Article History
Received: 18.04.2022
Received in revised form: 05.03.2023
Accepted: 15.03.2023
Article Type: Research Article

International Journal of Contemporary Educational Research (IJCER)

www.ijcer.net

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To cite this article:

Sodergren, C.D.C., Kettler, T., Sulak, T. N., & Payne, A. M. (2023). Teacher self-efficacy, innovativeness, and preparation to teach cross-curriculum skills. *International Journal of Contemporary Educational Research, 10*(1), 197-209. https://doi.org/10.33200/ijcer.1104747

IJCER International Journal of Contemporary Educational Research
Volume 10, Number 1, March 2023, Page 197-209 ISSN: 2148-3868

Teacher Self-Efficacy, Innovativeness, and Preparation to Teach Cross-Curriculum Skills

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Abstract

Teacher self-efficacy (TSE) is related to teachers' job satisfaction, retention, motivation to improve, and work-related stress. Using data from the 2018 Teaching and Learning International Survey (TALIS), we investigated the impact of an innovative campus culture and preparation for teaching cross-curriculum skills on TSE. Data indicated that working at innovative campuses had small effects on TSE in classroom management ($\beta = .12$), instruction ($\beta = .06$), and student engagement ($\beta = .17$). Teachers' preparation to teach cross-curriculum skills had small to medium effects on TSE in classroom management ($\beta = .20$), instruction ($\beta = .34$), and student engagement ($\beta = .30$).

Keywords: Teacher self-efficacy, Cross-curriculum, Innovative school, Innovative campus, Teacher preparation, Educational psychology

Teacher Self-Efficacy, Innovativeness, and Preparation to Teach Cross-curriculum Skills

Teacher self-efficacy affects the quality of both teacher and student experiences. Teacher self-efficacy (TSE) reflects the beliefs teachers have about their ability to effectively handle tasks, obligations, and challenges related to teaching, and influences academic outcomes. TSE is related to teachers' retention, job satisfaction, lower levels of work-related stress and motivation to learn and improve (Bandura, 1982; 2012; Klassen & Chiu, 2010; Marjolein & Helma, 2016). Understanding the factors that affect TSE is important for recruiting, training, and retaining effective teachers.

Bandura (1982) suggested that people with high self-efficacy are likely to persist and devote more effort to a task when it isperceived as difficult. This means that teachers with higher self-efficacy are more resilient in the face of changes or challenges and may even be able to support one another on teaching teams. Collective self-efficacy is derived from the social and organizational contexts of an individual's self-efficacy (Bandura, 2000; Viel-Ruma et al., 2010; Zaccaro, et al., 1995). Teachers working in a district or school context in which the individual self-efficacy of their peers is high may experience a boost in their own self-efficacy as they draw on the collective strength of the self-efficacy of others around them. A strong sense of individual efficacy that impacts changes in society or in the local community is directly related to perceived collective efficacy (Bandura, 2000). Removing barriers to positive collective self-efficacy is key to overcoming external obstacles (Bandura, 1982; 2000).

Teacher Self-Efficacy

Self-efficacy is the belief that individuals hold about their ability to engage in certain behaviors. People with high self-efficacy are more likely to be open to new experiences, conscientious, and embrace prosocial behaviors (Bandura, 2012). Teacher self-efficacy is defined as self-efficacy related to the tasks, skills, and challenges involved in the teaching profession and may impact motivation and affective commitment to remain in a position (Canrinus et al., 2012). Teachers from the same school are likely to have similar TSE, as a clustering effect appears to align their TSE with collective teacher self-efficacy (CTSE) (Caprara, et al., 2006; Skaalvik & Skaalvik, 2007). Collective self-efficacy may draw an individual's sense of self-efficacy upward or downward in that context. Teachers' job satisfaction is positively influenced by TSE in both instructional strategies and classroom management, suggesting that improving TSE may help improve overall job satisfaction (Klassen & Chiu, 2010).

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Professional development may also improve TSE; however, this is not guaranteed. Yoo (2016) found that teachers may either interpret the acquisition of knowledge as strengthening it or revealing flaws that were previously unknown; therefore, the frame of reference of the individual may impact the lens through which they view themselves.

According to a meta-analysis of Teaching and Learning International Survey (TALIS) related reports, TSE has a significant positive effect on job satisfaction, regardless of country, continent, or culture (Kasalak & Dağyar, 2020; Klassen & Chiu, 2010; Vieluf, et al., 2013). This is a universally impactful force in improving teacher success, which may also affect student success. A focus on TSE during in-service programmes is positively related to the improved quality of instructional support used in the classroom (Marjolein & Helma, 2016). Some studies have found mixed results about the relationship between TSE and student achievement, citing indirect impacts on student achievement through motivation and that teaching high-performing classes can positively impact TSE (Fackler & Malmberg, 2016; Marjolein & Helma, 2016).

Determining the variables that most strongly affect the TSE is somewhat more complicated. Some data indicate that positive emotions toward students help overcome the negative emotions experienced by teachers, thereby raising TSE in net effect (Buonomo et al., 2019). For example, if a teacher is experiencing difficulties but expresses a positive feeling toward their students, their self-efficacy is resistant to the impact of the difficulty. Teacher mental health is positively correlated with both individual and collective self-efficacy, as well as with emotional exhaustion, while depersonalization and depression are negatively correlated with both individual and collective self-efficacy, as well as job satisfaction (Capone & Petrillo, 2020). Teachers who lack support and resources have lower persistence and TSE, which may lead to a greater likelihood of leaving (Grant, 2006). In one study, novice teachers who believed that their teaching team or campus exhibited a shared collective responsibility for student success had a higher TSE and, therefore, a decreased intention to leave the profession (De Neve & Devos, 2017). Time spent in the profession is related to increases in individual TSE, and primary school teachers tend to have a slightly higher TSE for student engagement and classroom management than secondary school teachers, although there are no differences between primary and secondary school teachers in TSE for instructional strategies (George et al., 2018). The positive impact of time is limited; research reveals that after an average of 23 years in the profession, the TSE begins to decline (Klassen & Chiu, 2010; Krammer et al., 2018). CTSE is distinguishable from individual TSE; in contrast, the impact of time is negatively correlated with time and CTSE (Skaalvik & Skaalvik, 2007).

Teachers who experienced greater workload stress but not classroom stress had an unexpectedly higher TSE (Klaeijsen et al., 2018; Klassen & Chiu, 2010). This suggests that although teachers may take on stress from additional work-related loads—such as accepting the burden of additional duties, acting as sponsors for student groups, or supporting co-workers—they may actually feel more efficacious for having taken on additional work. Other factors that can positively impact TSE are student involvement in teacher evaluations, cooperation among teachers, and the perception of satisfactory classroom management techniques (Egido Gálvez et al., 2018). Egido Gálvez et al. (2018) also found that teachers who lacked professional development in an area may find that their TSE was negatively impacted by the need for professional development. In other words, when teachers realize they are lacking in a certain set of skills, they begin to feel less efficacious as a result of that awareness. Professional development, especially development based on current standards and immediately relevant to the classroom, is positively correlated with TSE (Marjolein & Helma, 2016; Yoo, 2016). Students expressed that the experience of effective teacher strategies impacted teachers' self-efficacy in a reciprocal relationship (Marjolein & Helma, 2016). When students talk about or share information about a teacher's teaching strategies positively, the teacher begins to feel more efficacious. Student achievement also affects TSE, and teachers teaching in high-achieving classrooms are more likely to have a higher TSE than their peers (Caprara et al., 2006). Principals who are supportive and deemed approachable by teachers also positively impact TSE (Aldridge & Fraser, 2016). In short, pleasant experiences that teachers have in the classroom, among their peers, and with their leadership may lead to greater TSE. Given that the research mentioned above indicates positive impacts from cooperation among teachers, professional development, positive student responses and achievement, and principal support, it becomes clear that the overall organizational climate of the school matters to the development of a healthy TSE, both individually and collectively.

Innovative Campuses

The literature in both psychology and management refers to innovative behaviors and creativity as the same or related constructs (Hsu et al., 2011; Ng & Lucianetti, 2015; Somech & Drach-Zahavy, 2013; Thurlings et al., 2015). Creativity leads to creative behaviors, which, when implemented in the workplace, result in innovation;

therefore, creative and innovative labels are largely interchangeable. Although a creative personality is an individual construct, a cohesive team can develop a collective personality that conforms to individual personalities (Dampérat et al., 2016; Grosser et al., 2017). The team acts as a unit that draws collectively on the individual personalities of team members as needed; thus, individuals can experience higher creative self-efficacy as members of a cohesive group (Dampérat et al., 2016; Somech & Drach-Zahavy, 2013). Park et al. (2021) found that the relationship between collective creative self-efficacy and performance has an inverted U-shape, suggesting that the greatest innovative output does not necessarily come from a collection of people with the highest individual self-efficacy. There may be an optimal level of individual efficacy at which collective efficacy becomes the most productive.

When teachers implement innovations, they not only teach new strategies but also model the process of innovation at the same time (Klaeijsen et al., 2018). While a change agent in an organization affects teams and organizations, teachers affect their teams, schools, countless children, and communities. Parry (2018) points out that developing a culture of teacher-led innovation is the best way to transform both the schools and communities in which they reside. Teachers' creativity, when directed toward productive change, is a powerful tool. Because of this potential, it is important to examine the relationship between TSE, the perception of innovative behavior, and the contexts in which these behaviors arise.

Teacher innovation research has demonstrated that factors such as teacher experience, skills, and teaching philosophy can impact the rate of teacher integration of novel technologies (Mueller et al., 2008). Supervisors or organizational expectations may have both positive and negative impacts, depending on the ability of the individual to meet or exceed those expectations (Chang et al., 2011; Pugh & Zhao, 2003; Tierney & Farmer, 2011). Goal interdependence, when combined with self-efficacy, has a positive effect on innovative behaviors (Thurlings et al., 2015); however, individuals with collectivist grounding may be concerned that increasing innovative behaviors could negatively impact social equilibrium (Ng & Lucianetti, 2016). Occupational self-efficacy was found to be positively correlated to the intrinsic motivation in teachers as well as with innovative behavior among teachers (Klaeijsen et al., 2018). Educational innovations on the rise include increased emphasis on the teaching and development of cross-curriculum skills in K-12 schools as programs such as the International Baccalaureate and STEM Problem-Based Learning models have become more popular. As these models proliferate, it becomes crucial to understand the impact of innovation uptake and implementation on teachers and scholars.

Cross-Curriculum Skills

Cross-curriculum skills, also called 21st Century skills, are cognitive skills that translate across all content areas and can be applied not only in the classroom but also later in life. There are many models and frameworks for identifying these skills, but most agree that problem-solving, collaboration, interpersonal, creativity, information literacy, and production skills are key cross-curriculum skills for young people today (Geisinger, 2016). Their importance grows as the speed of innovation continues to make existing jobs obsolete, and new areas of expertise arise with increasing frequency. Training students in the age of technology requires them to be adept at skills that will allow them to create their own jobs and navigate a rapidly changing world. Efforts to prepare teachers to implement change and teach these skills in the new age of technology have proven difficult, and little progress toward fundamental changes in school systems is evident (Erstad, et al, 2015). Some evidence points to the need for teachers to first develop their own cross-curriculum skills before they can effectively teach them to others (Karatas & Arpaci, 2021; Teo et al., 2021). Additionally, technical support and continued professional development contribute to teachers' successful implementation of innovative technologies and their ability to support students' skill development (Zheng, et al., 2016). While new-to-professional teachers are often prepared using the latest teaching methods for cross-curriculum skills, in-service teachers may have fewer opportunities to obtain and test strategies for innovative professional development.

In a systematic review of studies of pre-service education center programming on 21st century skills, Teo et al. (2021) identified three crucial missing pieces in teacher preparation programs: identifying the needs of teachers ahead of designing programs, developing theoretical frameworks and tools, and finding the crucial balance between keeping up with technological change and building sustainable programs. Many pre-service teachers have misconceptions about what these skills are, believing that 21st Century skills, or cross-curriculum skills, reference largely technology-related or digital literacy skills rather than including the full scope of problem-solving, critical thinking, and creativity skills (Karakoyun & Lindberg, 2020). In some teacher training programs, a blended learning approach was found to improve pre-service teachers' cross-curriculum skills as well as their self-efficacy and helped to increase their potential for becoming lifelong learners (Sentürk, 2021). Overcoming misperceptions and developing a shared vocabulary around cross-curriculum skills is the first step toward improving the successful replication of these skills in the classroom.

From the research already discussed, we understand that there are a variety of organizational factors that may impact the TSE. These include, but are not limited to, the relative supportiveness of school leadership, teachers' own experiences in the classroom, opportunities for professional development, and innovative structures and atmosphere. Figure 1 presents a theoretical model that includes these organizational factors.

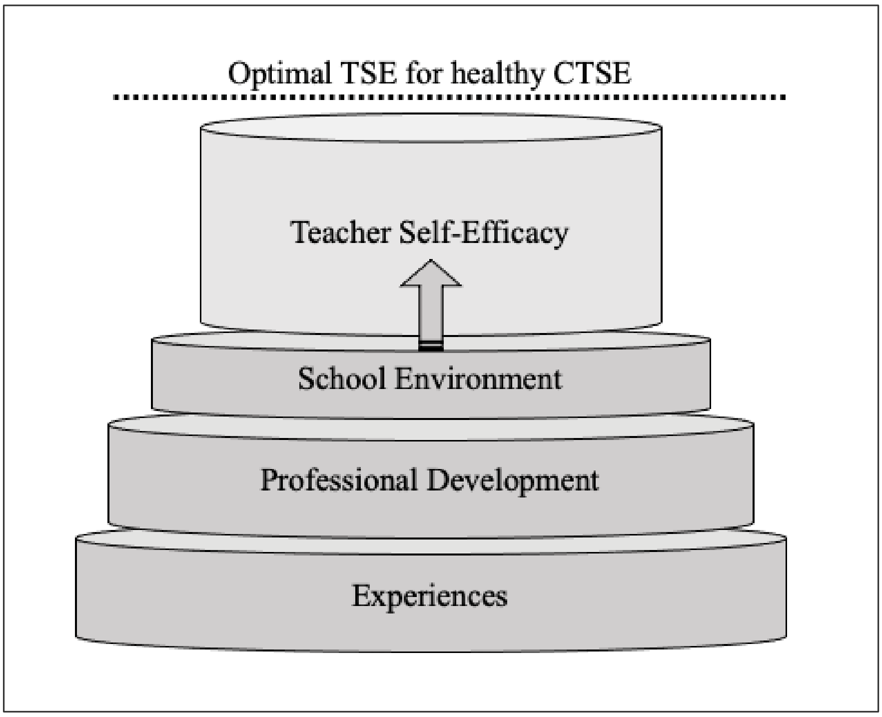

Figure 1. Theoretical model of innovation and teacher self-efficacy

Factors broadly defined as the school environment, teacher experiences, and professional development opportunities work together to support healthy teacher self-efficacy. As each variable increases in strength, teachers'self-efficacy also increases. Conversely, if any of these is underperforming or missing, the potential for a healthy TSE diminishes. The relative strength of TSE for individuals may also affect the CTSE of campus teams. Finding a way to achieve an optimal individual TSE for teachers so that the campus can achieve a strong CTSE for the campus as a whole should be an organizational goal. As each variable increases or decreases, the TSE of an individual also increases. Experience is defined as an individual variable known to affect TSE, such as the reciprocal relationship between teachers and students. School environment includes the innovativeness of the campus and the relative supportiveness of school leadership.

Purpose and Rationale

Considering the potential relationships identified in previous studies of occupational self-efficacy and innovation, further research is required to determine how these relationships interact within the teaching profession. TSE tends to predict higher engagement and job satisfaction, lower levels of burnout, and lower intention to leave the teaching profession (Avanzi et al., 2013; Brouwers & Tomic, 2000; Collie et al., 2012; Klassen & Chiu, 2010; Klassen et al., 2012; Saricam & Sakiz, 2014; Skaalvik & Skaalvik, 2007; 2010; 2011; 2014). Concurrently, contemporary knowledge economies feed an increasing demand for cross-curriculum skills, specifically creative thinking, critical thinking, and problem-solving (Dewett & Gruys, 2007; Mushynska & Kniazian, 2019; Parry, 2018; Schroeder et al., 2013). Moreover, teacher preparation to utilize and teach these cross-curriculum skills is needed in pre-service and continuing professional education (Hocenski et al., 2019). As technology and innovative cross-curriculum programs continue to grow in popularity, teasing out such relationships may have explanatory and predictive power for both researchers and practitioners.

Using Bandura's (1982) framework, this study examined the relationships between two organizational variables and teacher self-efficacy. The first predictor was teachers' perception of the innovative nature of their schools. Specifically, are teachers at school open to change, looking for new ways to teach, and generally supportive of innovative efforts? The second predictor variable was teachers' perception of how well prepared they believed they were to teach cross-curriculum skills such as creative thinking, critical thinking, and problem-solving. Thus, the following hypotheses were tested:

1) Working at an innovative school has a positive effect on teacher self-efficacy.
2) Preparation to teach cross-curriculum skills (e.g., creative thinking, critical thinking, and problem solving) has a positive effect on teacher self-efficacy.

Method

For this descriptive study of United States teachers, we analyzed secondary data from the 2018 Teaching and Learning International Survey (TALIS) implemented by the Organization for Economic Co-operation and Development (OECD, OECD.org, 2020). The psychometric data on the TALIS 2018 survey scales were originally reported in the *TALIS 2018 Technical Report* (OECD, 2019).

Participants

The participants were teachers (*N*=2,560) in the United States. Sixty-seven percent (*n*=1,717) were female, 32.7% (*n*=837) were male, and 0.3% (*n*=7) were not disclosed. The teachers had completed years of experience ranging from 0 to 50 years, with a mean of 13.98 years (*SD*=9.42). Most teachers (98.1%) had a bachelor's degree, and 1.9% had a master's degree.

Measures

The TALIS 2018 Teacher Questionnaire included 58 items, some of which required multiple responses. In this study, we used a portion of the TALIS items described below.

Teacher Self-Efficacy Scale

The TSE Scale (OECD, 2019) measures overall TSE with a three-factor structure; each factor includes four items. In this sample of teachers, the scale had a stratified Cronbach's alpha of 0.911. Each factor also indicted high levels of reliability: (a) classroom management, $\omega = 0.845$; (b) instruction, $\omega = 0.821$; and (c) student engagement, $\omega = 0.801$. Individual factor loadings exceeded 0.500 for all 12 items.

Team Innovativeness Scale

The Team Innovativeness Scale (OECD, 2019) measures teachers' perceptions of how their campus team (a) developed new ideas for teaching and learning, (b) was open to change, (c) searched for new ways to solve problems, and (d) provided practical support for each other in the application of new ideas. The four-item scale demonstrated high internal consistency, $\omega = 0.889$, and individual item loadings greater than .700 on all four items. The model fit indices are presented in Table 1. In this scale, it is important to note that team innovativeness was a measurement of the campus-wide teacher team, and not smaller sections of teams such as vertical teams, content teams, or teacher PLC groups.

Preparation to Teach Cross-curriculum Skills

In the TALIS data collection, teachers were asked about the elements of their pre-service programs and how prepared they believed they were to implement those elements. Teachers responded to a single item regarding their preparation for teaching cross-curriculum skills. Specifically, the item asked "how prepared do you currently feel to teach cross-curriculum skills (such as creative thinking, critical thinking, and problem-solving)?". Responses were provided on a Likert scale (1-not at all prepared, 2-somewhat prepared, 3-well prepared, 4-very well prepared).

Analysis

Previous research has indicated that structural equation modelling (SEM) is the suggested method for examining TALIS TSE data (Scherer et al., 2016); therefore, the research questions were addressed using SEM with sample and replicate weights. Both models were estimated in M*plus* (*v*.8.7; Muthén & Muthén, 2017) using maximum likelihood with robust standard errors, because this estimator corrects for non-normality and can be used with replicate weights (Stapleton, 2008). The fit results were reported for the model estimated with sample weights; fit statistics were not available for models using replicate weights (Muthén & Muthén, 2017). The Comparative Fit Index (CFI) and the Tucker Lewis Index compare the current model to a baseline, and values exceeding .95 for either index are interpreted as good model fit (Hu & Bentler, 1999). In addition, model fit interpretations typically include indicators such as the Root Mean Square Error of Approximation (RMSEA) and Standardized Room Mean Square Residual (SRMR). RMSEA provides an indication of model parsimony with values less than .05, interpreted as a lack of bad fit given the number of parameters. SRMR provides information about the correlation residual with values below .08, indicating a good model fit (Hu & Bentler, 1999; Kenny & McCoach, 2003). The last indicator of fit, a non-significant chi square, is difficult to achieve with large samples because of limitations in the way the chi square is calculated (Schumacker & Lomax, 2004), but a useful measure of fit can be calculated by using the chi square value divided by the degrees of freedom. This value should be less than five. No modification indices will be used, and residuals will not be correlated; correlated residuals may improve model fit but should only be used if the theoretical framework supports them. Parameter estimates are reported for the model using sample and replicate weights because standard errors on the sample and replicate weight models are considered the most accurate (Muthén & Muthén, 2017).

Results

The TSE and team innovation model was estimated twice with sample weights to provide fit statistics and once with sample and replicate weights to provide parameter estimates with correct standard errors. For the sample weight model, the multiple fit statistics indicated that the model fitted the data. While the chi square value is significant, $\chi^2(111) = 464.61$, $p < .001$, models with large sample sizes often return a significant chi square even when the model demonstrates adequate fit by other standards (Schumacker & Lomax, 2004). The final sample-weighted model containing all factors resulted in CFI = .95, TLI = .94, RMSEA = 0.045, 95% CI [0.042;0.048], and SRMR = .03. All fit statistics indicated the global fit of the model to the data and suggested model parsimony. Dividing the chi-square value by the degrees of freedom yields a value of 4.18, which is below the acceptable value of five. The correlation matrix for all the variables is presented in Table 1, and the general descriptive data are presented in Table 2. Examination of the loadings also revealed no evidence of local strain in the final model.

Table 1. Correlation Matrix

n =2,519	(1)	(2)	(3)
(1) Self-Efficacy: Classroom Management	-		
(2) Self-Efficacy: Instruction	.495**	-	
(3) Self-Efficacy: Student Engagement	.506**	.595**	-
(4) Team Innovativeness	.116**	.091**	.177**

Note: ***p* <.01

Table 2. Descriptive Data

(N=2,425)	Mean (SD)	Min	Max
Teacher Self Efficacy Total	12.83 (1.92)	4.00	16.00
TSE: Classroom Management	13.13 (2.36)	4.00	16.00
TSE: Instruction	13.08 (2.15)	4.00	16.00
TSE: Student Engagement	12.26 (2.48)	4.00	16.00
Team Innovativeness	11.78 (2.38)	4.00	16.00
Prepared to Teach Cross-Curricular Skills	2.78 (0.87)	1.00	4.00

TSE=Teacher Self Efficacy

Self-Efficacy, Cross-curriculum Preparation, and Team Innovation

The structural part of the model (see Figure 2) addressed both hypotheses about the relationships between teacher preparation to teach cross-curriculum skills and campus innovation and the three categories of TSE. Standardized estimates are reported below, and Table 3 in the appendix contains both standardized and unstandardized estimates. Standardized estimates can be interpreted as effect sizes using a scale similar to Pearson's *r* (*i.e.*, small =.1, medium = .3, and large =.5; (Field, 2017; Geiser, 2013)), which allows readers to judge the strength or magnitude of relationships between variables within the same model.

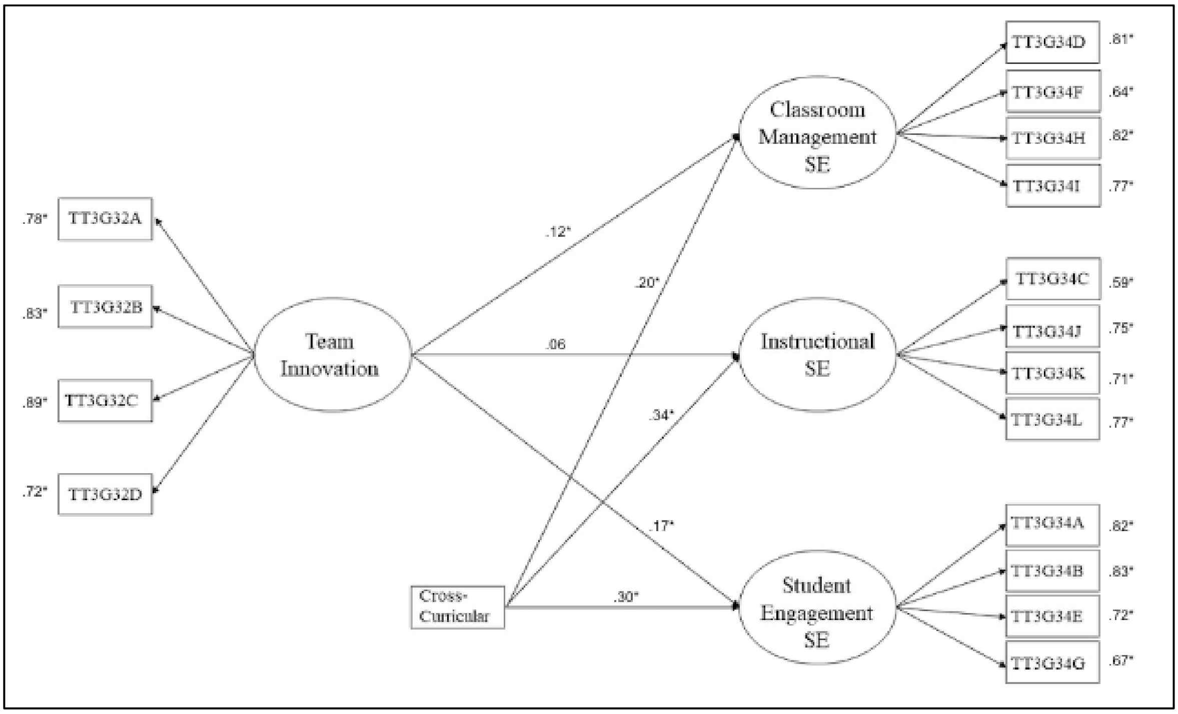

Figure 2. Conceptual Model of potential influences on TSE, * indicates $p < .001$

We rejected the first null hypothesis that there is no relationship between working at an innovative school and teacher self-efficacy. Working at an innovative school was related to teacher self-efficacy; however, the effect was small. The relationship was estimated for all three factors of teacher self-efficacy: classroom management self-efficacy ($\beta = .12$, $p < .001$), instructional self-efficacy ($\beta = .06$), and student engagement self-efficacy ($\beta = .17$, $p < .001$). When teachers perceive that they work at an innovative school, this perception tends to have a small positive effect on their teacher self-efficacy; however, the impact on instructional self-efficacy is perhaps negligible.

We also rejected the second null hypothesis, that there is no relationship between teachers' preparation to teach cross-curriculum skills and teacher self-efficacy. Feeling prepared to teach cross-curriculum skills, such as creative thinking, critical thinking, and problem solving, had a positive effect on teacher self-efficacy. Similarly, the effects were estimated for all three factors of teacher self-efficacy: classroom management self-efficacy ($\beta = .20$, $p < .001$), instructional self-efficacy ($\beta = .34$, $p < .001$), and student engagement self-efficacy ($\beta = .30$, $p < .001$). When teachers perceive that they are well prepared to teach cross-curriculum skills, perceived preparation yields small to medium effects on their teacher self-efficacy, with the smallest impact in the area of classroom management self-efficacy.

Discussion

Self-efficacy in general and TSE in particular tend to influence how teachers approach their work. In almost all professional circumstances, higher teacher self-efficacy is more desirable than lower self-efficacy. Thus, there is practical value in determining the factors that influence higher levels of teacher self-efficacy. Teachers with higher self-efficacy are more satisfied with their jobs, more willing to learn and grow professionally, and are better at managing work-related stress (Klassen & Chiu, 2010; Marjolein & Helma, 2016). This study tested two possible variables that might logically be related to teacher self-efficacy, and the results suggest that efforts to improve both variables may also raise the levels of teachers' self-efficacy.

Working at an innovative campus had a small positive effect on teacher self-efficacy. Self-efficacy may be influenced by the organizational environment or, at least, by teachers' perceptions of the environment (Bandura, 2000; Friedman, 2003). Friedman and Kass's (2002) conception of teacher self-efficacy includes not only teachers' personal efficacy beliefs but also teachers' beliefs about the organization and their relationships with others in the organization, which in this case is the school. The effects on self-efficacy for working at an innovative school were small but interesting in that they may support this conception of teacher self-efficacy as both personal and organizational. Similarly, Dampérat et al. (2016) and Somech and Drach-Zahavy (2013) found that individuals draw on the collective efficacy of a cohesive group to increase creative TSE. The impact of the school or fellow faculty members at TSE merits further study, in which team innovation is conceptualized in a broader category of organizational variables affecting TSE.

Conceptions of 21st Century education and the automation economy have increased an emphasis on teaching cross-curriculum skills, such as creative thinking, critical thinking, and problem-solving. These skills are cross-curriculum in that they are expected to be taught, modeled, and assessed across all disciplines of the curriculum. Some research (Author, 2016) suggests that teachers commonly misunderstand creativity and how to teach creative thinking. Similarly, teachers may have little training in teaching critical thinking or problem-solving skills (Abrami et al., 2015). Teachers who believed that they were well prepared to teach these skills tended to have a higher TSE on all three subscales.

Summary

These findings provide avenues for future research and have potential immediate practical implications. The mid-level positive predictability between cross-curriculum skills training and TSE in instruction and student engagement indicates that teachers are strengthened by preparing to teach skills that are most important to students. Indeed, even as greater emphasis has been placed on teaching cross-curriculum skills, such as creativity, problem solving, and communication, teachers still struggle to prove it in teaching in the classroom (Aldossari, 2021). As these skills are crucial to future student success, it follows that preparation for these skills and the subsequent boost in TSE that teachers receive from that preparation are key to students' actualization of these skills (DiBenedetto & Meyers, 2016).

Additionally, given previous research suggesting that principal support and approachability positively impact TSE (Aldridge & Fraser, 2016), it would be interesting to see whether other interorganizational factors may also contribute to building the individual and collective self-efficacy of campus teams. A potential avenue for future research would be to consider whether teacher data and principals' innovative team perceptions are related, as well as whether these relationships impact TSE. Another interesting question is whether specific types of educational organizations, such as Montessori, PTech, or IB schools, which are designed to emphasize cross-curriculum skills, promote greater preparation more directly for those skills in teachers, and whether teachers in those institutions have significant differences in TSE than their peers working in traditional school environments. We plan to pursue additional research comparing the data obtained in this study to principal data from the same TALIS survey to determine the relationships between perceptions of leadership and the perceptions of the teachers themselves.

Limitations

While we were able to determine positive relationships between preparation to teach cross-curriculum skills, innovative schools, and TSE, the use of TALIS data precluded gaining an understanding of one aspect of our theoretical model. These data were not useful in determining the optimal individual TSE for the campus to achieve an optimal collective TSE or CTSE. As the relationship between CTSE and innovative output requires a delicate balance (Park et al., 2021), it is important to determine how this balance can be achieved. Future research should examine the relationship between individual and collective TSE to determine whether there is a quantifiable optimum amount of CTSE to support innovation in schools. Rather than stopping at the theoretical implications of this research, future research should examine the practical application of adjusting organizational factors to achieve and maintain an optimal CTSE to create an atmosphere in a school or district where innovative output is maximized. This requires design thinking while structuring research that will allow for testing and adjusting organizational variables to find the sweet spot for optimal CTSE.

One caution for this type of future research is that it is often difficult to adjust for many organizational variables at play. While the amount and quality of professional development are more easily addressed, it is unlikely that a researcher will be able to change the leadership style on campus or address some of the classroom issues that teachers face. It is impossible to control for all potential experiences that a teacher would have, and indeed all that a team would experience collectively. Therefore, future studies should be conducted cautiously. Perhaps research that seeks to first examine schools that are similar in organizational environments, and later different in organizational environments in order to determine what is actually impacting TSE and CTSE would be beneficial. The potential for confounding variables was high. Utilizing qualitative research methods and longitudinal studies may allow us to determine whether specific organizational and professional development variables affect the attainment of optimal TSE. Qualitative studies should focus on determining how a principal might be able to identify what it looks like when optimal CTSE is reached, and how variables might be adjusted during the course of normal practice to reach and maintain that CTSE.

In addition, it is possible that what is determined to be an optimal CTSE may itself vary depending on context. For example, the unexpected impact of the COVID 19 pandemic and the dramatic shift to online schooling for many teachers may have required a different optimal CTSE than when the school was conducting a session in its usual format. Additionally, disruptions to the school environment, such as significant leadership changes, shifts to different schooling models, or disruptions due to natural disasters, may also affect the necessary optimal CTSE. Nevertheless, the next step should be to determine what an optimal CTSE looks like and how it might be balanced by supporting an individual TSE.

In any case, the further study of teacher self-efficacy and organizational innovativeness should be examined. As we enter a new world of technological innovation, we are preparing a generation for occupations that may not yet exist. The potential of the next generation to adapt and innovate in this unknown future is tightly bound to teachers' self-efficacy and abilities. As a result of the last several years of disruption to the educational community, identifying factors that may draw teachers into the profession and encourage teacher retention has become increasingly valuable. Determining the impact of TSE and how these variables can be manipulated to create optimal CTSE and innovative output are important goals for educational research and practice.

Acknowledgements or Notes

The authors thank the reviewers for giving of their time and attention in support of the peer review process.

Authors Contribution Rate

Celeste Sodergren: Concept and design, acquisition of data, analysis and interpretation, drafting, revising, approval. **Todd Kettler:** Concept and design, analysis and interpretation, drafting, revising, approval. **Tracey**

Sulak: Concept and design, analysis and interpretation, drafting, approval. **Anna Payne:** Analysis and interpretation, drafting, approval.

Conflicts of Interest

The authors declare no conflicts of interest. This study did not receive any specific grants from funding agencies in the public, commercial, or non-profit sectors.

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Appendix

Table 3. Standardized and unstandardized estimates from structural equation modeling

Parameter Estimate	Unstandardized	Standardized
Measurement Model Estimates		
Team Innovation		
TT3G32A- Teachers strive for new ideas	1.00	.78*
TT3G32B- Teachers open to change	1.08 (.04)	.83*
TT3G32C- Teacher look for new ways to solve problems	1.18 (.04)	.89*
TT3G32D- Teachers give each other practical support	0.95 (.05)	.72*
Class Management Self-Efficacy		
TT3G34D- Control disruptive behavior	1.00	.81*
TT3G34F- Make behavioral expectations clear	0.69 (.02)	.64*
TT3G34H- Get students to follow classroom rules	0.93 (.04)	.82*
TT3G34I- Calm a disruptive or noisy student	0.97 (.02)	.77*
Instructional Self-Efficacy		
TT3G34C- Craft good questions for students	1.00	.59*
TT3G34J- Use a variety of assessment methods	1.37 (.06)	.75*
TT3G34K- Provide alternative explanations	1.13 (.07)	.71*
TT3G34L- Vary instructional strategies	1.37 (.07)	.77*
Student Engagement Self-Efficacy		
TT3G34A- Get students to believe in self	1.00	.82*
TT3G34B- Help students value learning	1.10 (.02)	.83*
TT3G34E- Motivate students	0.94 (.03)	.72*
TT3G34G- Help students think critically	0.80 (.05)	.67*
Structural Model Estimates		
Team Innovation on TSE-Class Management	0.13 (.04)	.12*
Team Innovation on TSE-Instructional	0.04 (.02)	.06
Team Innovation on TSE-Student Engagement	0.19 (.03)	.17*
Cross-Curricular Skills on TSE-Class Management	0.12 (.02)	.20*
Cross-Curricular Skills on TSE-Instructional	0.13 (.01)	.34*
Cross-Curricular Skills on TSE-Student Engagement	0.18 (.02)	.30*
Instructional TSE with Class Management TSE	0.12 (.01)	.54*
Instructional TSE with Student Engagement TSE	0.17 (.01)	.52*
Student Engagement TSE with Class Management TSE	0.13 (.01)	.60*

Note. *$p < .001$