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Personal and Contextual Attributes Predicting Agriscience Teachers' Self-Efficacy in Texas High Schools

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Abstract

Enhancing the self-efficacy of agriscience teachers can help address the challenges of attrition and ensure the continuity of agricultural education in secondary schools and universities. Unfortunately, high school agriscience teachers face unique challenges that lead to dissatisfaction and burnout, causing many to leave the profession within two to seven years of starting their careers. On the other hand, research has shown that higher self-efficacy has a positive impact on teachers' performance, motivation, and perseverance, which may, in turn, foster a more satisfied and committed future workforce. This study aimed to predict agriscience teachers' self-efficacy from selected factors, including mentorship, job satisfaction, burnout, gender, teaching experience, and school context. Data were collected online using Qualtrics from a convenience sample of 122 agriscience teachers at secondary schools in Texas. The data were analyzed through STATA using binary logistic regression. The results indicated that the binary logistic model was statistically significant, $\chi 2(10) = 48.59$, $p < .001$, McFadden's $R^2 = .30$, suggesting that teaching experience, personal accomplishment, and job satisfaction contributed to the likelihood of teachers reporting a high level of self-efficacy. Notably, gender had a statistically significant negative effect on teaching self-efficacy. These findings highlight the urgent need for targeted strategies that enhance job satisfaction and support teacher retention, ultimately fostering stronger self-efficacy among agriscience educators.

Introduction

The increasing global demand for agricultural products, combined with the limited participation of many Americans in farming (Roberts et al., 2016), highlights the need to educate all concerned stakeholders,

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including the public and agricultural policymakers, about agricultural principles. This education is essential for engaging them in agricultural issues (Roberts et al., 2020; Roberts et al., 2016; Talbert et al., 2022). Secondary school agriculture can significantly promote agricultural literacy while also getting students interested and informed about food and fiber systems, including their economic prospects, historical context, and social and environmental impacts (National Research Council, 1998; Roberts et al., 2020). In the United States, agricultural literacy efforts target a wider audience, including those without any knowledge of the intricacies of agriculture (Mercier-Laurent, 2015). According to Roberts et al. (2016), a positive attitude is essential for achieving high levels of technological dissemination, adoption, increased productivity, and the ongoing sustainability of agricultural training institutions. Other researchers have supported this claim by demonstrating a connection between the increased willingness to adopt water-saving and treatment innovations and the positive attitudes of nursery and greenhouse operators (Lamm et al., 2017).

Despite the role of agricultural instruction in equipping students with insights and abilities pertinent to agriculture in formal learning institutions, attrition continues to surge within the teaching profession, thereby challenging the sustenance of formal agricultural education programs (Kantrovich, 2010; Roberts et al., 2020). Researchers have consistently reported alarming proportions of teachers quitting the profession after a few years of beginning their teaching appointment (Blackburn et al., 2017; Ingersoll, 2002). This phenomenon not only jeopardizes the sustained flow of agricultural knowledge but also triggers unwarranted expenses linked with the training and replacement of teachers (Blackburn & Robinson, 2008; Kantrovich, 2010). High school agricultural education requires teachers to perform multiple roles, including classroom instruction, mentoring FFA chapters, and supervised agricultural experience (SAE) projects (Lemons et al., 2015; Shoulders & Toland, 2017). The agricultural program, being a three-component model, brings additional demands on agriscience teachers, thereby becoming even more challenging for those new to the profession (Lemons et al., 2015). Most agriscience teachers have perceived the SAE element as a big challenge (Robinson & Haynes, 2011). It draws from the Smith-Hughes Act of 1917 and requires agricultural projects beyond conventional classroom and laboratory settings (Robinson & Haynes, 2011). The project-based method within SAE aims to cultivate experiential learning and enrich students' understanding of agriculture (Dyer & Williams, 1997). Despite this, many agriscience teachers have consistently sought supplementary training to boost their confidence and skills in designing, implementing, and managing SAE projects (Toombs et al., 2022).

The Agricultural Teachers Association of Texas (ATAT) website 2020 listed challenges agriscience teachers face, including classroom management, interpersonal relationships, and work-life balance. Newly employed teachers struggle with the demanding responsibilities of overseeing the entire FFA program, organizing livestock shows, and managing booster club activities, including competitive leadership and judging (ATAT, 2020; Murray et al., 2011). Compared to other disciplines, agriscience teachers work an additional ten hours per week, totaling fifty-seven (Sorensen & McKim, 2014). This demanding profession and significant time commitment have been consistently linked to higher attrition rates among agricultural teachers (ATAT, 2020; Blackburn et al., 2017; Blackburn & Robinson, 2008).

Enhancing student success is pegged on school districts and administrators' ability to attract and retain well-trained and committed teachers (Darling-Hammond, 2003). Consequently, school districts traditionally employ induction and training programs to equip secondary agriculture teachers with the skills needed to navigate the complexities of the teaching profession (Talbert et al., 1994). According to Talbert et al. (1994), these induction and training programs should strategically equip agriscience teachers with the needed competencies (Talbert et al., 1994). Previous research, including the present study, has identified key factors, particularly self-efficacy, job satisfaction, burnout, and school climate, as significant influences on teacher turnover in agriscience (Blackburn et al., 2017). For instance, a sufficient level of self-efficacy has been found to reduce teacher attrition (Blackburn & Robinson, 2008). Thus, it is recommended that

efforts be made to maintain a strong sense of self-efficacy among teachers to combat the non-ending attrition that has consistently affected the teaching profession.

According to Bandura and Wessels (1994), self-efficacy defines an individual's strong belief in their abilities to achieve specific life goals. It involves strategizing and executing the requisite actions for accomplishing desired outcomes across varying contexts (Bandura, 1986). Thus, fostering teachers' self-efficacy significantly and positively impacts teaching efficacy, motivation, and overall well-being (Bandura, 1997; Bandura & Wessels, 1994). Research suggests that educators with high self-efficacy excel in classroom management, inspire students, and create effective instructional plans (Tschannen-Moran et al., 1998). Thus, nurturing self-efficacy helps establish a supportive learning environment and catalyzes students' cognitive advancement and the overall vitality and well-being of learning institutions (Bandura, 1993, 1997).

It is reasonable to assert that teachers with high self-efficacy are valuable assets to schools. These teachers consider challenges as opportunities for growth, not threats, and attribute failures to a lack of effort (Bandura, 2010). Their belief in their agency defines their confidence to succeed in classroom instruction while effectively attending to the diverse needs of learners (Bandura, 1986, 1997). Moreover, teachers with a strong sense of self-efficacy tend to experience low-stress levels (Bandura, 2010) and exhibit increased motivation and a strong commitment to their work (Whittington et al., 2003). Research also indicates that high self-efficacy among teachers is linked to professional longevity, thereby saving schools money that would otherwise be spent on rehiring and retraining (Darling-Hammond et al., 2002; Judge et al., 1998).

Self-efficacy levels can vary and have different impacts depending on the context. Research has shown that new teachers often perceive the act of teaching as a significant challenge (Ingersoll, 2002; Siwatu, 2011), whereas more experienced ones often demonstrate a sense of mastery and confidence in their teaching (Bandura, 1994; Darling-Hammond et al., 2002). Bandura (1997) explains that self-efficacy develops gradually following successful experiences. Recent studies suggest that self-efficacy rises following successes and declines after failures (Wilson et al., 2020).

Regarding the impact of self-efficacy, some scholars have reported that teachers with high teaching self-efficacy exhibit greater job satisfaction than those who doubt their teaching abilities (Bandura, 1994; Klassen & Chiu, 2010). Teachers with established self-efficacy report higher levels of job satisfaction because of their consistency in meeting teaching performance standards (Bandura, 1997; Tschannen-Moran & Hoy, 2007). Research also suggests that educators with adequate self-efficacy levels experience low-stress levels and feelings of depression (Bandura, 2010; Tschannen-Moran & Hoy, 2007). Therefore, it is essential to establish mechanisms that promote teachers' professional fulfillment, as job satisfaction significantly influences their decisions to stay in or leave the profession (Blackburn & Robinson, 2008). In other words, a solid foundation enhances teachers' confidence and reduces burnout, increasing their commitment to the profession (Ingersoll, 2002; Whittington et al., 2006).

On the other hand, burnout negatively impacts teachers' instructional efficacy, overall well-being, and job satisfaction, often causing them to develop pessimistic attitudes toward teaching (Chaplain, 2008). In agriscience, burnout has been identified as the leading contributor to teacher attrition (Hasselquist et al., 2017; Pas et al., 2012; Roberts & Dyer, 2004; Strong, 2005). The demanding nature of the agriscience teaching profession, combined with longer hours and responsibilities such as FFA programs, livestock shows, and booster club activities, potentially result in burnout among agriscience teachers (Murray et al., 2011). However, empirical evidence underscores the potency of mentorship in enhancing teaching self-efficacy (Chizhik et al., 2018; Ingersoll & Strong, 2011; LoCasale-Crouch et al., 2012; Yost, 2002) and potentially mitigating burnout (Bandura, 2010). Furthermore, the dynamics of teaching self-efficacy can vary as influenced by factors such as teachers' gender (Bautista, 2011; Felicia, 2005; Odanga et al., 2015) and the contextual environment of the school (Hasselquist et al., 2017).

Literature Review of Empirical Studies

This literature explores agriscience teachers' self-efficacy, promoting an understanding of the various foundational theories and antecedents that influence self-efficacy in agricultural education. Several studies on agriscience have utilized diverse theoretical frameworks, measurement tools, and statistical methodologies to explore the complex aspects of agriscience educators' self-efficacy (Blackburn et al., 2017; Blackburn & Robinson, 2008; Hasselquist et al., 2017; Korte, 2017; Marx et al., 2014; Stripling et al., 2008; Stripling & Roberts, 2013; Wang et al., 2016).

Blackburn et al. (2017) applied the attribution theory to study the dynamic interrelationship between self-efficacy, job satisfaction, and work-life perceptions among Louisiana's agricultural educators. Their results revealed a strong positive correlation between educators' self-efficacy and job satisfaction and a moderate correlation between job satisfaction and work-life dynamics. Similarly, Blackburn and Robinson (2008) utilized Bandura's (1977) seminal self-efficacy theory to study the relationship between self-efficacy and job satisfaction among novice agriscience teachers in Kentucky. Their study established a link between job satisfaction and various self-efficacy constructs—student engagement, classroom instruction, and classroom management.

Hasselquist et al. (2017), also using Bandura's (1997) self-efficacy theory, looked at the relationship between educators' self-efficacy and overall job satisfaction using a multiple-stepwise linear regression. Hasselquist et al. (2017) found a combined linear effect of various support mechanisms, including parental, collegial, administrative, and financial dimensions, on agriscience educators' self-efficacy and job satisfaction. Their findings revealed the key role of school districts, administrative leadership, collegial support, and financial systems in elevating educators' job satisfaction. Korte (2017) studied the influence of information sources and support networks on the self-efficacy of fledgling agriscience educators in Indiana and Illinois. Anchored within the framework of social support models (Cohen & Willis, 1985), outcome expectancy constructs (Bandura, 1997), and the teacher efficacy model (Tschannen-Moran & Woolfolk Hoy, 2001), Korte's (2017) results revealed that educators' perceptions of support from educational spheres – notably students and the community – emerged as the preeminent determinant contributing to the variance observed in their self-efficacy. This finding intriguingly diverged from the established tenets that position mastery experiences as the most influential source of efficacy information.

Furthermore, the scrutiny of self-efficacy within agriscience education has spanned multiple educational epochs. Marx et al. (2014) applied the social cognitive career theory (Lent et al., 1994) to understand the relationship between career choice self-efficacy, participation in career development initiatives, and years of FFA membership among agricultural education pre-service teachers. They found a significant association between participation in career development and pre-service teachers' self-efficacy in making career decisions compared to their FFA membership duration. Meanwhile, Stripling et al. (2008) examined the self-efficacy of pre-service agricultural education teachers enrolled at institutions at the University of Georgia and Texas A&M. Anchoring their inquiry within the theoretical frameworks of Bandura's social cognitive (1986) and self-efficacy (1997) theories, their empirical examination involved one-group pretest-posttest survey model. They aimed to detect any variance in teaching self-efficacy for student engagement, instructional strategies, and classroom management– before and after a teaching methods course and student teaching. The findings revealed elevated self-efficacy scores across the three interventions, with instructional self-efficacy leading, followed by classroom management and student engagement.

Although the growing body of literature reveals progress on self-efficacy in agriscience education, a consistent unified approach is still needed. Scholars have followed a range of theoretical frameworks (Blackburn et al., 2017), Bandura's self-efficacy theory (Blackburn & Robinson, 2008; Hasselquist et al., 2017; Stripling et al., 2008), Bandura's social cognitive theory (Stripling et al., 2008), social cognitive

career theory (Marx et al., 2014), and the teacher efficacy model (Tschannen-Moran et al., 1998). The applications of different theories have resulted in conflicting conceptualizations and measurements of self-efficacy. Furthermore, the reviewed studies regard different populations—novice teachers (Blackburn et al., 2017; Blackburn & Robinson, 2008; Korte, 2017)—further complicating the development of a standardized framework. Thus, while progress continues, agriscience teaching self-efficacy scholars should propose a common theoretical and methodological framework for examining the field.

Even with diverse theoretical and methodological approaches, a consistent pattern is evident across the papers regarding sources of self-efficacy information. Most outstanding—self-efficacy is positively correlated with contextual and support-related factors. The sources include a healthy work-life balance, institutional and peer support, and availability of financial resources, all of which not only elevate self-efficacy but also contribute to overall job satisfaction (Blackburn et al., 2017; Blackburn & Robinson, 2008; Hasselquist et al., 2017). External sources of support, for instance, the perceived encouragement from students and the wider school community, significantly increase teachers' sense of teaching capabilities (Hasselquist et al., 2017). Bandura (1997) considers encouraging comments among positive verbal persuasions/ feedback. Korte (2017), on the other hand, found that teachers perceived institutional support as the most impactful source of self-efficacy, contradicting the dominant hypothesis by most self-efficacy scholars that mastery experience is the most impactful source of self-efficacy beliefs. Career development initiatives have been shown to impact self-efficacy, with participation in such programs enhancing the pre-service teachers' confidence in their career choices (Marx et al., 2014).

Furthermore, a good number of these studies examined the three highly recommended primary domains of teaching self-efficacy (Tschannen-Moran & Woolfolk Hoy, 2001; Tschannen-Moran & Hoy, 2007; Tschannen-Moran et al., 1998): classroom instruction, student engagement, and classroom management (Blackburn & Robinson, 2008; Stripling et al., 2008). The findings indicate that instructional methodologies, particularly micro-teaching, greatly impacted teachers' confidence in classroom instruction and student engagement. In other words, the instructional self-efficacy domain emerged as the most improved, followed by classroom management and student engagement (Blackburn & Robinson, 2008; Stripling et al., 2008). In short, these studies show that self-efficacy is a multifaceted construct. They also showcase how various information sources, such as job satisfaction, external support systems, career development opportunities, and teaching competencies, impact teachers' self-perceptions and effectiveness. This information could help school districts and administrators understand better and implement strategies to elevate teaching self-efficacy within agriscience.

Theoretical Frameworks

The Social Cognitive Theory

The social cognitive (Bandura, 1986, 1997) and teacher efficacy models (Tschannen-Moran et al., 1998) were used as the theoretical framework in this study to discuss, measure, and predict agriscience teaching self-efficacy. The social cognitive theory postulates that human actions result from triadic relationships between personal, social, and environmental variables (Bandura, 1986). The social cognitive theory derives from the agentic view that people are self-developing, self-regulating, self-reflective, and proactive (Bandura, 1986, 2005). Individuals actively engage in certain activities and behaviors to achieve their life goals, not just passively produced by their environments (Pajares et al., 2009). Self-efficacy is a subset of the social cognitive theory depicting peoples' believed capability to perform given skills (Bandura, 1997). Self-efficacy measures a person's perceived ability to complete a task within a given context and achieve the desired outcome (Bandura, 1997).

Efficacy beliefs are capability judgments tailored to a specific outcome and should be measured at an appropriate level of specificity (Bong, 2006) or closer to the prediction target (Bandura, 1997). Self-efficacy items should thus focus on self-assessed confidence- whether one can successfully execute the

expected behavior under specified circumstances (Bong, 2006). Therefore, self-efficacy should contain verbs like 'can' or 'be' able to solicit mastery expectations based on personal competence: Each statement should start with 'I' to gauge the individual's capability (Bandura, 1997; Bong, 2006). Teaching self-efficacy is the teacher's perceived ability to plan, organize, and carry out specific teaching tasks within a given school context (Bandura, 1997; Tschannen-Moran et al., 1998). Since teaching is context-dependent, teachers' self-efficacy often varies depending on the prevailing circumstances and exposure to the four information sources (Tschannen-Moran et al., 1998; Tschannen-Moran & Hoy, 2001). Teaching self-efficacy in the present study referred to Texas agriscience teachers' perceived ability to successfully teach (Tschannen-Moran & Hoy, 2001) measured as an index of a weighted average of the three self-efficacy constructs- instructing, engaging students, and managing classrooms.

The Cyclical Nature of Teaching Efficacy

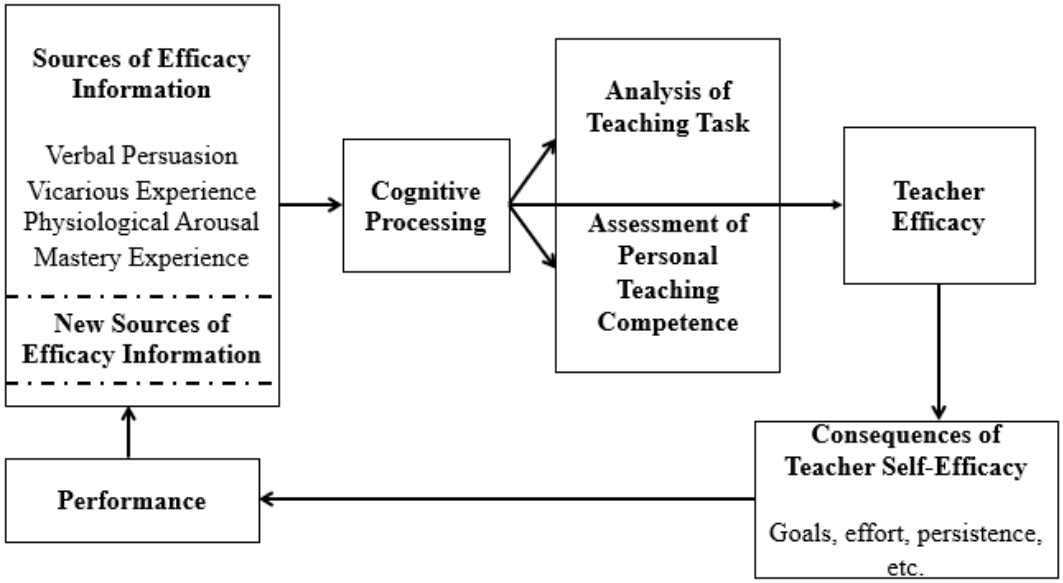
Tschannen-Moran et al. (1998) expanded the socio-cognitive theory to provide a comprehensive conceptual elucidation of the cyclical nature of teaching self-efficacy. As illustrated in Figure 1, the teacher efficacy model suggests that teachers instinctively evaluate their capabilities and constraints when faced with teaching tasks (Tschannen-Moran et al., 1998). The primary sources of the teachers' self-evaluation include verbal persuasions, vicarious experiences, mastery experiences, and physiological arousal (Tschannen-Moran et al., 1998). The impact of each source on task analysis, self-perceived proficiency, and teaching self-efficacy depends on the cognitive evaluations that teachers assign to each source (Tschannen-Moran et al., 1998). Tschannen-Moran et al. posit that the influence of each efficacy source varies depending on how teachers recall, relate to, and reflect on them. External factors such as resource constraints and other pedagogical elements significantly shape teaching performance.

Moreover, personal, social, and situational factors also mediate the impact of each information source on teaching self-efficacy (Tschannen-Moran et al., 1998). Empirical research supports Bandura's (1997) and Tschannen-Moran et al.'s (1998) claim that mastery experience is the most influential source of efficacy (Capa Aydin et al., 2018; Loo & Choy, 2013; Usher & Pajares, 2006). The level of self-efficacy has significant implications (Tschannen-Moran et al., 1998; Wilson et al., 2020). Teachers with higher self-efficacy are more likely to set better objectives and invest the necessary efforts needed to overcome any challenges foreseen to their teaching performance, both in the present and the future (Tschannen-Moran et al., 1998).

The conceptual framework in the present study is based on the cyclical teacher efficacy model (depicted in Figure 1), which proposes that various teacher-specific and contextual factors contribute significantly to the likelihood of either high or low self-efficacy among agriscience teachers. Importantly, the complex cognitive processing of self-efficacy and the varying impacts of each information source are beyond the scope of this study. Instead, this study examines teaching self-efficacy as a binary outcome (low and high) to determine selected predictors that potentially elevate or diminish the presence of self-efficacy.

Figure 1

A Model of the Cyclical Nature of Teacher Efficacy



Source. Tschannen-Moran et al. (1998)

Purpose & Research Objectives

The purpose of the study was to describe the personal and contextual characteristics of Texas secondary agriscience teachers and determine their predictive effect on teaching self-efficacy. The study specifically sought to:

1. To describe personal and contextual characteristics of agriscience high school teachers in Texas.
2. To determine the log odds of teachers having high teaching self-efficacy as predicted by

mentorship, job satisfaction, burnout, gender, teaching experience, and school context.

Methods

Research Design

The study used a non-experimental, cross-sectional, predictive survey design (Fraenkel et al., 2015; Johnson, 2001) to examine how personal and contextual attributes predict agriscience teachers' self-efficacy.

Participants and Sampling

After obtaining the approval from the Texas Tech University's Institutional Review Board (IRB), an online survey was built in Qualtrics™, piloted in other states, and later administered to all agriscience teachers in Texas secondary schools through the Executive Director of the ATAT program via email. The Survey development and administration were based on the guidelines by Dillman (2014). A convenience sample of 122 teachers in Texas fully completed the survey, resulting in a 15% non-response rate. Although convenience sampling limits generalizability, the researcher's primary selection criterion was related to the ease of obtaining a sample (see Hibberts et al., 2012). To minimize non-response bias, the researchers adhered to guidelines established by Dillman et al. (2014) by pre-testing demographic items with Texas

Tech agricultural education graduate students. The authors then piloted the entire instrument with agriscience teachers in other states. Additionally, the researcher randomized question blocks to vary item order, sent two reminders each week to encourage completion, assured respondents of their anonymity, collected no identifying information, and excluded incomplete or inattentive responses from the analysis (see Dillman et al., 2014).

Data Collection

The survey instruments used in the present study—measuring teaching self-efficacy, sources of self-efficacy, burnout, and job satisfaction—have been extensively employed and validated across various educational and cultural contexts (e.g., Klassen et al., 2009; Tschannen-Moran & Hoy, 2001; Suen & Ary, 2014; Guadagnoli & Velicer, 1988; Pfitzner-Eden, 2016; Chang, 2013; Gold, 1984; Kokkinos, 2006; Maslach, 1986; Judge et al., 1998). To ensure contextual fit in the present study, all instruments were pre-tested and piloted with agriscience teachers from outside Texas. Post-hoc reliability analysis confirmed acceptable internal consistency with all Cronbach's alpha coefficients well within acceptable levels of .70 threshold (Nunnally, 1978): Classroom Management (.86), Student Engagement (.74), and Instructional Strategies (.84) for the teaching self-efficacy construct; Emotional Exhaustion (.92), Personal Accomplishment (.71), and Depersonalization (.65) for burnout; Mastery Experience (.82), Vicarious Experience (.91), Verbal Persuasion (.90), and Psychological and Affective State (.70) for sources of self-efficacy; and Job Satisfaction (.80). The reported Cronbach's alpha coefficient for the Depersonalization subscale in this study aligns with findings from previous research (e.g., Kokkinos, 2006; Suen & Ary, 2014).

Variable Description

The dependent variable, self-efficacy, was measured using the short version of the Teachers' Self-Efficacy Scale ([TSES] Tschannen-Moran et al., 2001). TSES contained 12 self-efficacy items, each measured using a nine-point Likert type scale (1 - 9). The 12 ratio-level items represented three teaching self-efficacy constructs: classroom management, student engagement, and classroom instruction. Different labels were assigned to different points on the TSES (1 = None at all, 3 = Very little, 5 = Some degree, 7 = Quite a bit, and 9 = A great deal). A teaching self-efficacy index was first computed from a weighted average of the 12 TSES items. The index computed from the weighted average was then binned to make teaching self-efficacy a two-level nominal variable with low teaching self-efficacy (0) and high teaching self-efficacy (1). Those respondents who scored seven and below were considered low teaching self-efficacy, while those above seven represented the high efficacy group.

The six independent variables included mentorship status, a three-level nominal variable measured as not mentored (0), non-ATAT mentored (1), and ATAT mentored (2). Burnout was measured using 22 statements on a six-point Likert-type scale (0-6), as assessed by the MBI for Educators Survey ([MBI-ES]; Maslach & Jackson, 1981). Different labels were assigned to various points along the MBI-ES (0 = Never, 1 = A few times a year, 2 = Once a month or less, 3 = A few times a month, 4 = Once a week, 5 = A few times a week, 6 = Every day). The burnout constructs were personal accomplishment (PAC), emotional exhaustion (EEX), and depersonalization (DEP), each measured as indices (scale: 0-6) computed by averaging related items on the MBI-ES. Job satisfaction (JSI) was an average of five ratio-level statements, each rated using a 10-point Likert-type job satisfaction scale ([JSS]0-10) following Judge et al.'s (1998) recommendations. Different labels were assigned to various points along the JSS (0 = strongly disagree, 3 = Moderately Disagree, 5 = Undecided, 7 = Moderately agree, 10 = Strongly Agree). The teaching experience was a ratio-level variable quantified as the total number of years in the teaching profession. Finally, school context was a three-categorical variable, with urban (0), suburban (1), and rural (2) categories, while gender was a two-categorical variable with male (0) and female (1) categories.

Data Analysis

To predict the likelihood of high versus low teaching self-efficacy among Texas agriscience teachers from factors including mentorship, job satisfaction, burnout, gender, school context, and teaching experience, a binary logistic regression was applied with the logit transformation:

$$\eta = \text{logit}(\pi) = log\left(\frac{\pi}{1-\pi}\right). \quad (1)$$

By fitting a linear model of the so-called *propensity* η, binary logistic regression predicts membership in only two categories [0,1] (e.g., Agresti, 2003; Field, 2018). This propensity is a transformation of the probability $\pi = \Pr(y = 1)$. The logistic regression aims at finding parameter estimates (β_s) that best fit

$$\eta_i = \beta_0 + \sum_{s=1}^{K} x_{si}\beta_s + \varepsilon_i, \quad (2)$$

where β_0 is the estimated value of the propensity η_i when all predictors are valued at zero. Unlike ordinary regression, the β_s parameters require maximum likelihood estimation. Once estimates for η_i are computed, the probability of a "success" ($y_i = 1$) for any given individual can be estimated by applying the inverse logit:

$$\hat{\pi}_i = logit^{-1}(\hat{\eta}_i) = \frac{exp(\hat{\eta}_i)}{1+exp(\hat{\eta}_i)}. \quad (3)$$

Finally, a simple approach to estimate outcomes for Y (self-efficacy) is to let $\hat{y}_i = round(\hat{\pi}_i)$. The logistic model applied was

$$logit(\hat{\pi}_i) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} \ldots + \beta_{ni} X_{ni} + \varepsilon, \quad (4)$$

The estimated model agriscience teaching self-efficacy was:

$$logit(BinnedSEI) = \beta_0 + \beta_1 Gender + \beta_2 Experience + \beta_3 School\ Context + \beta_4 Mentorship + \beta_5 Burnout + \beta_6 Burnout + \beta_7 Burnout + \beta_8 Job\ Satisfaction + \varepsilon, \quad (5)$$

Binary logistic regression is robust against key linear regression assumptions—homoscedasticity and residual normality —and, to a degree, tolerates multicollinearity. Nonetheless, multicollinearity was assessed, and all variance inflation factors (VIFs) were well below the critical threshold of 10 ([see Appendix 1] Menard, 2010). Regarding model fit, Louviere et al. (2000) note that a McFadden R^2 of 0.20 indicates an excellent logistic model; the McFadden R^2 in the present study was 0.30, confirming a strong overall fit.

Results

Descriptive Statistics of Agriscience Teachers

The study sample (n = 122) had a higher representation of females (52.5%) than males, with a few others (1.68%) failing to disclose their gender. Most teachers were whites (90.1%). The rest were Black/African Americans (1.94) and Asians (.82). Regarding school context, slightly over half of the teachers were from rural schools (54.1%), a significant segment from suburban schools (30%), and the rest from urban school environments. Approximately half of the teachers were not participating in mentorship programs (47.1%). Many of the teachers who received mentorship appeared to benefit from initiatives like ATAT and other mentoring programs. Regarding academic qualifications, many teachers in this sample hold bachelor's degrees (67%), while a good proportion have master's degrees (47%). For additional information regarding demographics, refer to Table 1.

Table 1

Frequency Tabulation of Texas High School Agriscience Teachers' Characteristics (N = 122)

Characteristic	%
Mentorship Status	
Not mentored	47.10
ATAT mentored	31.00
Non-ATAT mentored (other mentorship programs)	21.90
Race	
Black or African American	1.94
White	90.10
Asian	0.82
Not specified	7.14
Gender	
Female	52.94
Male	45.38
Not specified	1.68
School Context	
Urban	15.50
Suburban	30.00
Rural	54.10
Not specified	4.20
Highest Education Level	
Bachelor's degree	67.00
Master's	47.00
Not specified	5.88

Respondents' teaching self-efficacy scored a mean of 7.10 (SD = 0.95) on the 9-point TSES scale, indicating potential for further enhancement in their agriscience teaching self-efficacy. The mean scores for depersonalization (M = 1.29, SD = 1.07), emotional exhaustion (M = 2.66, SD = 1.30), and personal accomplishment (M = 4.79, SD = 0.67) pointed out that teachers were not burned out. The mean value of job satisfaction (M = 6.17, SD = 2.35) of the teachers was between undecided (5) and moderately agree (7) on the 9-point JSS scale. The mean value implies that agriscience teachers' level of contentment with their profession is yet to align with the expected standards. The teachers' mean age was 36.53 (11.73) years. Teachers' age ranged from 22, the youngest, to 66, the eldest. Furthermore, the teachers' mean teaching experience was 2.31 years, teaching 105 students per academic year on average. See Table 2 for more information.

Table 2

Summary Statistics of Texas High School Agriscience Teachers' Characteristics (N = 122)

Characteristic	*M*	*SD*	*n*	SE_M	Min	Max
Teaching self-efficacy[a]	7.10	0.95	119	0.09	4.08	9.00
Depersonalization burnout[b]	1.29	1.07	119	0.10	0.00	4.60
Emotional exhaustion burnout[b]	2.66	1.30	119	0.12	0.00	5.67
Personal accomplishment burnout[b]	4.79	0.67	119	0.06	2.86	6.00
Teaching experience[c]	12.31	10.73	119	0.98	1.00	44.00
Number of students[d]	105.07	35.38	116	3.29	15.00	190.00
Age[e]	36.53	11.73	119	1.08	22.00	66.00
Job satisfaction	6.17	2.35	116	0.22	1.00	9.00

Note. [a]Scale is 1= Cannot do at all to 9 = Highly certain can do; [b]Scale is 0 = Never to 6 = Eveyday [c]Scale is Years of teaching; [d]Scale is Number students taught per academic year; [e]Scale is Age in years; [f]Scale is 0 = Strongly disagree to 10 = Strongly agree

Binary Logistic Regression of Agriscience Teaching Self-Efficacy

A binary logistic regression was applied to predict the likelihood of high versus low agriscience teaching self-efficacy, mentorship, job satisfaction, burnout, gender, school context, and teaching experience. The overall logistic model was significant at 0.05 alpha level set *a priori*, $\chi 2(10) = 48.59$, $p < .001$ (Table 1) with a McFadden's R^2 value of .30. greater than .02, depicting an excellent fitting model (Pituch & Stevens, 2015). Of the four significant predictors, gender had a significant negative effect. At the same time, teaching experience, job satisfaction, and personal accomplishment significantly predicted the log odds of teachers having high teaching self-efficacy (Table 3).

The unstandardized beta coefficient of gender was statistically significant but negative, $B = -1.23$, OR = 0.29, $p = .035$, implying the probability (odds) of observing high levels of teaching self-efficacy would decrease by approximately 71% for male teachers. The predictive effect of teaching experience, $B = 0.09$ OR = 1.09, $p = .003$, indicated that the teachers' probability (odds) of observing high teaching self-efficacy would increase by approximately 9% for every additional year of teaching. Likewise, the personal accomplishment was statistically significant, $B = 1.34$, OR = 3.83, $p = .001$, indicating that the probability (odds) of observing high teaching self-efficacy among teachers would increase by approximately 283% for every unit increase in personal accomplishment. Job satisfaction was statistically significant, $B = 0.32$, OR = 1.38, $p = .006$, indicating that the probability (odds) of observing high teaching self-efficacy among teachers would increase by approximately 38% for a unit increase in job satisfaction. Strangely, the mean values for depersonalization ($M = 1.29$, $SD = 1.07$), emotional exhaustion ($M = 2.66$, $SD = 1.30$), and personal accomplishment ($M = 4.79$, $SD = 0.67$) indicated that the teachers were not burned out. Detailed results are available in Table 3.

Table 3

Predicting Teaching Self-Efficacy[a] from Mentorship Status, Burnout, and Job-satisfaction & Selected Teacher factors (N = 122)

Independent Variables	*B*	*SE*	χ^2	*p*	*OR*	95% CI
(Intercept)	-6.36	2.24	8.02	.005	-	-
Gender- male[g]	-1.23	0.58	4.46	.035*	0.29	[0.09, 0.92]
Teaching experience[c]	0.09	0.03	8.71	.003**	1.09	[1.03, 1.15]
School- suburban[h]	-1.07	0.84	1.61	.204	0.34	[0.07, 1.79]
School- rural[h]	-1.40	0.81	2.97	.085	0.25	[0.05, 1.21]
Non-ATAT mentored[i]	-0.78	0.64	1.47	.225	0.46	[0.13, 1.61]
ATAT mentored[i]	-0.02	0.57	0.00	.973	0.98	[0.32, 2.97]
Burnout- PAC[b]	1.34	0.42	10.28	.001**	3.83	[1.68, 8.69]
Burnout- DEP[b]	-0.37	0.34	1.17	.279	0.69	[0.35, 1.35]
Burnout- EEX[b]	-0.11	0.27	0.17	.683	0.90	[0.53, 1.52]
Job satisfaction[f]	0.32	0.12	7.64	.006**	1.38	[1.10, 1.73]

Note. Note. $*p < .01$, $**p < .05$. $\chi 2(10) = 48.59$, $p < .01$**, McFadden $R^2 = 0.30$. [a]Scale is 1= Cannot do at all to 9 = Highly certain can do; [b]Scale = 0 is = Never to 6 = Eveyday [c]Scale = Years of teaching; [d]Scale is Number students taught per academic year; [e]Scale is Age in years; [f]Scale is 0 = Strongly disagree to 10 = Strongly agree; [g]Scale is Male = 0, Female = 1; [h]Scale is Urban = 0, 1= Surburban, 2 = Rural; [i]Scale is 0 = Not mentored, 1= Non-ATAT mentored, 2 = ATAT mentored.

Conclusion and Discussion

This study explored personal and contextual characteristics predicting the self-efficacy of agriscience teachers from Texas high schools who consented. Most teachers in the sample were females, whites, and from rural schools. About half of them participated in mentoring, while a significant number were not. Over 50% percent of teachers in the sample had either a bachelor's or master's degree. The respondents' mean age and teaching experience in the present study were similar to those reported for agriculture teachers in Louisiana, Illinois, and Indiana (Blackburn et al., 2017; Korte, 2017; Sarfo et al., 2015). Agriscience teachers in Texas believe there is potential for improvement in their perceived teaching abilities, as reflected in their mean self-efficacy levels. Similarly, agriculture teachers in Louisiana (Blackburn et al., 2017), as well as those in Illinois and Indiana (Korte, 2017), and preservice teachers from the University of Georgia and Texas A&M reported similar levels of teaching self-efficacy (Stripling, 2008).

In this study, the mean job satisfaction among Texas agriscience teachers indicates that their level of contentment in their roles is below the overall satisfaction level measured by the Job Satisfaction Survey (JSS) scale. Similarly, an examination of job satisfaction among Louisiana agricultural teachers revealed a decline in contentment and a reduced sense of fulfillment in their professional roles (Blackburn et al., 2017). Interestingly, the mean scores for depersonalization and emotional exhaustion suggested that teachers in the present study do not experience burnout. On the other hand, the mean score for personal accomplishment reflected a positive outlook regarding their professional achievements.

The binary logistic regression results indicate that gender, teaching experience, personal accomplishment, and job satisfaction have a significant influence on agriscience teaching self-efficacy. The finding that female teachers tend to exhibit higher levels of self-efficacy aligns with the conclusions of Sarfo et al. (2015), who found that female teachers demonstrated higher instructional efficacy than their male counterparts. However, this gender effect contradicts some studies (e.g., Odanga et al., 2015), which

reported lower teaching self-efficacy among female high school teachers in co-teaching environments and those teaching in boys' schools. Additionally, the gender difference identified in this study contrasts with Klassen and Chiu's (2010) findings, which suggest that female teachers have lower self-efficacy in classroom management due to factors such as workload demands and student behaviors. Research has shown that lower self-efficacy among male teachers may lead to premature exits from the teaching profession (Darling-Hammond et al., 2002; Evans & Tribble, 1986; Judge et al., 1998). This unexpected turnover could force school districts to exceed their budget projections to recruit and train new teachers to replenish the teaching workforce (ATAT, 2020). Furthermore, teacher shortages compromise the quality of instruction and student performance (Blackburn et al., 2017; Darling-Hammond, 2003).

Research indicates that teaching experience has a positive impact on teachers' self-efficacy, implying that accumulated years of teaching can enhance teachers' confidence in their perceived teaching abilities. This aligns with previous studies (Bandura, 1994; Darling-Hammond et al., 2002), which suggest that effective mastery experiences build self-efficacy over time (Bandura, 1997). Many novice teachers often doubt their capabilities, especially during the initial years of teaching, which are filled with new challenges (Ingersoll, 2002; Siwatu, 2011). In contrast, seasoned teachers display greater confidence due to their extensive professional experience (Bandura, 1994; Darling-Hammond et al., 2002). Darling-Hammond (2003) points out that a teacher's effectiveness tends to improve significantly after the early years of their career. Therefore, it is essential to implement strategies that help retain teachers longer, allowing them to develop stable levels of self-efficacy, sustained motivation, and long-term professional commitment (Darling-Hammond, 2003; Hakanen et al., 2006).

Contrary to some earlier researchers, the school context did not predict teachers' self-efficacy (e.g., Felicia, 2005; Odanga et al., 2015). The term' school context' encompasses various factors, including the school's geographical location, available resources, and prevailing cultural norms, all of which can influence teachers' self-efficacy (Felicia, 2005; Tschannen-Moran et al., 1998; Tschannen-Moran & Hoy, 2001). For example, schools where agricultural teachers perceive a strong sense of community have supportive administration, and benefit from colleagues who accommodate their diverse needs tend to experience lower attrition rates (Hasselquist et al., 2017). Positive collegial relationships and collaborative interactions among peers act as contextual elements that inspire teachers and enhance job satisfaction by fostering a welcoming atmosphere that values all individuals and their contributions (Hasselquist et al., 2017). Additionally, the unique needs of agricultural teachers—such as access to specialized facilities and equipment—are better supported in schools that provide adequate resources and funding, which in turn can enhance teaching effectiveness (Boone & Boone, 2009).

While previous studies have indicated that mentorship predicts teachers' self-efficacy (e.g., Chizhik et al., 2018; LoCasale-Crouch et al., 2012), the present study found no such impact. Based on prior research, it was hypothesized that mentorship would enhance teaching self-efficacy because it provides career modeling, guidance, and psychosocial support, especially for less experienced teachers (Kram & Isabella, 1985). However, the lack of impact observed in this study may suggest a false perception among novice teachers that induction and mentoring processes are either ineffective or nonexistent (Howe, 2006), particularly given that the mean teaching experience in the present study was less than three years. It is important to note that some scholars caution against attributing positive career outcomes exclusively to the existence or involvement of mentors (Ragins et al., 2009). Additionally, others argue that the success of mentoring relationships should correlate with the quality of interpersonal connections (Noe et al., 2002). However, this study did not examine interpersonal relationships.

The only significant factor contributing to burnout among agriscience teachers in Texas was personal accomplishment, which had a positive correlation. This suggests that these teachers felt competent and successful in their job roles. Unlike previous research findings, depersonalization and emotional exhaustion did not seem to affect the self-efficacy of agriscience teachers (Betoret, 2006; Gunduz, 2012;

Skaalvik & Skaalvik, 2010). Teachers who experienced a sense of personal accomplishment demonstrated a strong sense of self-efficacy in their teaching practices (Luszczynska & Schwarzer, 2015). Firm self-efficacy beliefs have been shown to enhance teaching confidence and reduce burnout (Kram & Isabella, 1985). Conversely, individuals who feel diminished personal accomplishment often develop a cynical view of themselves and doubt their ability to complete important tasks (Maslach & Jackson, 1981; Skaalvik & Skaalvik, 2010). Additionally, some researchers have linked low self-esteem to teacher stress and attrition (Hakanen et al., 2006; Leung & Lee, 2006). The level of stress experienced by a teacher is inversely related to their effectiveness in instructional performance (Tschannen-Moran et al., 1998; Tschannen-Moran & Woolfolk Hoy, 2001).

The findings of this study reveal a positive correlation between job satisfaction and teaching self-efficacy, a trend that aligns with prior research (e.g., Blackburn et al., 2017; Caprara et al., 2006; Klassen & Chiu, 2010; Kasalak & Dayar, 2020). This supports the connection between job satisfaction and teaching self-efficacy, highlighting the importance of implementing strategies to promote job satisfaction in order to enhance the well-being of agriscience educators in Texas secondary schools.

Study Limitations

While this study provides valuable insights into the factors influencing agriscience teachers' self-efficacy, several limitations should be acknowledged. The study is limited by a convenience sample of 122 agriscience teachers drawn from Texas, mainly through the ATAT program. Thus, results may not generalize to teachers in other states or to Texas agriscience teachers who did not respond or who have already left the profession. The focus on Texas teachers excludes other mentoring programs, restricting cross-program comparisons. The findings of this study are based on respondents' self-report, without qualitative follow-up or consideration of possible COVID-19 effects, so findings reflect perceptions rather than observed behaviors.

Recommendations

Recommendations for Practice

The current study revealed that male teachers exhibit lower self-efficacy in agriscience teaching compared to female teachers. Additionally, the mean score for teaching self-efficacy indicated that teachers in the present study have room for improvement in their teaching self-efficacy. Given this observation, Texas school administrations must investigate and cultivate an environment that fosters higher self-efficacy levels among teachers, surpassing the thresholds reported in this study. Previous research demonstrates a positive correlation between teaching self-efficacy and teachers' intentions to remain in the profession (Darling-Hammond et al., 2002; Judge et al., 1998).

The study also found that increased job satisfaction is associated with higher teaching self-efficacy. However, the descriptive statistics reveal an ironic contrast: on average, teachers do not feel fully satisfied with their jobs. Despite this, teachers exhibited low levels of depersonalization, emotional exhaustion, and a high sense of personal accomplishment. Considering this paradox:

- School administrators should engage in direct conversations with teachers to further explore the underlying reasons for their low job satisfaction and self-efficacy.
- School administrations should advocate for supportive educational policies and implement strategies and resources to enhance teachers' job satisfaction and personal accomplishment.

Research has consistently shown that improving the two aspects among teachers results in positive outcomes, such as classroom self-efficacy, motivation, academic achievement, stress reduction, and longer

professional commitment (e.g., Blackburn et al., 2017; Caprara et al., 2006; Klassen & Chiu, 2010; Kasalak & Dayar, 2020).

Recommendations for Research

Future researchers should integrate qualitative and mixed methods of research designs to shed more light on the underlying causes of teachers' decreased self-efficacy and job satisfaction scores. It would also be valuable to investigate the aspects of agriscience contributing to low self-efficacy among male teachers. Researchers should also explore the relationship between teachers' self-perceived competence and their early departure from the profession. It is essential to examine whether gender acts as a mediator or moderator in the relationship between self-efficacy and teacher attrition. This may involve comparing attrition rates across different genders and varying levels of self-efficacy. Furthermore, tracking the career paths of agriscience teachers who leave their positions prematurely could provide insights into the reasons for their departure and help develop strategies to promote sustained engagement in the profession.

Agriscience teachers may present overly optimistic beliefs regarding their self-efficacy beliefs. Therefore, future researchers are encouraged to utilize longitudinal studies, experimental designs, and psychophysiological tools. These approaches would capture real-time and authentic levels of self-efficacy, leading to a more accurate understanding of teachers' self-assessment processes in relation to their performance proficiency (Bandura, 1997).

In examining the findings on mentorship and its minimal impact on teaching self-efficacy, future researchers should explore how participation in non-participation in mentoring programs affects self-efficacy. They should explore potential alternative outcomes of mentorship and the influences of interpersonal relationships (Noe et al., 2002). This study achieved an R^2 value of 0.30, indicating a well-fitted logistic model (Louviere et al., 2000; Pituch & Stevens, 2015). This calls for further validation and exploration with additional variables and a larger, more diverse cohort of teachers. This investigation aimed to identify an optimal method for unraveling the complex relationship between self-efficacy and its associated variables, thus providing a foundation for continued exploration (Skaalvik & Skaalvik, 2010)

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Appendices

Appendix 1

Variance Inflation Factors Values for the Independent Variables (N = 122)

Variable	VIF
Gender	1.58
Teaching Experience	1.54
School Context	1.41
Mentorship Status	1.32
Personal Accomplishment	1.13
Depersonalization	1.85
Emotional Exhaustion	1.85
Job Satisfaction	1.29

The Test Statistic = Binary Logistic Regression Test; the Dependent Variable = Teaching Self-Efficacy (weighted mean of 12 TSES items, dichotomized [≤ 7 = low = 0; > 7 = high = 1]); the Independent Variables = Mentorship Status (0 = none, 1 = non-ATAT, 2 = ATAT); Burnout Indices: EX, PAC, DEP (0–6); School Context (0 = urban, 1 = suburban, 2 = rural); Job Satisfaction (0–10); Teaching Experience (years); Gender (0 = male, 1 = female)

Appendix 2

Instrument's Post Hoc Reliability (Cronbach's α) and Summary Statistics (N =122)

Construct		M	SD	α
Self-Efficacy	Classroom Management	7.34	1.12	.86
	Student Engagement	6.75	1.06	.74
	Classroom Instruction	7.19	1.11	.84
Burnout	Emotional exhaustion	2.64	1.29	.92
	Personal accomplishment	4.80	.66	.71
	Depersonalization	1.28	1.06	.65
Sources of Self-efficacy	Mastery Experience	7.24	1.10	.82
	Vicarious Experience	7.46	1.54	.91
	Verbal persuasion	7.47	1.70	.90
	Psychological and Affective State	3.14	1.10	.70
Job Satisfaction		7.34	1.79	.80