Changes in STEM Teacher Self-Efficacy: Examining Professional Transitions of STEM Interns in a Secondary Teacher Education Program

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This study builds on a previous report of preservice STEM teacher development that examined how their perceptions of professional self-efficacy changed over the course of enrollment in the Master of Arts in Teaching in Secondary (MAT) Education Program. This study examined themes of transition from pre-professional to professional status for six preservice teachers enrolled in a Master of Arts in Teaching in Secondary Education Program in 2022-23. A mixed methods research design utilized qualitative methods for deriving data from pre and post essays and quantitative methods for describing the reliability and relationships among standardized measures of professional self-efficacy. Results indicated a generalized level of confidence for interns in the total experience of teaching, ability to manage a classroom, deriving personal goals, maintaining confidence in sustaining self and students' engagement in their classrooms, and professional knowledge of instruction.

Keywords: STEM teacher professional development, self-efficacy, professional transition, preservice teachers, professional knowledge, teacher induction

INTRODUCTION

This study builds on a previous report of STEM secondary preservice teacher development (Toolin & Meyers, 2020) that examined how interns' perceptions of their professional self-efficacy (Bandura, 1997; Tschannen-Moran & Woolfolk Hoy, 2001, 2007) changed throughout enrollment in the Master of Arts in Teaching in Secondary (MAT) Education Program. In this earlier study, we found that interns' pre and post program essays demonstrated clear evidence of the development of personal and professional confidence, particularly in expressions of professional knowledge and skills as well as the ability to be reflective and cognizant of their own professional self-efficacy as they progressed through the MAT program (Toolin & Meyers, 2020).

In the present study, professional self-efficacy was partially defined by the outcome of a process of coding essays written by interns pre and post program based on questions developed from five Broad Emergent Themes (BETs) identified by Bischoff et al. (2017). To build on this work, a correlated definition of professional self-efficacy was obtained from the participants' response to the Teacher Self-Efficacy Scale (TSES), a standardized measure of professional self-efficacy developed by Tshannen-Moran and Woolfolk Hoy (2001).

In addition to examining change in interns' professional self-efficacy from pre to post MAT program completion, we expanded on our previous study by including two new research questions:

RQ1. To what extent and in what direction do measures of professional self-efficacy vary within and between subjects across time?

RQ 2. To what extent are measures of professional self-efficacy expressed as narrative essay themes associated with a standardized measure of teacher self-efficacy (TSES)?

BACKGROUND/FRAMEWORK

Teacher Professional Transitions

Educational researchers have investigated several aspects of professional transitions of preservice teachers throughout enrollment in teacher education programs. As part of a three-year longitudinal research project, Bischoff et al. (2017) examined the progression of interns' self-view as STEM educators identifying five broad emergent themes (BETs) that described how interns developed from preservice to in-service teachers. The five broad emergent themes included the experience, challenges, career goals, satisfaction and confidence, and general perspective of intern progression over time. Bischoff et al. (2017) reported that interns' self-view transformed from a typical focus on personal subjective experiences as undergraduate students to a more nuanced understanding of the professional knowledge and skills, challenges, and overall practices required in becoming proficient educators teaching in high-need schools.

Whitfield's (2016) study (n=61) of Noyce interns' perceptions and decisions about the teaching profession reported that Noyce interns' decisions to become teachers occurred at a younger age (before 18 years) than non-Noyce interns. Whitfield identified two other characteristics of Noyce interns and other MAT students that might signal differences in maturation. These characteristics included the perception that a teaching career would be more conducive to family life and that interns took more graduate courses and completed more graduate degrees than non-Noyce interns.

Teacher Self-Efficacy

The more generalized term "self-confidence" may be further defined by research on self-awareness among professionals. Bandura (1986) defined self-efficacy as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances." Bandura (1997) theorized that an individual's self-efficacy had various effects on their actions, the extent of effort, perseverance, and resilience they bring to bear, the kinds of thought patterns and coping mechanisms they cultivate, and the degrees of accomplishments they achieve. Several researchers (Tschannen-Moran & Hoy, 2001, 2007; Bamburg, 1994) have linked Bandura's construct of self-efficacy to teacher progression, particularly in developing effective teaching and organizational practices. High levels of self-efficacy are attributed to teachers who are more inclined to integrate new strategies and methods into their teaching practice, be more efficient, organized, and self-directed consistently, and often exhibit professional attitudes of accomplishment and enthusiasm with themselves and their overall teaching practice.

Teacher readiness and willingness to engage in professional learning requiring some risk and reflection when experimenting with new teaching behaviors may be related to a teacher's self-perception of his or her comfort expressed as a position on Maslow's hierarchy of personal need. (Joyce et al., 1983; Joyce & McKibbin, 1980). To successfully assume the roles and responsibilities of a teacher, preservice teachers need to be cognizant of their personal and professional self-efficacy (Ryel et al., 2001) as well as the impact they may have on overall student achievement in their classrooms (Guo et al., 2010; Capa Aydin, T. & Woolfolk Hoy, A. (2005); Shoulders & Krei, 2015).

The literature on teacher self-efficacy may be classified within a larger set of studies of teacher resilience (Ainsworth & Oldfield, 2019). In addressing the problem of attrition from the profession these authors describe eighteen individual and contextual factors that are correlated with retention, job satisfaction, burnout and wellbeing with each other. One of these factors was the measure of self-efficacy

employed in the present study. Two constructs, self-care and self-esteem, emerged as important individual level variables. Contextual variables of supportive management, reasonable workloads and positive school culture were identified as explaining a larger percentage of the variance in job satisfaction, burnout and wellbeing. (Ainsworth & Oldfield, 2019)

While not directly addressing broader contextual events as drivers of self-efficacy change, the relationship between the Covid-19 pandemic coinciding with the present study was of interest. While research on this topic is limited, a few studies as reported by Pressley (2021) have described the relationship between the impact of Covid-19 and teacher self-efficacy. See, for example, Dolighan & Owen, 2021, Pellerone, 2021; Rabaglietti et al., 2021. The Pellerone study (2021) utilized two of the TSES scales (Engagement and Instructional Efficacy) and found that class size, the presence of students with disabilities, and grade level taught were related to teachers' perceptions of self-efficacy. Not surprisingly self-efficacy mediated emotional competence and personal accomplishment during the pandemic suggesting that future research account for the interaction of such events with self-efficacy.

METHODOLOGY

Study Design

This mixed-methods study used qualitative methods to derive data from pre and post essays and quantitative methods to describe the reliability and relationships among standardized measures of professional self-efficacy. The combination of data drawn from pre and post essays, intern portfolios and pre and post measures of perceptions of teacher self-efficacy constituted a mixed-methods approach (Creswell & Plano Clark, 2011). Combining qualitative with quantitative data enhanced the study from the standpoint that observed patterns of response to related measures of self-efficacy if found to be similarly directional and consistent with respect to the conceptual framework can add to the validity of observations. Specifically, in the previous related study (Toolin & Meyers, 2020), self-efficacy was examined from a content analysis of scholar case studies for changes in personal and professional orientation to the teacher's role. In the present study, the framework of self-efficacy that was the basis for the previous study was maintained but a standardized measure of self-efficacy (Tschannen-Moran & Woolfolk Hoy, 2007) was added to the analysis to estimate the magnitude of changes in scholar perceptions of self-efficacy.

Themes of professional transition (Bischoff et al., 2017) served as the conceptual and analytical frameworks that examined changes in intern professional self-efficacy pre and post MAT program completion. Five broad emergent themes that described how interns evolved from preservice to in-service teachers were utilized in coding and analysis. The five broad emergent themes were matched with standardized measures of Teacher Self-Efficacy (Tschannen-Moran & Woolfolk Hoy, 2001) and are summarized in Table 1. In addition, drawing upon the literature (Bandura, 1997; Hoy & Woolfolk, 1993; Moore & Esselman, 1992) of teacher perceptions of self-efficacy and competence, expected changes in the current data were derived for each theme. The TSES scores (pre-test, post-test, and gain scores) were grouped with a matrix of self-efficacy themes from the essay data aligned with factor scores from the TSES pre and post questionnaires.

Internship Growth Model Expectations

The literature describing processes of identity formation and reformation has often focused on teachers' beliefs, values, and the ongoing experiences that nearly every teacher has on personal and professional levels, (Ainsworth & Oldfield, 2019; Edwards & Edwards, 2016; Vermunt et al; 2017; Alsup, 2006; Beauchamp & Thomas, 2009; Beijaard et al., 2004; Flores & Day, 2006, Geijsel & Meijers, 2005; Walkington, 2005; Rodgers & Scott, 2008). Transformation of teachers' identities has been conceptualized as a 'complex dynamic system' (Henry, 2016). Characteristics of complex dynamic systems include an acknowledgment that change in identity may take place on many variable time scales with the requirement that data collection and analysis proceed from a 'discourse analytical approach' (Potter & Wetherell, 1995) and that specific procedures as described by Coyle (2006) and Bell and Das (2011) provide the structure for collecting the data. Henry's (2016) study findings suggest that there are describable changes in teacher

identity that occur on varying time scales. This study suggests that longer-term predictability of the direction of identity change may be limited by researchers' understanding of the nature of relationships among active variables in dynamic systems that teachers inhabit. (Henry, 2016, p. 30).

Growth Model for the Present Study

A model of growth expectations was developed for the present study that identified broad emergent themes drawn from the research by Bischoff et al. (2017), matched with the Teacher Self Efficacy Scales (TSES). Expected changes representing increasing complexity, resolution, commitment, confidence, and sophistication were then applied to a coding schematic to enable the analysis of data recorded from the pre and post essays and TSES questionnaire.

Linking themes observed in pre-internship and post-internship essays with response data from the TSES survey was accomplished by matching the more generalized emergent themes with the more detailed theme descriptions serving as deductive codes (Yi, 2018) identified in the essays and subsequently matched with factor scores of the TSES in Table 1.

TABLE 1
BROAD EMERGENT SELF-EFFICACY THEMES AND EXPECTED CHANGE IN SELF-PERCEPTION RELATED TO TSES SCALES

Theme*	Theme Descriptions	Expected Change	TSES Scales
Experience	A statement specifically referring to a teaching or learning event in which the intern participated.	Increasing complexity reported by interns as they reflect on the meaning of their experience.	Total TSES
Challenges	A statement where the intern specifically describes a challenging situation.	Continuous positive resolution of challenge reported by interns as they describe their resolution of challenges experienced.	Management
Career Goals	An affirmative statement about becoming a teacher, a statement about where they plan on teaching, or a statement describing some other professional goal they wish to accomplish.	Sustained commitment to earlier reporting of expectations to develop a professional teaching career.	Goals
Confidence	Statements describing a sense of satisfaction with their work or a sense of confidence in their ability to teach.	Increasing confidence in interns reported satisfaction with their ability to teach all learners.	Engagement
General Perspective	Statements describing general teacher knowledge, relationships with students, classroom management or familiarity with content and pedagogy.	Increasing sophistication with the application of theory into practice as interns reflect upon their perceptions of the links between teaching methods, efforts and their results.	Instruction

* Bischoff, P., French, P. & Schaumloffel, J., (2017), pp.1222-1223

Items to Themes to Factors Matrix

The development of the original TSES included a survey of all instructors who worked with prospective teachers at Ohio State University in 2001, asking the instructors what students should be able to do upon completion of teacher education coursework. The result was a list of 32 teaching skills such as manage

classrooms, evaluate student work, use cooperative learning approaches, teach basic concepts of fractions, and build science learning on student's intuitive understandings. The first iteration of the TSES scale was a questionnaire named the Teaching Confidence Scale. The initial scale asked students to rate on a 6-point scale how confident they were in their ability to accomplish each skill, the higher the score, the more confident. The authors then calculated a total average score for each respondent. Total and subscale reliabilities (Cronbach alpha) were obtained from these data which ranged from .94 to .87. (Tschannen-Moran & Woolfolk Hoy, 2001).

The TSES was factor analyzed by Tschannen-Moran & Woolfolk Hoy (2001) during scale development to consist of three factors:
- Student Engagement (Items 1, 2, 4, 6, 9, 12, 14, 22)
- Instructional Practices (Items 7, 10, 11, 17, 18, 20, 23, 24)
- Classroom Management (Items 3, 5, 8, 13, 15, 16, 19, 21)

In the present study, an item grouping of Goals corresponding to the Bishoff et al. (2017) theme of Career Goals (not factor analyzed by the TSES authors) was added by the current authors consisting of Items 4, 5, 6, 7, 9, 12, & 22.

Study Participants

This study examined changes in professional self-efficacy from pre to post program completion for 6 Master of Arts in Teaching (MAT) in secondary education interns working towards science teaching licensure during the 2022-23 academic year. Interns enrolled in a 31-credit year-long MAT program consisting of a full-year internship at a local high-need middle school or high school and a breadth of education coursework that included topics such as adolescent development, educational psychology, special education, curriculum, assessment, literacy integration, classroom management and STEM teaching methods.

All interns are white and completed the program in Spring 2023 earning an MAT in Secondary Education degree with a 4.0 average GPA. All earned licensure in their respective subjects and secured a STEM teaching position in a high-need school for the 2023-24 academic year. Demographic data for all interns are summarized in Table 2.

TABLE 2
INTERN DEMOGRAPHIC INFORMATION

Intern	Age	Gender	Major	Licensure	Teaching Position
S2	29	Male	Mechanical Engineering	Science 7-12	MS Science
S2	35	Male	Biology	Science 7-12	HS Biology
S3	27	Female	Environmental Science	Science 7-12	HS Biology/ Env. Science
S4	25	Female	Environmental Science	Science 7-12	HS Physics
S5	24	Female	Biochemistry	Science 7-12	HS Physics
S6	27	Female	Chemistry	Science 7-12	HS Biology/Gen. Science

Data Sources

Pre and Post Essays. The professional transition broad emergent themes developed by Bischoff et al. (2017) formed the basis for developing pre and post essay questions to capture interns' perceptions of self-efficacy related to their experiences, challenges, goals, confidence, and general perspective about teaching.

Pre and Post Essay Questions
- What are your reasons for undertaking study in the MAT program?
- What is your readiness for assuming professional responsibility for teaching students. You may cite examples of personal experiences you have had in the past that you feel have prepared you for pursuing a career in teaching. More specifically:
- What challenges to your professional goals have helped to pursue a career in teaching?

- What changes in career goals have emerged as you decided to apply to the program?
- How do you describe your confidence and satisfaction in working with students at this point in the program?
- What professional knowledge and skills have you developed thus far in the program?
- How confident are you in being sufficiently prepared to demonstrate your teaching skill and knowledge?

All six interns wrote an essay describing self-assessment of their competency prior to beginning their internship in January 2023. Responses to the pre-self-assessment essay were compared to a professional practice essay on the same questions that each wrote near the completion of the MAT Program. They completed post essays during the spring of 2023 and responded to the TSES pre and post measures of self-efficacy in January and May 2023. Themes of Experience, Challenges, Career Goals, Satisfaction and Confidence and General Perspective were extracted from the essays and coded according to increasing complexity, resolution, commitment, confidence, and sophistication. Following extraction, themes were matched with the TSES scales of the Total Score, (Experience) Classroom Management (Challenges), Goals (Career Goals), Engagement (Confidence) and Instruction (General Perspective).

TSES Questionnaire Data

The Teacher Sense of Efficacy Scale (TSES) pre and post surveys were the primary quantitative data sources for this study. The 24-item TSES surveys were administered pre-post student teaching at the beginning and end of the 2023 spring semester constituting approximately sixteen weeks for change measurement. In a validation study by Tschannen-Moran and Woolfolk Hoy (2007), all reliability coefficients (Cronbach alpha) were at or above .70. In the present study, replication of the reliability analysis done by Tschannen-Moran and Woolfolk Hoy with the current study population obtained a Cronbach alpha reliability coefficient for the Total TSES scale at .92. Alpha coefficients for subscales ranged from Instructional Strategies (.70), Classroom Management (.78), Engagement (.90) to Goals (.93). Due to the limited number of participants (n=6) analysis of scale scores was limited to the non-parametric Wilcoxon Signed Ranks tests (Posten,1982).

RESULTS

Transition Themes, Change, and Comparison With TSES Data

This section on results is divided into three parts. The first section is a narrative account of perceptions of professional transitions from the series of essays describing five recurring and interrelated themes summarized in Table 3. All five professional transition themes were observed in the post internship essays for all interns engaged in this study. All interns responded to questions associated with all the transition themes. One intern presents each theme as an example of the perception of change. In the second section, the results from analysis of the TSES associated scales (in parentheses) include personal experience (Experiences), challenges in career goals (Challenges), changes in career goals (Goals), satisfaction and confidence in professional roles (Confidence), and development of professional knowledge and skills over time (General Perspective). The third section presents the comparison of essay and TSES questionnaire data.

TABLE 3
EXAMPLES OF INTERN PRE AND POST ESSAY DATA

Intern	Theme	Pre/Post	Representative Excerpt
S2	Experience	Pre	This move towards a teaching position and away from my previous occupation as a musician and sound engineer has been to fill a role of more community-focused work that has been lacking in my personal life. I see teaching not only as a position of importance for the next generation's ability to participate well in a changing world, but also as one that will provide me the emotional elements that I need to be a whole person – a sense of communal purpose. The baseline of expectation was not based on related experience but rather an abstract vision of the role of the teacher. In the post-essay, there appeared a more complex, reflective and detailed response. I am now very aware of, and am a bit nervous of, the friction between my goals as a teacher and my vision of what learning looks like in the educational systems that I will enter hopefully in the near future. There are many external forces, and I feel very motivated to push students beyond those superficial learning goals and encourage them to critically think about the structures around them, and I hope these types of actions will not put my career in too much jeopardy going against the grain.
S5	Challenges	Pre	When I started high school, I was the new kid who had never been to public school, and was woefully behind, socially and academically. I believed that I was going to fail as soon as I started, but have always been stubborn, and worked hard to catch up with my peers. I felt it would be a weakness to show how hard school was for me, so I tried my best to hide the fact that I was struggling.
S5	Challenges	Post	In the fall, I had not taken the initiative to discuss with my mentor how to address a student of concern to other faculty in emails, as well as how to ensure I was abiding by a student's special education plan. Through my special education course at the university and discussing with my mentor, I am now confident in my ability to closely adhere to school policies and practices, FERPA, and student discipline. I now take it upon myself to search a student's education plan to make sure I am adhering to it. When I photograph or film a student, I make sure they are not on the school's no photograph list. I am confident in my ability to do the right vs. wrong action in times of student disciplinary action. I have no doubt in my ability to closely follow the school's policies.

Intern	Theme	Pre/Post	Representative Excerpt
S3	Goals	Post	I don't think my career goals changed as I applied for the program. I was pleasantly surprised when I learned about the program that there was an organization that wanted to support increasing the capabilities and number of teachers who want to work with rural and underfunded schools. At the time that applied I was switching careers from outdoor education to classroom education because I wanted to be able to help schools, students, and communities build sustainable relationships that supported student development.
S6	Confidence	Post	I have acquired unique qualities to set myself apart from others. I believe I have an innate ability to hone in on individuals' learning styles and quickly develop techniques that cater to their specific needs. I am constantly assessing what works well and tweaking things that might need a better means of delivery. I do this to ensure optimal success for each individual.

In their pre-essay, Intern S1 wrote a summary statement about changes in the qualities they perceived they brought to the program.

> As a TA during a study abroad trip, I was reminded again of the important lesson I learned as an orientation leader, respecting each person's experience. A professor of mine selected me to be a TA for a Fluid Mechanics course on a half-semester study abroad trip with 17 students. When students came to me with questions, I remembered the important lessons to me as an orientation leader. No matter how simple or complex the questions, each student's concern was very important to them and I did not let the frequency of questions or redundancy of the course material keep me from remembering that fact. My work as a TA highlighted one of my weaknesses. When I approached helping others with questions, I would try to frame my answers in the way that would have been most helpful for me as a student; however, every student is different. I recognized this and during my time as a TA I focused more on explaining concepts in many different ways to help people with different learning styles understand. I improved with time, and I am grateful that being a TA allowed me to confront this challenge.

In the post-essay, Intern S1 presented a perception of their role that was broader and more nuanced as one outcome of their program and internship experiences.

> One of my strengths in fostering student learning understanding is my ability to ask probing questions to students to guide them in their learning instead of directly giving them the answer. Throughout the energy unit, I was attentive to how I was answering questions to understand their thoughts as we discussed the solution to their problem. This technique allowed me to make the most of my check-ins with students by hearing the reasoning behind their growing understanding of the material. To engage students in a reflective process without a discussion, I did an activity where students assessed their formative quizzes with an answer key. This activity fits into the strengths that I have as an educator. I am always looking for ways that students can reflect on their thoughts and grapple with their explanations.

Essay Analysis Summary

A summary of intern post essay analysis indicates an awareness of professional growth for most interns.

- Most interns reported few challenges in developing professional goals while enrolled in the program. Limited experience with adolescents was cited as a source of challenge to developing a professional vision of the teacher's role.
- Most interns reported growth in their developing professional vision of the teacher's role. They reported an awareness that their perceptions were changing over time.
- Most interns reported increasing confidence and perception of their developing skills.
- Interns were generally aware that their professional knowledge and skill had increased in quantity and quality over the time they were enrolled in the program.
- Interns indicated that they were growing in professional competence and confidence in the planning and delivery of instruction, the ability to lead parent/teacher conferences, the use of formative assessment data to inform instruction, and the ability to bring their knowledge of science to bear in the design of units.

TSES Questionnaire Results

All six interns completed pre and post measures of the TSES scales. Responses were tabulated and the TSES scales were analyzed for each of the factors of the Total Scale, Management, Goals, Engagement and Instruction. A Wilcoxon signed-rank test indicated that interns' confidence in their ability to provide instruction successfully was significantly higher after completing their internship than before, $z = -2.207$, $p = .027$. The median score on a 10-point Likert-scale item was 7 after completing the internship compared with 6 before completing it. A Wilcoxon signed-rank test indicated that interns' confidence in their ability to Manage a classroom successfully was significantly higher after completing their internship than before, $z = -2.201$, $p = .028$. The median score on a 10-point Likert-scale was 7 after completing the internship compared with 6 before completing it. Wilcoxon tests on other scales (Total TSES, Goals and Engagement) did not produce significant pre/post differences. However, all median differences were directionally trending in a positive direction of change. Since there were 6 intern records for these data, inspecting both sub-scales and items was possible. An inspection of these tabular data suggests that not all interns felt equally efficacious on the TSES Post Scales (Table 4).

Linking TSES Questionnaire Data and Essay Responses

Linking the intern TSES data to the essay and portfolio data enables a description of teacher development that could be subject to intervention during a cohort's development from program admission to graduation as each source of data is collected and monitored during the program. A conceptual linkage model was accomplished by the array of application essay themes related to portfolio essay themes and the factors posited by the factor analysis of TSES data.

Table 4. presents a summary of interns' essay responses when matched with the TSES pre and post measures. Review of essays revealed evidence of expected change in intern perceptions of each theme. Positive or negative change indicating a perception or lack of growth was noted for each intern. Summaries of change in TSES scores are associated with each theme for each intern.

Essay and TSES summary data indicates a general increase in all measures. All post essays demonstrated growth according to the expectations for growth as identified in Table 1. A general increase in TSES scales was observed from pre to post measurement with the following exceptions: S4 on Total Scale; S3 and S4 on Class Management Scale; S2 on Goals Scale; and S4 on Engagement Scale. All interns increased on Knowledge Scale. In a summary assessment of all TSES scales, perception values increased, but only two of the scales (Instruction and Management) increased significantly on a non-parametric test.

TABLE 4
ESSAY ANALYSIS ALIGNED WITH TSES PRE/POST RESULTS: PRE TO POST CHANGE IN PROFESSIONAL SELF-EFFICACY

Direction of Change by intern for each of five themes										
Sources: (T1) = Pre-internship essays > (T2) = internship completion essays										
(T3) =TSES Total Scores Change from Pre to Post Direction of Change (+, -)										
Intern	**Experience (Total)**		**Challenges (Management)**		**Goals (Goals)**		**Confidence (Engage)**		**General (Instruction)**	
	T1> T2	**T3**	**T1> T2**	**T3**	**T1> T2**	**T3**	**T1> T2**	**T3**	**T1> T2**	**T3**
S1	+	+	+	+	+	+	+	+	+	+
S2	+	+	+	+	+	-	+	+	+	+
S3	+	+	+	-	+	+	+	+	+	+
S4	+	-	+	-	+	+	+	-	+	+
S5	+	+	+	+	+	+	+	+	+	+
S6	+	+	+	+	+	+	+	+	+	+
Summary	+	+	+	+*	+	+	+	+	+	+*
+ indicates positive qualitative change in narrative themes representing growth in essay results;										
+ TSES data change represents a positive increase in ranked scores with an average standard deviation equal or in excess of .4 for each scale.										
– indicates negative change in qualitative or quantitative measures.										
*Significant Wilcoxon Signed Ranks p <.03										

In the context of expected changes identified in Table 1., Table 4. indicates the relationships between and among the pre-essay, post essay measures and the associated TSES Scale scores for selected interns. Summary results provide opportunity for analysis of change across the group of interns over time. Two of the scales produced significant change in perception over time (Instruction and Management).

DISCUSSION AND CONCLUSION

The interns' perceptions of professional self-efficacy changed from pre to post MAT Program completion (RQ1). The development of personal and professional self-efficacy was evident in the pre and post essays of each of the six interns and in the pre and post measures of the TSES. Interns demonstrated growing confidence in their ability to manage a variety of unique challenges as well as growth in their knowledge and skills enabling them to effectively teach a wide range of learners. This finding was consistent with intern cohort studies of the previous five years of evaluations of professional portfolios wherein interns wrote essays describing their professional growth before admission to the program and again upon graduation (Toolin & Meyers, 2020).

Pre and post essay analysis revealed areas of significant growth for interns that included reflective processes aimed at deriving career goals and increases in professional knowledge and skills related to instruction. When matched with a standardized measure of teacher self-efficacy, qualitative analysis of pre and post essay data provides evidence for positive change in interns' perceptions of growth. Areas of growth included their abilities to function as professional teachers with respect to their generalized level of confidence in the total experience of teaching, their abilities to manage a classroom and derive their personal goals, maintain their confidence in sustaining students' and their own engagement in their classroom, and knowledge of instruction.

Further, the case for comparing standardized measures of professional self-efficacy (TSES) was strengthened by aligning themes of professional development expressed through pre and post internship

essays (RQ2). The somewhat unexpected increase in intern perceptions of the Management and Instruction subscales of the TSES signals some evidence that within the context of the theory of teacher self-efficacy related to personal perceptions of self-efficacy and commitment these interns may have a higher level of probability for retention in the profession than expected (Nieto, 2003; Cochran-Smith, 2004). Findings from the analysis of pre and post survey data provide trend evidence that measures of self-efficacy including the overall TSES scale and sub-scales varied across time and within subjects.

Most interns reflected confidence in their ability to teach a wide range of learners in post program essays. Professional self-efficacy and growth were most evident in the professional knowledge and skills theme. Changes in intern professional self-efficacy from pre to post MAT program completion were demonstrated in most of the interns' abilities to be reflective and cognizant of their professional self-efficacy as they progressed through the MAT program. Post essays demonstrated the importance of peer collaboration, the development of teaching and organizational practices that integrate student-centered teaching strategies and growth in professional attitudes of accomplishment and enthusiasm with themselves and their overall teaching practice.

In the context of Pellerone's (2021) finding, self-efficacy was related to the presence/absence of students with disabilities during the pandemic. An important dimension of the interns' experience was an emphasis on teaching students with disabilities, including each intern having completed a structured case study on teaching a student with a disability. In a study currently underway, review of interns' case studies reported in each of their portfolios revealed a common understanding of the challenges and success that each experienced with students with disabilities. Consistent with findings made by Pellerone (2021), the TSES Instruction scale was significantly related to the present study's interns' perceptions of self-efficacy.

IMPLICATIONS

Implications arising from this study may be informative for teacher educators and school professionals who become colleagues of MAT graduates who have had an opportunity to deeply reflect upon the personal and professional growth that they have experienced in their teacher preparation program. The common view of novice teachers may be that they enter the teaching profession with little understanding of their own growth and little to share with colleagues. The data observed in this study suggests that far from being novice teachers, graduates of programs that foster reflection and colleagueship may be considered valued partners in professional learning communities with much to share about the knowledge and experience that they have gained during practicum and student teaching internships that extend into initial years of teaching. Like other research engaged in self-efficacy study (Thompson et al., 2019, 2020) this research adds to the body of knowledge supporting the integration of professional course work, practicum field experiences, and self-reflection as pathways to self-efficacy and resiliency that may predict longer and more productive trajectories for teachers (Capara et al., 2006). More specifically, the findings of growth in perception of self-efficacy support greater emphasis on those components of the program (mentoring and self-reflection) that emphasize the development of personal values (Nieto, 2003).

LIMITATIONS AND FUTURE RESEARCH

An analysis of intern pre and post essays demonstrates clear evidence of the development of personal and professional self-efficacy. It might be argued that the context of the pre-internship experience (a preliminary practicum) as preceding the interns' experience of the teaching internship may have led interns to write about personal rather than professional self-efficacy in the pre-internship essay. While some of the interns may have done some teaching during the practicum period, the emphasis for that experience was on direct observation and planning with some teaching experience. Review of the pre-internship essays indicates that most of the interns cited their pre-internship teaching experience without describing how these experiences were related to their views of self-efficacy. Periodic measurement of intern perceptions of self-efficacy throughout teacher education programs could provide points of intervention that might enable faculty, mentors, and interns to open authentic dialogue and further develop meaningful mentoring

relationships. Related to the potential influence of contextual events, arising from the research on the Pandemic (Pellerone, 2021), a more detailed and focused study on the relationship of contemporary contextual events to intern perceptions may serve to provide a deeper understanding of the dynamics of self-efficacy change.

Limitations of this study include its small sample size. A new subscale dimension to the TSES analysis was added but the small sample size precluded factor analysis of that scale. In addition, interns' perceptions of their self-efficacy on both the TSES scales and essays may have been prompted by the expectations of faculty that interns' perceptions should improve. Furthermore, it is also possible that the act of writing the pre-internship essay may have biased the expectation that self-efficacy should improve on the TSES scales. Simultaneously, the acts of writing and reflection may be considered components of the intervention through the portfolio requirement that is designed to measure and support growth. Variation in found patterns of self-report between and among subjects and measures notwithstanding, future studies might include the utilization of portfolio entries and post internship questions as additional pre and post data sources for the study. Other sources of data and additional theoretical perspectives such as Henry's (2016) complex dynamic system and inner dynamics of transformation as seen through the lens of dialogical analysis of identity shifts (Hermans, 2008) could add further triangulation of self-efficacy change.

Causal effects linking the program components to outcomes such as teacher self-efficacy were beyond the scope of this study. Program components included the specific courses required for licensure, intern support strategies such as mentoring and coaching during the internship, the process of developing a professional portfolio requiring reflection and personal writing, cohort enrichment activities such as field and laboratory study constitute variables that may or may not have influenced interns' self-perceptions.

In addition to documenting the program's effects on interns' professional self-efficacy, this study serves as a potential gateway to more extensive research that might be the subject of future study of MAT intern development. Potential investigations may include examining the relationship between interns' use of assessment data from their students and the levels of clarity and intensity of their own views of self-efficacy. Finally, the existence of a qualitative record of a program related expression of self-efficacy provides the opportunity to continue a longitudinal study of intern development and longer-term relationships of self-efficacy to persistence in the profession. Larger questions concerning the relationships among individual and contextual variables to recruitment and retention in the teaching profession (Ainsworth and Oldfield, 2019) are beyond the scope of this study but remain a primary motivation for longitudinal study related to program design and investment.

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