievement in mathematics is directly related to their teacher's effectiveness in mathematics teaching.	4.67	1.05
	If parents comment that their child is showing more interesting in mathematics at school, it is probably due to the performance of the child's teacher.	4.64	1.17

* = reversely coded

Teacher efficacy. To gauge preservice teachers' overall teacher efficacy, preservice teachers' efficacy was assessed by Hoy and Woolfolk (1993)'s Teacher Efficacy Scale Short Form. This measure contains 2 constructs: Personal Teaching Efficacy (PTE) and General Teacher Efficacy (GTE). The PTE can be defined as a teacher's belief in their professional knowledge, teaching-related skills, and general abilities to be an effective teacher. The GTE can be defined as a teacher's belief in the notion that student learning is associated with effective teaching in general (not their teaching), and consequently, student performances are reflections of effective teaching or other external factors such as family involvement and other parent factors. In turn, the GTE reflects preservice teachers' beliefs in causal attributions on student outcomes not their belief in their abilities to teach.

Each construct consists of 5 items that assess the degree to which preservice teachers feel efficacious about their teaching capabilities. A sample item for PTE is, "If one of my students couldn't do a class assignment, I would be able to accurately assess whether the assignment was at the correct level of difficulty." A sample item for GTE is, "The amount a student can learn is primarily related to family background." Preservice teachers' sense of efficacy was scored by a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The Cronbach's alpha values for PTE and GTE were .75 and .55, respectively. The Cronbach's alpha for GTE seems to be low, but it does not mean that there is no acceptable internal consistency among the items in the construct (Tavakol & Dennick, 2011). The items in GTE include teachers' perception about students learning but caused by different causal attributes including teacher's influence and other external factors like parental influences, etc. We used PTE as overall teacher efficacy among preservice teachers as the PTE question items present preservice teachers' sense of teaching efficacy while GTE items present their perspectives on student learning outcomes.

Data analysis. Descriptive statistics, Pearson's correlation, and hierarchical multiple regression analysis were performed to answer the research questions. For the hierarchical multiple regression analyses, we checked for violation of multicollinearity by examining tolerance and the Variance Inflation Factor (VIF) using two collinearity diagnostic factors, an individual R-square value and a VIF.

Results

Descriptive Analysis

On a 7-point scale, our sample of early childhood preservice teachers showed high levels of mathematics teaching efficacy (M = 5.61, SD = .85) and mathematics teaching outcome expectancy (M = 4.68, SD = .70). The preservice teachers showed high levels of harmonious passion (M = 5.45, SD = 1.09) while showing relatively lower levels of obsessive passion (M = 3.43, SD = .99). On a 7-point scale, the preservice teachers showed high levels of personal teacher efficacy (M = 5.45, SD = .67) while showing relatively lower levels of general teacher efficacy (M = 3.38, SD = 1.10).

Correlation among Mathematics Teaching Efficacy, Preservice Teacher Efficacy, and Passion

The results of Pearson's correlation showed that personal mathematics teaching efficacy was positively related with harmonious passion (r = .41, p < .01) and personal teacher efficacy (PTE: r = .34, p < .01) while it was negatively related with general teacher efficacy (GTE: r = -.14 p < .05). In other words, the more efficacious in the personal mathematics teaching, the more harmonious passion they had in teacher preparation work and the more personally efficacious they were in mathematics teaching related activities (see Table 2).

Table 2. *Correlations among Key Variables (N = 193)*

Variables	1	2	3	4	5	6
1. Harmonious Passion	1	.39**	-.02	.04	.41**	.09
2. Obsessive Passion		1	.03	-.17*	-.12	.14
3. General Teacher Efficacy			1	-.17*	-.14*	-.12
4. Personal Teacher Efficacy				1	.34**	.19**
5. Mathematics Teaching Efficacy					1	.22**
6. Mathematics Teaching Outcome Expectancy						1
M	5.45	3.43	3.38	5.45	5.61	4.68
SD	1.09	.99	1.10	.67	.85	.70

*p < .05, **p < .01 (2-tailed)

The Impact of Passion and Overall Teacher Efficacy on Mathematics Teaching Efficacy

To see the changes in predictability in both personal mathematics teaching efficacy and mathematics teaching outcome expectancy, we performed hierarchical linear regression analyses by entering teacher efficacy at the first step, followed by passion for teacher preparation at the second step. At the last step, we considered the interactional effect between harmonious passion and teacher efficacy by entering an interaction term to understand early childhood preservice teachers' mathematics teaching efficacy.

The result of hierarchical regression analyses on personal mathematics efficacy showed that the 3-level model was statistically significant across all steps ($F = 13.405$, $p < .001$; $F = 23.590$, $p < .001$; $F = 20.050$, $p < .001$). When we entered personal teacher efficacy ($\beta = .42$, $t = 3.26$, $p < .001$) and general teacher efficacy ($\beta = -.07$, $t = -1.27$, $p < .01$) at the first step, the model showed an R^2 of .124. About 12.4% of the preservice teachers' mathematics teaching efficacy was explained by Personal Teacher Efficacy (PTE) and General Teacher Efficacy (GTE). The entry of harmonious passion ($\beta = .39$, $t = 7.63$, $p < .001$) and obsessive passion ($\beta = -.23$, $t = -4.09$, $p < .001$) at the second step resulted in an increase in R^2 by .211, showing an overall R^2 of .334. By adding passion factors, positive effect of harmonious passion was increased while showing a minor increase in the negative effect of general teacher effects on mathematics teaching efficacy. At the last step, the interaction term between harmonious passion and personal teacher efficacy added 1.5% more predictability on early childhood preservice teachers' mathematics teaching efficacy. The effect of the interaction term between harmonious passion and personal teacher efficacy was detected at $p < 0.5$ level. In turn, about 34.9 % of the variability of the preservice teachers' mathematics teaching efficacy can be explained by all predictors. Among the predictors, harmonious passion ($\beta = .40$, $t = 7.81$, $p < .001$) for teacher preparation was the most significant predictor of early childhood preservice teachers' mathematics teaching efficacy (see Table 3).

Table 3. *Predictability of Passion and Teaching Efficacy on Mathematics Teaching Efficacy*

Step	Predictors	β	*t*	*Tol.*	*VIF*	*F*	$R^2(\Delta)$
1						13.405***	.124
	Personal teacher efficacy	.42	3.26***	.971	1.03		
	General teacher efficacy	-.07	-1.27**	.971	1.03		
2						23.590***	.334 (.211)
	Personal teacher efficacy	.33	4.22***	.932	1.07		
	General teacher efficacy	-.06	-1.30	.971	1.03		
	Harmonious passion	.39	7.63***	.834	1.19		
	Obsessive passion	-.23	-4.09***	.812	1.23		
3						20.050***	.349 (.015)
	Personal teacher efficacy	.32	4.14***	.929	1.08		
	General teacher efficacy	-.07	-1.58	.953	1.05		
	Harmonious passion	.40	7.81***	.831	1.20		
	Obsessive passion	-.25	-4.36*	.799	1.25		
	Personal teacher efficacy × harmonious passion	-.11	-2.06*	.965	1.03		

Note. *Tol* = tolerance; $R^2(\Delta)$ = changes in R^2; *VIF* = variance inflation factor.
***$p < .001$, **$p < .01$, *$p < .05$.

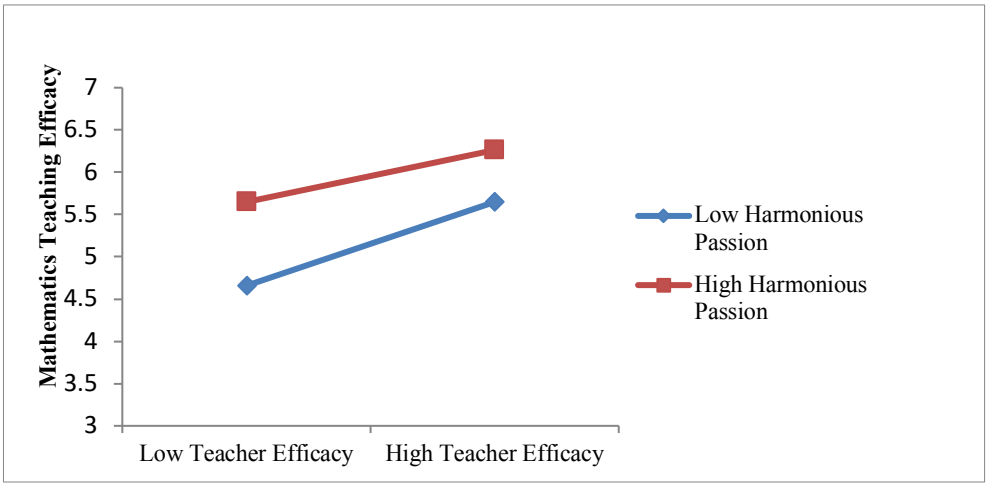

Figure 1. Interaction Effects between Harmonious Passion and Teacher Efficacy on Early Childhood Preservice Teachers' Mathematics Teaching Efficacy

To better understand the nature of the two-way interaction between harmonious passion and personal teacher efficacy, simple slope tests were conducted and we graphed regression lines at a low (1 *SD* above the mean) and a high (1 *SD* below the mean) level of teaching efficacy (see Figure 1), following the guidelines proposed by Aiken and West (1991). The result implied that harmonious passion had a significant influence on early childhood preservice teachers' mathematics teaching efficacy when preservice teachers had both high and low levels of teacher efficacy, with low and high teacher efficacy leading to a higher mathematics teaching efficacy. The effect of interaction with harmonious passion was better when preservice teachers had a low level of harmonious passion.

Discussion

The purpose of this study was to examine mathematics teaching efficacy beliefs and their association with preservice teachers' passion for teacher preparation and overall teacher efficacy among early childhood preservice teachers. Using SPSS 25, this study analyzed 193 early childhood preservice teachers from a university in the Midwestern United States. Controlling for the influence of overall teacher efficacy beliefs, the results indicated that harmonious passion for teacher preparation was the most significant predictor of personal mathematics teaching efficacy, implying that harmonious passion had a significant moderating influence on early childhood preservice teachers' mathematics teaching efficacy, with both low and high teacher efficacy leading to a higher mathematics teaching efficacy.

This study made several findings. First, the results revealed that the preservice teachers were highly efficacious about their mathematics teaching in general. This result seems to be very optimistic as the preservice teachers in this study were juniors and seniors in the teacher education program who will be teachers soon. Descriptive statistics also showed that the early childhood preservice teacher participants had a strong sense of confidence in their overall teaching (Personal Teacher Efficacy: PTE) and balanced their teacher preparation work with their college life, showing a high level of harmonious passion.

Second, the Pearson's correlation showed that the early childhood preservice teachers'

mathematics teaching efficacy was positively related with harmonious passion and personal teacher efficacy. This finding is congruent with the outcomes from Kim (2013, 2017)'s studies that reported that passionate preservice teachers showed higher levels of teaching efficacy beliefs and more positive perspectives on teacher preparation than their counterparts. This outcome supports the previous studies in the role of passion and its impacts on positive outcomes in other professions (Carbonneau et al., 2008; Rousseau et al., 2002; Vallerand et al., 2003). Like the previous studies that looked at the role of passion on teacher efficacy, the preservice teachers' harmonious passion was significantly associated with subject-specific teaching efficacy, mathematics' teaching efficacy for this study. As teaching efficacy beliefs may not depict subject specific efficacy (Enochs et al., 2000; Hamlin & Wisneski, 2012; Pajares, 1992; Riggs & Enochs, 1990), this study examined the correlations between General Teaching Efficacy (GTE) and mathematics teaching efficacy. Our preservice teachers showed that their general teaching efficacy, which is situated in the notion that students' performance is the outcome of effective teaching or other external factors, was negatively related to mathematics teaching efficacy while it was positively related to personal teaching efficacy (teaching efficacy). This finding is in line with the extant studies that examined preservice teachers' teaching efficacy with regards to the two sub-constructs of personal teaching efficacy and outcome expectancy (Pajares & Graham, 1999; Zeldin, Britner, & Pajares, 2008; Zuya, Kwalat, & Attah, 2016). Like personal mathematics teaching efficacy, preservice teachers' beliefs in their ability to efficaciously teach mathematics, personal teacher efficacy (PTE), represents preservice teachers' beliefs in their ability to teach in general. Both MTOE and GTE do not reflect preservice teachers' mathematics teaching efficacy and overall teaching efficacy. The low Cronbach's alpha of .55 in GTE implies that mathematics teaching efficacy should not be gauged by preservice teachers' beliefs in causal attributions of student academic outcomes and by students' mathematics outcome expectancy. This is an extension of Gibson and Dembo (1984)'s results in capturing GTE which present teachers' perceptions of their confidence in teaching and teaching related-activities and tasks (Tschannen-Moran & Hoy, 2001). The findings support Enochs et al. (2000)'s initial speculation on personal mathematics teaching efficacy and mathematics teaching outcome expectancy beliefs.

Third, in order to see the impact of overall teaching efficacy and preservice teachers' passion on their mathematic teaching efficacy, we performed hierarchical regression after

checking multicollinearity. The results showed that among all significant predictors, harmonious passion for teacher preparation was the most significant predictor of their personal mathematics teaching efficacy. We also examined these two factors' impacts on their mathematics teaching outcomes expectancy and found that harmonious passion was the most significant factor in explaining the variability in the preservice teachers' mathematics teaching efficacy. The results implied that harmonious passion over overall teaching efficacy seems to be a discernible psychological factor that influences early childhood preservice teachers' mathematics teaching efficacy both when the preservice teachers had high and low levels of overall teacher efficacy, with high and low overall teacher efficacy leading to higher mathematics teaching efficacy. In turn, preservice teachers' attitudes toward and passion for their teacher preparation program helped them have a high level of confidence in teaching mathematics. Our study supports the positive effects of harmonious passion and the negative effects of obsessive passion on an adaptive teacher outcome, mathematics teaching efficacy. These results support the extant literature that teachers with high mathematics teaching efficacy are likely to be innovative, adventurous, and optimistic and less likely to be frustrated and burned out (Brouwers & Tomic, 2003; Zuya et al., 2016). The results showed the joint effectiveness of personal teacher efficacy and harmonious passion on early childhood preservice teachers' mathematics teaching efficacy. These results align with the findings of studies in the role of harmonious passion and its impact on desirable psychological outcomes (Carbonneau et al., 2008; Rousseau et al., 2002; Vallerand et al., 2003).

Conclusion

The present study examined preservice teachers' teaching efficacy beliefs and as a result, recommendations for future studies highlight the importance of mathematics teaching specific preparation for preservice teachers enrolled in teacher preparation programs. There are several issues that should be considered in the future studies pertaining to early childhood preservice teachers' mathematics teaching efficacy. First, in order to better understand how preservice teachers develop their mathematics teaching efficacy, more accurate and comprehensive instruments should be adopted, particularly for early childhood

preservice teachers. Thus, we suggest the additional studies should consider a more comprehensive and reliable teacher efficacy instrument to gauge early childhood preservice teachers' efficacy in addition to Hoy and Woolfolk (1993)'s Teacher Efficacy Scale Short Form. Second, since the age range of early childhood is widely defined from state to state, age-focused examinations in early childhood teachers' efficacy and mathematics teaching efficacy should be done for teacher education programs to implement the research outcomes into the teacher education curriculum and professional development opportunities. These research-outcome based professional development opportunities will provide preservice teachers with chances to enhance specific mathematics skills and knowledge to improve their confidence and mathematics teaching efficacy in teaching different age groups in early childhood. Thus, follow up studies should investigate types of potential effective professional development and how they impact preservice teachers' mathematics teaching efficacy. Lastly, future studies should consider other factors such as the number of mathematics-related courses, the method course instructor's teaching method, years of field experience teaching mathematics, motivation, teaching beliefs, etc., in order to better understand how preservice teachers construct their knowledge and skills in mathematics teaching.

In conclusion, based on the findings, this study suggests that the teacher education programs should facilitate preservice teachers' mathematics efficacy by enhancing harmonious passion among preservice teachers through diverse activities, not only for their teacher preparation, but also for a rich college life. In that way, these preservice teachers could be more motivated to improve their subject knowledge and skills and enhance their subject specific teaching efficacy over the teacher preparation program. Enhancing preservice teachers' confidence in teaching through diverse activities connecting them to the local community also enhances their mathematics teaching efficacy and overall teaching efficacy. This will flourish their college life while they are studying in the teacher education program and ultimately enhance student learning in the future.

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