Teacher Self-Efficacy and Mathematics Achievement of Secondary-Level Students With Disabilities

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Abstract

Students with learning and other education-related disabilities generally demonstrate low mathematics achievement. While this is a complex phenomenon, one related factor may be low teacher self-efficacy for teaching mathematics to these students. The current study was a preliminary investigation ($N = 40$) into (a) differences in self-efficacy between general, special, and dual-licensed educators and (b) correlations between teacher self-efficacy and student achievement. Findings revealed that special educators reported the highest self-efficacy for inclusive practice whereas dual-licensed teachers reported the highest self-efficacy for mathematics instruction. Correlations between teacher self-efficacy and student achievement were weak for general educators and strong for dual-licensed teachers (special educators not included in correlational analysis). Findings indicate the value of studying these constructs on a larger and more nuanced scale. Implications for practice include opportunities to merge knowledge of mathematics pedagogy with instructional practices for students with learning disabilities.

Keywords: Teacher self-efficacy, mathematics achievement, learning disabilities, students with disabilities, inclusion, mathematics instruction

Secondary-level students with learning and other education-related disabilities consistently demonstrate lower achievement and slower growth in mathematics than peers without disabilities (Schulte & Stevens, 2015). A factor potentially related to this low achievement is that many special educators are not confident about supporting students with disabilities in higher-level mathematics, and that general mathematics educators are often not confident about teaching their content area to students with disabilities (Allsopp & Haley, 2015). That is, teachers' self-efficacy (Bandura, 1977) with regard to providing mathematics instruction to secondary-level students with learning and other education-related disabilities tends to be low.

Mathematics Achievement

Mathematics is a particular area of challenge for students with disabilities. According to the 2019 National Assessment of Educational Progress (NAEP), only 7% of 12th-grade students with disabilities in the U.S. were proficient in mathematics compared to 27% of 12th-grade students without disabilities (National Center on Educational Statistics, n.d.). Students with disabilities who struggle with mathematics demonstrate a number of specific challenges (Wei et al., 2012), including poor computation skills and even lower performance with application problems, limited conceptual understanding of mathematics, and inadequate strategies for problem solving. Additionally, their learning is often impacted by challenges with long-term memory, working memory, self-monitoring, and self-regulation.

While the challenges of students with learning disabilities with regard to mathematics are pervasive and well documented, students with other disability

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diagnoses also have an increased risk of mathematics difficulties. Thus, students with autism spectrum disorder (Oswald et al., 2016), intellectual disability (Wei et al., 2012), attention-deficit/hyperactivity disorder (Zental, 2007), deafness/hard-of-hearing (Pagliaro & Kritzer, 2012), visual impairment (Smith, 2017), and emotional-behavioral disorders (Nelson et al., 2004) also often struggle with and need specialized instruction in mathematics. Indeed, low achievement is a complex issue, and teacher-related factors may also impact students' ability to learn mathematics.

Teacher Qualifications

Students with learning and other education-related disabilities may be taught by teachers licensed in an area of general education, those certified in special education, or educators who are dual-licensed in general and special education. General educators are usually expected to demonstrate expertise in grade-level curriculum and pedagogy specific to the subject(s) they teach whereas special educators are expected to demonstrate expertise in effective pedagogy for students with disabilities more broadly (Gilmour, 2020). While most teachers hold either a general or special education teaching license (Gilmour, 2020), an increasing number of educators are dually certified in the two areas (Gomez-Najarro et al., 2023). These teachers may pursue each license sequentially, or they may pursue them simultaneously through a preparation program designed for dual licensure (Gomez-Najarro et al., 2023). Dual licensure is not typically associated with a unique teaching position, rather dual-licensed educators fulfill the roles and responsibilities of either a general or special educator informed by greater breadth of knowledge.

Considerable research has explored the link between teacher qualifications and student outcomes. Specifically, many studies have observed that teacher quality, including education level, certification, and years of experience, has little or no impact on student achievement (Gage et al., 2017; Gilmour & Henry, 2018), while others have reported a notable impact. For example, Feng and Sass (2013) found that students with learning and similar education-related disabilities showed higher achievement in reading and mathematics when taught by teachers certified in special education and higher achievement in mathematics when their teachers had advanced degrees. Additionally, students without disabilities showed slightly higher achievement with general education teachers who had some training in special education. However, students of veteran teachers – with or without advanced degrees – showed similar outcomes, suggesting that experience can substitute for advanced training. Myers et al. (2020) found that at-risk students demonstrated the most substantial gains in mathematics when taught by the most experienced and credentialed teachers in terms of mathematics content and pedagogical knowledge; similarly, Kirksey and Lloydhauser (2022) found significant student gains when students were taught by teachers dually certified in both special and elementary education.

Teacher Self-Efficacy

Bandura (1977) conceptualized self-efficacy as a person's belief that they can successfully influence a desired result. As such, self-efficacy is theorized to relate to effectiveness in that it impacts the amount of effort someone puts forth and how long they persevere when facing a challenge. Furthermore, Bandura suggested a self-efficacy – persistence – feedback loop. That is, as people persist in challenging situations, they receive feedback to improve their performance in the future, which increases self-efficacy, and consequently persistence, until the behavior is performed or the situation is managed successfully.

Ashton (1984) contextualized Bandura's definition of self-efficacy for teachers as a teacher's belief that they are capable of improving student achievement. Special educators tend to report high general self-efficacy for teaching students with disabilities (Desombre et al., 2019; Paneque & Barbetta, 2006). Findings are less consistent for general educators' sense of efficacy for teaching students with disabilities. On one hand, Hauerwas and Mahon (2018) found that general educators had high self-efficacy for working with students with disabilities. Specifically, higher efficacy for providing instruction compared to managing behaviors and collaborating with colleagues and parents. In contrast, the general educators who participated in Desombre et al. (2019) and Schwab's (2019) research reported significantly lower levels of self-efficacy than special educators.

A number of factors can impact teacher self-efficacy for working with students with disabilities. One is related to student characteristics. Teachers tend to perceive lower self-efficacy for working with students who demonstrate behavioral, attention, and learning challenges whereas they perceive higher self-efficacy for working with students with physical disabilities and those who demonstrate prosocial behaviors (Schwab, 2019). Another factor is experience; both years of teaching (Whitley, 2010)

and experience teaching students with disabilities (Yakut, 2021) impact self-efficacy. In both cases, more experience leads to higher self-efficacy. Teacher beliefs about learning challenges can impact their sense of self-efficacy (Woolfson & Brady, 2009). That is, when teachers believe that learning difficulties are caused by factors external to the student or that learning challenges are amenable to change, they report a higher sense of self-efficacy. Finally, training influences teacher self-efficacy. Whether through postsecondary coursework or professional development, educators with training in special education or teaching in inclusive contexts had either higher perceptions of self-efficacy compared to educators who did not have such training or reported an increase in self-efficacy after training (Desombre et al., 2019; Forlin et al., 2014; Hauerwas & Mahon, 2018; Reyes et al., 2017). Similarly, advanced training in mathematics instruction resulted in stronger self-efficacy for teaching math to students with disabilities (van der Sandt, 2018).

Self-efficacy warrants particular consideration as it relates to teachers' behavior in the classroom and student achievement. Evidence suggests that teachers with high teaching self-efficacy invest more effort in their teaching, including spending more time planning and organizing and trying new teaching methods (Tschannen-Moran & Woolkfolk Hoy, 2001). They are more resilient in the face of setbacks, are less critical of student errors, and work more persistently with struggling students. These teachers also express greater enthusiasm for teaching, associated with lower rates of burnout and greater longevity in teaching careers.

The relationship between teacher self-efficacy and student achievement is more challenging to pinpoint in current literature. Bandura (1977) theorized a relationship between self-efficacy and effectiveness, and educational research addressing self-efficacy often maintains this assumption with relatively little research making a connection between teacher self-efficacy and teacher effectiveness in terms of student learning and achievement (Allsopp & Haley, 2015; Sharma & Sokal, 2015). Furthermore, the literature that does investigate this relationship presents inconsistent results. Allinder (1995), Whitley (2010), and Yakut (2021), for example, found significant positive relationships between teacher self-efficacy and achievement of students with disabilities. In the studies conducted by Whitley and Yakut, however, student achievement was teacher-reported rather than based on an objective measure. Similarly, Hines (2008) determined that students whose teachers reported greater self-efficacy had significantly higher scores on their statewide mathematics assessment than those whose teachers reported low self-efficacy. In contrast, Cope (2013) found a significant negative relationship between teacher self-efficacy and students' achievement in algebra when controlling for student characteristics. Additionally, several studies have determined that there is no significant relationship between teachers' sense of self-efficacy and student math achievement (Phillips, 2015; Prewett & Whitney, 2021; Richard, 2013; Tschannen-Moran & Barr, 2004; Yates, 2014).

Context for Present Study and Research Questions

Consideration of dual-licensed teachers presents a notable gap in the self-efficacy literature. Therefore, the present study contributes to the existing literature by examining the differences in self-efficacy of general, special, and dual-licensed teachers (i.e., those with both special and general education certifications) for providing mathematics instruction to students with learning and related disabilities and investigating the relationship between self-efficacy and student achievement in mathematics. It is a preliminary investigation, involving a small sample size, to determine if these relationships are sufficiently significant to warrant research of these constructs on a larger scale. As a preliminary analysis, we are primarily associating licensure types with preservice training such that general educators are expected to have greater training in mathematics content and pedagogy, special educators are expected to have greater training in instruction and accommodation for students with unique learning needs, and dual-licensed teachers are expected to have received training in both (Gilmour, 2020). We acknowledge that licensure is more nuanced than this and that teacher characteristics other than licensure may impact self-efficacy, but it was not within the scope of the study to consider these constructs with that level of complexity.

We addressed these research questions:

1. Among general, special, and dual-licensed educators, what is the difference in:
   (a) self-efficacy for teaching mathematics?
   (b) self-efficacy for inclusive practices?
2. For general and dual-licensed educators, does a relationship exist between:
   (a) teacher self-efficacy in teaching mathematics and student mathematics achievement?
   (b) teacher self-efficacy in inclusive practices and student mathematics achievement?

Method

Research Design

The present study utilized a correlational research design to determine if and to what extent two quantifiable variables (i.e., teacher self-efficacy and student mathematics achievement) were related (Mills & Gay, 2019).

Participants

Participants were recruited using purposive sampling (Mills & Gay, 2019). To that end, the coordinator for secondary mathematics for a suburban school district in the southwestern United States identified individuals who met the following criteria: (a) held the position of "teacher"; (b) worked at the middle or high school level; and (c) had taught mathematics to at least one student who qualified for special education services due to a disability. Ninety-two individuals were found to meet the inclusion criteria. Forty of them completed surveys (response rate: 43.5%). Student achievement data were available for 26 respondents (65%). Table 1 presents the characteristics of the participants who completed surveys and those for whom student achievement scores were available.

Measures

Teacher Surveys

Teacher surveys were constructed and completed electronically using Opinio, an online survey platform; it took participants approximately 20 minutes to complete the instrument. The survey included informed consent, participant demographic information, the Teacher Efficacy for Inclusive Practices scale (TEIP; Sharma et al., 2012), and the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI; Enochs et al., 2000). Because a single, valid instrument does not exist to assess teacher self-efficacy for teaching mathematics to students with disabilities, the study followed the example of Rimpola (2014), utilizing separate self-efficacy instruments to address each aspect of this construct. The TEIP focuses on teaching students with disabilities on the domains of inclusive instruction, collaboration, and managing disruptive behaviors. Sharma and colleagues (2012) established content validity for the TEIP scale through expert review; internal consistency measures (i.e., Cronbach's alpha) were 0.89 for the whole scale and 0.93, 0.85, and 0.85 for the inclusive instruction, collaboration, and behavior management subscales, respectively. The MTEBI taps into teachers' beliefs about their abilities to teach math generally (personal mathematics teaching efficacy subscale) and their beliefs about the association between mathematics instruction and student mathematics achievement (mathematics teaching outcome expectancy subscale). Construct validity for the MTEBI was established through confirmatory factor analysis; internal consistency for the personal mathematics teaching efficacy subscale was 0.88 and 0.77 for the mathematics teaching outcome expectancy subscale (Enochs et al., 2000). The TEIP and MTEBI use similar Likert-type scales ranging from "strongly disagree" to "strongly agree." The survey is provided in the Appendix.

Student Achievement Data

Achievement data were collected as individual student mathematics scores on district common final exams for Fall 2018 and district and state common final exams for Spring 2019. These exams align with Common Core State Standards for Mathematics and provide consistency in assessment above the classroom level (i.e., all 7th-grade students took the same exam regardless of teacher). Achievement scores were reported as the percentage of correct answers and were provided by the district coordinator for each teacher who completed a survey and was employed by the district in the 2018-2019 school year ($N = 26$). This year was selected to avoid interference from COVID-19 pandemic-related factors on student achievement (e.g., alternative methods of instruction, interrupted learning). Achievement scores were provided for 2,851 students, of which 369 received special education services for a disability: 260 for specific learning disability, 47 for other health impairment (predominantly attention-deficit/hyperactivity disorder), 25 for emotional-behavioral disorder, 14 for speech-language impairment, 2 for traumatic brain injury, and 1 for intellectual disability.

Procedures

All procedures were approved by a university ethics review board and the research review committee for the participating school district. Once approvals were received, the district coordinator identified all teachers in the district who met the inclusion criteria. She then forwarded a recruitment email from the researchers to eligible participants, copying the researchers on the email. The recruitment email described the

Table 1
Teacher Characteristics

		Survey Participants (*N* = *40*)	Student Achievement Data (*N* = *26*)
Gender	Female	21	13
	Male	19	13
Age	21-30	8	4
	31-40	12	7
	41-50	11	8
	51-60	6	5
	61-70	2	2
	"I prefer not to say"	1	0
Race	American Indian/Alaskan Native	1	1
	Asian	1	0
	Black/African American	2	2
	Hispanic/Latino	11	5
	White	24	17
	"I prefer not to say"	1	1
License Type	General education	24	19
	Special education	3	2
	Dual-licensed	13	5
Grade Band	Middle school (6-8)	19	11
	High school (9-12)	21	15
Instructional Setting	Solo-taught general education/inclusion	18	14
	Co-taught general education/inclusion	17	10
	Resource room	1	0
	Self-contained classroom	1	1
	Other	3	1
Years of Teaching	Mean	11.08	11.85
	Range	2-34	3-34
Years in Position	Mean	5.55	6.46
	Range	1-21	1-14
Courses Taught	6th-grade math	6	2
	7th-grade math	6	4
	8th-grade math	6	5
	Math intervention	2	1
	Algebra 1	6	4
	Geometry	7	5
	Algebra 2	8	7
	Financial Literacy	1	1
	Trigonometry	1	0
	Pre-calculus	2	2
	Statistics	2	1
	Calculus	2	0

study and participant compensation; it also included the survey link and survey close date, which was one month from when the recruitment email was sent. The researchers used the recipient list from the initial recruitment email to send reminder emails two weeks and then one week before the survey closed.

Interested teachers used the link shared in each of the emails to access the survey at a time and location of their choosing and completed the survey in Opinio. When the survey closed, participating teachers were compensated with electronic gift cards for completing the survey, and the researchers requested student achievement data and applicable disability categories from the district coordinator (who had no access to survey responses) for each participating teacher. The student-level data were shared with the researchers as electronic spreadsheets and were subsequently prepared for analysis by linking demographic information, self-efficacy ratings, and student achievement scores with individualized numerical codes for each teacher-participant and removing identifiable information from the records.

Data Analysis

Descriptive statistics including, frequency, mean, and range, were calculated for participant demographics. The first research question inquired about differences in self-efficacy according to licensure type (i.e., general education, special education, dual licensure). To answer this question, we determined the mean scores on each self-efficacy scale and conducted an analysis of variance (ANOVA) with the 40 survey responses to determine if differences existed between groups and whether those differences were significant. The second research question, regarding the relationship between teacher self-efficacy and student mathematics achievement, was analyzed using Pearson's *r*. Although student achievement data corresponding to 26 participants was received, we included only 22 teacher-student data sets in this analysis. Data sets for two general education teachers were excluded because they had no students with disabilities in the 2018-2019 school year. Additionally, only two special education teachers had student achievement data available, and since a minimum of three data sets is required to determine correlation, those two data sets were also excluded. Therefore, the analysis included only general and dual-licensed educators.

Results

Differences in Self-Efficacy Among General, Special, and Dual-License Educators

In order to answer our first research question, we began by determining the mean rating for each scale (i.e., TEIP; Sharma et al., 2012; MTEBI; Enochs et al., 2000) according to each licensure type (see Table 2). The TEIP uses a scale from 1-6, while the MTEBI uses a scale from 1-5. For both, higher numerical ratings indicate higher self-efficacy. On both scales, general educators reported the lowest mean self-efficacy ratings (4.76 on TEIP and 3.85 on MTEBI). Special educators indicated mean self-efficacy ratings of 5.63 for inclusive practices and 4.07 for mathematics teaching. Dual-licensed teachers had mean ratings of 5.20 and 4.23 on the TEIP and MTEBI, respectively.

Next, we conducted an ANOVA for the three groups – general education teachers, dual-licensed educators, and special educators – across both scales. On the TEIP scale, the one-way ANOVA showed a statistically significant difference between groups on three survey statements: (a) "I can make parents feel comfortable coming to school," $F(2, 37) = 6.58$, $p = 0.0036$; (b) "I am confident in designing learning tasks so that the individual needs of students with disabilities are accommodated," $F(2,37 = 13.07$, $p = 0.0001)$; and (c) "I am confident in informing others who know little about laws and policies relating to the inclusion of students with disabilities," $F(2,37 = 7.65$, $p = 0.0017)$. A Tukey post-hoc test revealed that special educators indicated that their self-efficacy for making parents feel comfortable coming to school was statistically significantly higher than that of the general education teachers (1.08 ± 0.32, $p = 0.006$). However, there were no statistically

Table 2
Mean Ratings on Teacher Self-Efficacy Scales by Licensure Type

TEIP Scale			MTEBI Scale		
General Educators	Special Educators	Dual-License Educators	General Educators	Special Educators	Dual-License Educators
4.76	5.63	5.20	3.86	4.07	4.23

Note. TEIP = Teacher Efficacy for Inclusive Practices scale; MTEBI = Mathematics Teaching Efficacy Beliefs Instrument.

significant differences between special and dual-license educators (0.39 ± 0.33, $p = 0.099$) and general and dual-license educators (0.69 ± 0.34, $p = 0.122$) on this item. For the other two statements, however, the Tukey post-hoc test revealed that both special and dual-license educators indicated that their self-efficacy about designing learning tasks so that the individual needs of students with disabilities are accommodated (1.54 ± 0.46, $p = 0.005$ and 1.16 ± 0.26, $p = 0.000$, respectively) and informing others who know little about laws and policies relating to the inclusion of students with disabilities (1.75 ± 0.61, $p = 0.018$ and 1.08 ± 0.34, $p = 0.008$, respectively) were statistically significantly higher than that of general education teachers. However, there were no statistically significant differences between dual-license and special educators on either of these statements (0.38 ± 0.48, $p = 0.708$ and 0.66 ± 0.63, $p = 0.552$, respectively).

Using a one-way ANOVA on the MTEBI, we found a statically significant difference between groups on three items: (a) "If students are underachieving in mathematics, it is mostly due to ineffective mathematics teaching," $F(2, 37) = 8.76$, $p = 0.008$); (b) "The inadequacy of a student's mathematics background can be overcome by good teaching," $F(2,37 = 6.05$, $p = 0.0053)$; and (c) "When a low-achieving child progresses in mathematics, it is usually due to extra attention given by the teacher," $F(2,37 = 4.12$, $p = 0.0241)$. A Tukey post-hoc test revealed that on the first statement, special educators' self-efficacy ratings were statistically significantly higher than those of general education (2.00 ± 0.48, $p = 0.001$) and dual-license teachers (1.95 ± 0.50, $p = 0.001$). However, there were no statistically significant differences between general educators and dual-license educators (0.05 ± 0.27, $p = 0.981$) on this item. For the second statement, dual-license educators indicated a statistically significantly higher rating than general education teachers (0.66 ± 0.25, $p = 0.031$) and special educators (1.41 ± 0.46, $p = 0.012$). However, there were no statistically significant differences between general and special educators (0.75 ± 0.44, $p = 0.222$) on the same item. For the third statement, dual-license educators' self-efficacy ratings were statistically significantly higher than those of general education teachers (0.64 ± 0.26, $p = 0.045$). However, there were no statistically significant differences on this item between general and special educators (0.87 ± 0.46, $p = 0.153$) and dual-license and special educators (0.23 ± 0.48, $p = 0.882$).

Relationship Between Teacher Self-Efficacy and Student Mathematics Achievement

To answer our second research question, we determined the correlation between self-efficacy ratings on the TEIP and MTEBI and student mathematics achievement scores, presented in Table 3. For general education teachers, we found an insignificant correlation between self-efficacy for inclusive practices and student mathematics achievement, regardless of disability status. We found a similar result for self-efficacy for teaching mathematics and student mathematics achievement.

However, for dual-licensed educators, we found a significant strong positive correlation between self-efficacy for inclusive practices and mathematics achievement for students with disabilities (r (7) = 0.79, $p = 0.05$) and a moderate but insignificant correlation for students without disabilities. Similarly, we found a significant strong positive correlation between self-efficacy for teaching mathematics and mathematics achievement for students with disabilities (r (7) = 0.87, p = 0.02) and a moderate but insignificant correlation for typically developing students.

Discussion

This preliminary study investigated the differences in self-efficacy of general, special, and dual-licensed teachers with regard to providing mathematics instruction to students with learning and other education-related disabilities and the relationship between educators' self-efficacy and student achievement in mathematics. General educators reported the lowest self-efficacy for both inclusive practice and mathematics instruction,

Table 3
Correlation of Teacher Self-Efficacy and Student Achievement

	General Educators		Dual-Licensed Educators	
	TEIP	MTEBI	TEIP	MTEBI
Math Scores: Students with Disabilities	0.0076	0.2969	0.7992*	0.8716*
Math Scores: Students without Disabilities	0.0382	0.1941	0.5745	0.6872

Note. TEIP = Teacher Efficacy for Inclusive Practices scale; MTEBI = Mathematics Teaching Efficacy Beliefs Instrument.
*$p<0.05$.

although their means on the TEIP scale and MTEBI indicated a moderate level of self-efficacy. These findings align with those of Desombre et al. (2019) and Schwab (2019) that general education teachers tend to have lower self-efficacy than special educators with regard to teaching students with disabilities. Dual-licensed teachers reported higher efficacy for inclusive practice, which supports Hauerwas and Mahon's (2018) assertion that training in special education leads to higher self-efficacy. Special education teachers had the highest mean self-efficacy rating for inclusive practice, while teachers with dual licensure demonstrated the highest self-efficacy for providing mathematics instruction. The latter finding supports van der Sandt's (2018) conclusion that advanced content-area training increases self-efficacy. In contrast, the moderate to high self-efficacy ratings of all participants seem to contradict Allsopp and Haley's (2015) finding that general and special educators report low self-efficacy for teaching mathematics to students with learning disabilities.

The survey rating scales indicated a significant difference in self-efficacy by license type. On the TEIP, special educators reported stronger agreement with the statement "I can make parents feel comfortable coming to school" than general educators, but there was not a significant difference between special and dual-licensed educators or between dual-licensed and general educators. One general educator provided a possible explanation, commenting that parent-teacher (i.e., general educator) interactions are often regulated by school administrators, while special educators have designated opportunities to engage with parents (e.g., individualized education program meetings). The TEIP items "I am confident in designing learning tasks so that the individual needs of students with disabilities are accommodated" and "I am confident in informing others who know little about laws and policies relating to the inclusion of students with disabilities" were both rated with higher agreement by special education and dual-licensed teachers than general educators. This is understandable, since these skills and knowledge are addressed through coursework unique to special education licensure programs.

On the MTEBI, special educators more strongly agreed with the item "If students are underachieving in mathematics, it is mostly due to ineffective teaching" than general and dual-licensed educators. "The inadequacy of a student's mathematics background can be overcome by good teaching" received a higher rating by dual-licensed teachers than general and special educators. Finally, the statement "When a low-achieving child progresses in mathematics, it is usually due to extra attention given by the teacher" received stronger agreement from teachers with dual licensure than from general education teachers (the differences between special education teachers and the other groups were not significant). Interestingly, all MTEBI items on which there were significant differences described relationships between low achievement and teaching. This may reflect beliefs held by special educators, including those with dual licensure, that learning differences are attributed to factors external to the student, which supports Woolfson and Brady's (2009) finding that this perspective promotes high self-efficacy.

The relationship between teacher self-efficacy and student achievement for mathematics also varied by licensure type. For general education teachers, the correlation between self-efficacy and achievement for students with and without disabilities was weak and insignificant, indicating that the two constructs have little bearing on one another. This aligns with other studies (Phillips, 2015; Prewett & Whitney, 2021; Richard, 2013; Yates, 2014) that found no significant relationship between teacher self-efficacy and their students' mathematics achievement. Although not explicitly stated, presumably most of the teachers were general educators and the students included those with and without disabilities. The insignificant correlation between general educators' self-efficacy and their students' achievement in mathematics found here contrasts with the positive correlations found by Hines (2008; classroom teachers and all students), Whitley (2010; classroom teachers and students with and without disabilities disaggregated), and Yakut (2021; classroom teachers and students with disabilities). A possible explanation for the difference between the latter two studies is that student achievement was teacher-reported.

In contrast, the present study revealed a strong, positive correlation between self-efficacy and achievement of students with disabilities for dual-licensed teachers. This finding is a similar to that of Allinder (1995), who noted a significant positive correlation between special educators' self-efficacy and the mathematics achievement of students with disabilities, and also supports the finding by Kirksey and Lloydhauser (2022) that students with disabilities taught by dual-licensed teachers demonstrate higher achievement in mathematics. However, our study appears to be the first to explicitly consider the relationship between teaching self-efficacy and mathematics achievement for educators with dual licensure. In this case, both teacher self-efficacy and student mathematics achievement were high, which may be attributed to more comprehensive training for dual-licensed teachers in

content-area pedagogy and instructional practices for students with learning and other education-related disabilities. This assessment also aligns with the finding by Myers et al. (2020) that at-risk students, including those with disabilities, who were taught by the most experienced and credentialed teachers in terms of math content and pedagogical knowledge showed the most substantial academic gains in mathematics. The correlation between dual-licensed teachers' self-efficacy and achievement of students without disabilities was moderate but not statistically significant.

Limitations

The primary purpose of this study was to inform future research. Readers are cautioned against making generalizations beyond this purpose as a number of factors may have impacted the results. The first is small sample size: 40 survey respondents across three licensure types and only 26 respondents with student achievement data. This sample size necessitated investigating licensure and self-efficacy at face value rather than with complexity. Relatedly, only two respondents with student achievement data were special educators, so we were not able to determine the relationship between their self-efficacy and their students' mathematics achievement. Knowledge of this relationship may have influenced the interpretation and implications of our findings. Furthermore, selection bias could be a concern. The low response rate of 43.5% might be the result of conducting the study early during the COVID-19 pandemic or might indicate that the survey was primarily completed by teachers with stronger self-efficacy and/or those who were comfortable with having their student achievement data shared with the researchers. Potentially, self-efficacy ratings may appear higher or correlations between self-efficacy and achievement may seem stronger if the sample consisted largely of these teachers. Additionally, because the study was conducted in a single state in the United States with a unique student population and achievement trends, teacher self-efficacy and the correlation between self-efficacy and mathematics achievement may be influenced by context.

Recommendations for Research

The findings from this preliminary study indicate that licensure type impacts teacher self-efficacy and the relationship between self-efficacy and student mathematics achievement. These preliminary findings support continuation of this line of research on a larger scale. With a larger sample size, researchers are encouraged to consider licensure as a more nuanced construct that includes specificity of preservice training for mathematics and special education, variation in instructional and other responsibilities, primary roles of dual-licensed teachers toward general or special education, and licensure levels. It is also recommended that researchers investigate the role of factors that are not directly associated with licensure such as years of experience, student-to-teacher ratios, student demographics, and access to resources including professional development. Furthermore, a study investigating the factors that teachers believe impact their self-efficacy would be informative.

Implications for Practice

While the primary purpose of this study was to inform future research, some implications for practice may be gleaned from our preliminary findings. Our interpretation of the findings is framed by Bandura's (1977) self-efficacy – persistence – feedback loop. We considered how licensure type and the knowledge associated with it might influence self-efficacy and the relationship between self-efficacy and student achievement as part of the feedback loop. The high self-efficacy for inclusive practice and mathematics instruction reported by dual-licensed participants as well as the strong association between self-efficacy and student mathematics achievement seem to indicate value of knowledge and skills for both mathematics content and pedagogy and working with students with learning and other education-related disabilities. Participation in teacher education programs for dual licensure is one path to comprehensively prepare teachers for the multifaceted nature of their work. Because most teachers are either general educators or special educators by training, activities that focus on merging their knowledge and skills would likely also be beneficial. Specific recommendations include professional development addressing mathematics instruction for students with learning and other education-related disabilities and co-teaching for inclusive classes. Collaborative activities between general and special educators such as co-planning and consultation for mathematics content or instructional strategies for students with disabilities could also be useful. Such activities would allow general and special educators to share their unique knowledge so that it can be integrated or negotiated to meet the unique learning needs of students with learning disability particularly for mathematics.

Conclusion

The current study was a preliminary investigation of teacher self-efficacy with regard to inclusive practice and mathematics instruction and the relationship between teacher self-efficacy and achievement in mathematics of students with and without disabilities. Results demonstrate moderate to high teacher self-efficacy for both constructs, with general education teachers reporting the lowest self-efficacy, special educators having the highest self-efficacy for inclusive practice, and dual-licensed teachers reporting the highest self-efficacy for mathematics instruction. The association between teaching self-efficacy and student mathematics achievement was weak for general educators but moderate to strong for teachers with dual licensure. Our findings support further research on these constructs and preliminarily point to the value of teachers being knowledgeable about mathematics content and pedagogy and instructional practices for students with learning and other education-related disabilities.

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Appendix

Teacher Self-Efficacy Survey

First name: _____

Last name: _____

Gender:

- ☐ Female
- ☐ Male
- ☐ Other: _____
- ☐ I prefer not to say

Age range:

- ☐ 21-30
- ☐ 31-40
- ☐ 41-50
- ☐ 51-60
- ☐ 61-70
- ☐ I prefer not to say

Race/ethnicity:

- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Hispanic or Latino
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ White
- ☐ Other: _____
- ☐ I prefer not to say

How many years have you worked as a teacher? _____

How many years have you worked in your current position?

_____

What math course(s) do you currently teach?
(e.g., 6th grade math, Algebra I, math support, consumer/community-based math)

_____

_____

I am licensed to teach…

- ☐ general education
  Please specify areas of licensure:

  _____
- ☐ special education
- ☐ both
- ☐ neither

My current students are (check all that apply)…

- ☐ 6th graders
- ☐ 7th graders
- ☐ 8th graders
- ☐ 9th graders
- ☐ 10th graders
- ☐ 11th graders
- ☐ 12th graders
- ☐ non-graded students

I primarily teach in a…

- ☐ solo-taught general education/inclusive classroom
- ☐ co-taught general education/inclusive classroom
- ☐ resource classroom
- ☐ self-contained classroom
- ☐ other: _____

In a typical school year, approximately ___% of my students have an IEP for a disability.

- ☐ 0%
- ☐ 25%
- ☐ 50%
- ☐ 75%
- ☐ 100%

I have taught students with the following disabilities (check all that apply)…

- ☐ Attention-deficit/hyperactivity disorder (ADHD)
- ☐ Autism spectrum disorder
- ☐ Blindness or visual impairment
- ☐ Deafness or reduced hearing
- ☐ Emotional-behavioral disorder
- ☐ Intellectual disability
- ☐ Learning disability
- ☐ Physical disability
- ☐ Speech or language impairment
- ☐ Other: _____

Please select the option that best represents your opinion about each of these statements for a typical school year.

	Strongly disagree	**Disagree**	**Disagree somewhat**	**Agree somewhat**	**Agree**	**Strongly agree**
I can make my expectations clear about student behavior.	☐	☐	☐	☐	☐	☐
I am able to calm a student who is disruptive or noisy.	☐	☐	☐	☐	☐	☐
I can make parents feel comfortable coming to school.	☐	☐	☐	☐	☐	☐
I can assist families in helping their children do well in school.	☐	☐	☐	☐	☐	☐
I can accurately gauge student comprehension of what I have taught.	☐	☐	☐	☐	☐	☐
I can provide appropriate challenges for very capable students.	☐	☐	☐	☐	☐	☐
I am confident in my ability to prevent disruptive behavior in the classroom before it occurs.	☐	☐	☐	☐	☐	☐
I can control disruptive behavior in the classroom.	☐	☐	☐	☐	☐	☐
I am confident in my ability to get parents involved in school activities of their children with disabilities.	☐	☐	☐	☐	☐	☐
I am confident in designing learning tasks so that the individual needs of students with disabilities are accommodated.	☐	☐	☐	☐	☐	☐
I am able to get children to follow classroom rules.	☐	☐	☐	☐	☐	☐
I can collaborate with other professionals (e.g., itinerant teachers or speech pathologists) in designing educational plans for students with disabilities.	☐	☐	☐	☐	☐	☐
I am able to work jointly with other professionals and staff (e.g., aides, other teachers) to teach students with disabilities in the classroom.	☐	☐	☐	☐	☐	☐
I am confident in my ability to get students to work together in pairs or in small groups.	☐	☐	☐	☐	☐	☐
I can use a variety of assessment strategies (e.g., portfolio assessment, modified tests, performance-based assessment, etc.).	☐	☐	☐	☐	☐	☐
I am confident in informing others who know little about laws and policies relating to the inclusion of students with disabilities.	☐	☐	☐	☐	☐	☐
I am confident when dealing with students who are physically aggressive.	☐	☐	☐	☐	☐	☐
I am able to provide an alternate explanation or example when students are confused.	☐	☐	☐	☐	☐	☐

Please select the option that best represents your opinion about each of these statements for a typical school year. (note: the response options have changed)

	Strongly disagree	**Disagree**	**Uncertain**	**Agree**	**Strongly agree**
When a student does better than usual in mathematics, it is often because the teacher exerted a little extra effort.	☐	☐	☐	☐	☐
I will continually find better ways to teach mathematics.	☐	☐	☐	☐	☐
Even if I try very hard, I will not teach mathematics as well as I will most subjects.	☐	☐	☐	☐	☐
When the mathematics grades of students improve, it is often due to their teacher having found a more effective teaching approach.	☐	☐	☐	☐	☐
I know how to teach mathematics concepts effectively.	☐	☐	☐	☐	☐
I will not be very effective in monitoring mathematics activities.	☐	☐	☐	☐	☐
If students are underachieving in mathematics, it is most likely due to ineffective mathematics teaching.	☐	☐	☐	☐	☐
I will generally teach mathematics ineffectively.	☐	☐	☐	☐	☐
The inadequacy of a student's mathematics background can be overcome by good teaching.	☐	☐	☐	☐	☐
When a low-achieving child progresses in mathematics, it is usually due to extra attention given by the teacher.	☐	☐	☐	☐	☐
I understand mathematics concepts well enough to be effective in teaching mathematics.	☐	☐	☐	☐	☐
The teacher is generally responsible for the achievement of students in mathematics.	☐	☐	☐	☐	☐
Students' achievement in mathematics is directly related to their teachers' effectiveness in mathematics teaching.	☐	☐	☐	☐	☐
If parents comment that their child is showing more interest in mathematics at school, it is probably due to the performance of the child's teacher.	☐	☐	☐	☐	☐
I find it difficult to use manipulatives to explain to students why mathematics works.	☐	☐	☐	☐	☐
I will typically be able to answer students' questions.	☐	☐	☐	☐	☐
I wonder if I have the necessary skills to teach mathematics.	☐	☐	☐	☐	☐
Given a choice, I will not invite the principal to evaluate my mathematics teaching.	☐	☐	☐	☐	☐
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.	☐	☐	☐	☐	☐
When teaching mathematics, I will usually welcome student questions.	☐	☐	☐	☐	☐
I do not know what to do to turn students on to mathematics.	☐	☐	☐	☐	☐