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Self-Efficacy, School Culture, and Teaching Anxiety as Predictors of Science Teachers' Job Satisfaction

Fen Bilgisi Öğretmenlerinin İş Doyumunun Yordayıcıları Olarak Öz-Yeterlik, Okul Kültürü ve Öğretim Kaygısı

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ABSTRACT: In this research, we study the relationship of science teachers' job satisfaction with the teacher self-efficacy, the teaching self-efficacy, the anxiety toward teaching and school culture. The sample of the study consists of 185 science teachers working in public schools. We obtain the data by using "The Teacher Self Efficacy Scale", "The School Culture Scale", "Science Teaching Self-Efficacy Scale", "The Anxiety toward Science Teaching Scale" and "Job Satisfaction Scale". The results of the current research showed that science teachers' job satisfaction was directly positively correlated with their self-efficacy, science teaching self-efficacy and school culture. However, teachers' science teaching anxiety no had a direct significant relationship with their job satisfaction. In addition, the results of the structural model indicated that school culture was a strong predictor of science teachers' job satisfaction. The result of multiple regression analysis showed that these independent variables explain 40% of the variance of teachers' job satisfaction. These results shown that a positive school culture, teacher self-efficacy and teaching self-efficacy play an important role in order to provide the affective support necessary for the science teachers' job satisfaction.

Keywords: Science teachers, job satisfaction, self-efficacy, teaching anxiety, school culture.

ÖZ: Bu araştırmada, fen bilgisi öğretmenlerinin iş doyumlarının, öğretmen öz-yeterliği, öğretim öz-yeterliği, öğretime yönelik kaygı ve okul kültürü ile ilişkisi incelenmiştir. Araştırmanın örneklemini devlet okullarında görev yapan 185 fen bilgisi öğretmeni oluşturmaktadır. Veriler, "Öğretmen Öz Yeterlik Ölçeği", "Okul Kültürü Ölçeği", "Fen Öğretimi Öz Yeterlik Ölçeği", "Fen Öğretimine Yönelik Kaygı Ölçeği" ve "İş Doyumu Ölçeği" kullanılarak elde edilmiştir. Bulgular, fen bilgisi öğretmenlerinin iş doyumlarının, öz-yeterlikleri, fen öğretimi öz-yeterlikleri ve okul kültürleri ile doğrudan pozitif ilişkili olduğunu göstermiştir. Ancak öğretmenlerin fen öğretimi kaygılarının iş doyumları ile doğrudan anlamlı bir ilişkisinin olmadığı görülmüştür. Bununla birlikte yapısal modelin sonuçları, okul kültürünün fen bilgisi öğretmenlerinin iş doyumunun güçlü bir yordayıcısı olduğunu göstermiştir. Çoklu regresyon analizinin sonucu, bu bağımsız değişkenlerin öğretmenlerin iş doyumu varyansının %40'ını açıkladığını göstermiştir. Bu sonuçlar, fen bilgisi öğretmenlerinin iş doyumu için gerekli olan duyuşsal desteğin sağlanmasında olumlu bir okul kültürü, öğretmen öz-yeterliği ve öğretme öz-yeterliğinin önemli bir rol oynadığını göstermiştir.

Anahtar kelimeler: Fen bilgisi öğretmenleri, iş doyumu, öz-yeterlik, öğretim kaygısı, okul kültürü.

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There is a significant increase in the level of pressures and demands on teachers today. This situation occurs especially in relation to the development of students' academic success and skills. It is possible for the teacher, who is one of the most important factors that will bring student success, to be able to respond to these demands by being both mentally comfortable and adequate. Teachers' Job Satisfaction (JS) is an important predictor of their attachment and commitment to the profession (Dicke et al., 2020; Sahito & Vaisanen, 2020; Zhang & Yuan, 2020). In the literature, "student behavior problems", "classroom climate", "school location", "school management understanding", "teacher autonomy", "stakeholder participation", "professional experience", "teacher self-efficacy", "teacher-student relations", "cooperation between teachers" and "career development practices" were emphasized as important factors affecting teachers' JS (Katsantonis, 2020; Toropova et al., 2021; Wang et al., 2019).

Cribbin (1972) defines that job satisfaction (JS) is "a positive, relaxing and calming affection that an individual tries to get from the work environment" (p. 155). This concept refers to the reaction of individuals to the work environment and how they feel about various aspects of the profession. Gender, age, term of service, marital status, education level, personality, motives, knowledge, skills and abilities, salary, physical conditions, working conditions, promotion, hierarchical relations, the relationships with colleagues, corporate culture, and climate are the factors influencing the JS of individuals (Telman & Unsal, 2004). Researchers have revealed that increased JS has a positive effect on general life satisfaction and mental-physical behaviors at the individual level, and professional productivity and commitment at the institutional level. At the same time, they reported that the decrease in JS leads to results such as being late for work, absenteeism and quitting (Gursoy, 2013; Kurt & Demirbolat, 2019; Telef, 2011). Burke and El-Kot (2010) found that JS and turnover intention were related to job engagement. Alzyoud et al. (2015) emphasized that greater job engagement and JS predict outcomes such as lower absenteeism, willingness to leave, and better job performance. According to Ariani (2013), employees' work engagement was positively related to their individual job performance.

Considering the working conditions of all occupational groups today, teaching comes to the forefront as one of the stressful, tiring and attritional professions. However, education is seen as the basis of a country's qualified work force and economic development (Little & Green, 2009). One of the important determinants of effective education is the teacher. The effectiveness of education can be possible through the positive interaction of teachers with parents, students, colleagues, school staff and society in general (Kurt & Demirbolat, 2019; Skaalvik & Skaalvik, 2011). In all this interaction, teachers' professional commitment and professional satisfaction are affected by both teachers' own factors and social and environmental factors (Manalo et al., 2020). Skaalvik and Skaalvik (2011) examined the relationships between school context variables and teachers' sense of belonging, emotional exhaustion, JS, and intention to leave the teaching profession. According to their research results, aspects of the school context such as value congruence, supervisory support, relationships with colleagues and parents, time pressure, and discipline problems were all associated with JS and intention to leave the teaching profession. Manalo et al. (2020) revealed in their research that teachers' high levels of motivation and JS show their high levels of organizational commitment and work commitment. The results of Klassen and Chiu's

(2011) research showed that self-efficacy (SE), job stress and contextual factors affect both pre-service and service teachers' professional commitment and turnover intentions.

In literature science teachers' JS is mostly explained through many factors such as difficult working conditions, the relations with students, administrators and parents, student success, status in society, salary, the social rights, changing education policies and workload (Hean & Garrett, 2001; Mostafa & Pal, 2018). Considering the intensity and impact of science teacher attrition on education systems worldwide, Mostafa and Pal (2018) posed the question "Why do science teachers leave their jobs". Happy and satisfied teachers are more likely to continue doing their jobs, while dissatisfied teachers are more likely to quit. Therefore, they considered the satisfaction of science teachers as the key to maintaining their profession. 21st century education systems have brought an important workload for science teachers to continue their professional lives effectively. The integrated science, technology, engineering and mathematics (STEM) education, which has an important place in education reforms, has put a serious pressure on science teachers today (Du et al., 2019; Suebsing & Nuangchalerm, 2021; Thibaut et al., 2018). Science teachers have a key role in STEM education in increasing students' learning skills necessary in daily life. In general, STEM education refers to a holistic and interdisciplinary approach to solving problems encountered in daily life related to the four areas it includes. Students can learn to solve complex real-world problems with qualified science teachers who encourage the use of interdisciplinary knowledge (Wang et al., 2011; Yang et al., 2021). Hean and Garrett (2001) identified science teachers' JS as an important factor affecting the effectiveness of the science program and the quality of teaching.

While educational systems seek ways to train qualified teachers, they also strive to keep teachers in the system in the profession (Ingersoll, 2001). Mostafa and Pal (2018) reported in their comprehensive study that science teachers' JS would contribute significantly to students' motivation for success in science and their science-related career plans. From this point of view, it was interesting to determine the factors related to the JS of science teachers and to reveal the importance of these factors on JS (Russell et al., 2010; Song & Mustafa, 2015). Zakariya (2020) revealed that school climate and teacher SE have a strong direct effect on the JS of a group of teachers, including science teachers. Among the science teachers who participated in Song and Mustafa's (2015) research, those who were in the first years of their profession stated that they needed the emotional support of administrators, senior colleagues and parents in order to reduce their job dissatisfaction. Despite the aforementioned studies, Hasselquist et al. (2017) reported that studies covering affective factors associated with science teachers' JS are quite limited. We decided to carry out this research in order to provide data that will support the increase of JS of qualified science teachers in their stay in the profession. The focus of our research is to study some psychological variables related to the profession of science teachers, who have a critical impact on students' outcomes, and to pay attention to the burdens they may experience. Examining science teachers' emotions associated with their professional lives can help administrators and policymakers identify better ways to retain teachers in the field and ultimately facilitate desired student outcomes. Improving the variables associated with work engagement, such as JS, will benefit science teachers to improve their job performance. Policy

makers can use the results of the study as a basis for formulating policies and programs to help improve science teachers' well-being.

Teachers' Job Satisfaction

Zembylas and Papanastasiou (2006) defined teachers' JS as the emotional relationship that teachers establish towards their profession. Also, Adeniyi and Adeniyi (2018) expressed teachers' JS as the feeling the teachers feels towards their students, the school environment, teaching roles and all teaching and learning conditions. Caprara et al. (2003) stated that teachers' JS is a determining factor on teaching performance and defined teachers' JS as the satisfaction and pleasure they derive from fulfilling their teaching roles.

Teachers' JS is a very important factor that will influence the teaching performance and productivity of the schools (Skaalvik & Skaalvik, 2011). Teachers can teach their students more effectively when they are satisfied with their work (Nigama et al., 2018). Low JS is a major cause of teacher attrition (Nagar, 2012). According to Klusmann et al. (2008), the teachers with a high sense of JS create more learning-supportive environments for students and try to do their best to motivate the students. A great number of factors can affect the teachers' JS (Admiraal et al., 2019; Chaaban & Du, 2017; Klassen & Chiu, 2010). Dinham and Scott (1998) classify teachers' JS sources in three areas. These are: (a) the factors internally related to the "teaching profession", (b) "school-based factors" and (c) "non-school factors". In addition, Mostafa and Pal (2018) presented a model that explains the factors associated with teachers' JS based on teacher and student characteristics and school contexts. Two main components come to the fore in teacher job satisfaction: job comfort and task fulfillment. While job satisfaction refers to how satisfying the job conditions are for an individual, task fulfillment is the satisfaction one feels from achieving important aspects of one's job (Evans, 1997). Teachers' job satisfaction is expressed as an important factor affecting students' learning outcomes. Job satisfaction contributes to student satisfaction and education quality, which is the primary goal of a school (Baluyos et al., 2019). However, teacher's job satisfaction includes in-school factors such as time pressure, negative student behaviors, and school values, as well as relationships with colleagues, parents, and school management. Outside of school factors include government reforms, society's perspective on school, and the image of the teaching profession in society (Admiraal et al., 2019).

Teachers' Self-Efficacy (TSE)

Bandura's (1977) SE theory states that how one perceives one's own abilities will affect his actions. The SE reflects an individual's belief in their ability to perform their duties effectively (Bandura, 1997; Pajares, 2021). Furthermore, the SE determines how the environmental opportunities and barriers are seen according to social cognitive theory (Bandura, 2006). Therefore, efficacy affects the goals, motivation, and behavior of people. In this context, the SE is conceptualized as a multidimensional and field-specific structure (Avanzi et al., 2013; Meiring, 2019; Skaalvik & Skaalvik, 2019). Most of the research on teacher SE is based on Bandura's conceptualization of SE based on social cognitive theory (Federici & Skaalvik, 2012; Klassen & Chiu, 2011; Morris et al., 2017; Putwain & Von der Embse, 2019; Yang et al., 2021; Zakariya, 2020). Tschannen-Moran and Woolfolk Hoy (2001) defined that TSE as the teachers' beliefs in

their own abilities upon effectively teaching a subject to the students, ensuring student participation and achieving the desired results from teaching. Moreover, it is also defined as the teacher's belief in the ability to organize and implement the actions necessary to accomplish a teaching task in a given context (Gibson & Dembo, 1984; Tschannen-Moran et al., 1998). In this context, TSE is conceptualized as having three basic components: "student participation", "the competence for teaching strategies" and "classroom management" (Tschannen-Moran & Woolfolk Hoy, 2001).

The source of TSE consists of the perceptions of successful or less successful teaching experiences, including classroom management experiences, motivating students to train, collaborating with colleagues and parents (Yang & Wang, 2019). The teachers with a high sense of SE are more likely to develop challenging lessons, provide more autonomy for student learning, try new teaching strategies, and choose different teaching materials than the teachers with low SE (McKinnon & Lamberts, 2014; Sandholtz & Ringstaff, 2014). According to the studies on TSE, the student discipline problems and low motivation are associated with teacher's low SE (Gilbert et al., 2014; Klassen & Chiu, 2010; Skaalvik & Skaalvik, 2016). A number of research studies have suggested that science teacher's SE play an important role in order to determine the teaching practices (Menon & Sadler, 2018; Teig et al., 2019). It has also been reported that science teachers' negative beliefs about their experience in science teaching may affect their teaching practices (Avery & Meyer, 2012; Kazempour & Sadler, 2015). According to Enochs and Riggs (1990), "science teaching self-efficacy" (STSE) consists of two components: "personal science teaching competence", which is the belief that a person has the ability to teach science effectively, and "science teaching outcome expectation", which is the level of teacher's confidence that the student will learn the content. Kazempour (2014) implies that the teachers with low SE perception in science teaching have doubts about their ability to teach science and are indifferent to science education. On the contrary, it is emphasized that the science teachers with SE suffer less from "stress and exhaustion" and mostly "experience personal accomplishment", "commitment" and JS (Vieluf et al., 2013; Zee & Koomen, 2016).

Anxiety toward Teaching (ATT)

Nayak (2014) define that anxiety is as an emotional discomfort, fear, disappointment and worry that threaten making decisions. Moreover, anxiety is the physical, emotional and mental responses that a person experiences when faced with a stimulus from the outside or internal world (Ucak & Say, 2019). If the level of anxiety felt by the individual complicates his learning level and negatively affects his success, it is defined as negative anxiety. If the anxiety is not at a level that prevents the individual from thinking and making healthy decisions, it can sometimes cause the person to achieve success above their own inclinations, and this type of anxiety is defined as positive anxiety (Aytekin et al., 2017). Teaching is an intellectually demanding and emotionally exhausting profession. Teachers' anxiety often affects their ability to function effectively and can cause exhaustion (Desouky & Allam, 2017). The teachers should have a strong teaching qualification to encounter challenging demands. Otherwise, anxiety can disrupt the effective teaching process (Anusiem & Okoiye, 2015). Thomas (2006) defines ATT as emotions, beliefs or behaviors that interfere with a person's ability to begin continuing or finish teaching tasks. ATT can have dramatic

effects on teachers' professional effectiveness and classroom behavior. A limited number of studies have been conducted in the last thirty years to investigate the sources and solutions of anxiety toward science teaching (ATST) (Czerniak, 1989; Czerniak & Chiarelott, 1990; Czerniak & Haney, 1998; Czerniak & Lumpe, 1996; Novak & Wisdom, 2018; Yuruk, 2011). Aytekin et al. (2017) say that ATST can be affected by many reasons. If the anxiety level of the teacher responsible for teaching the lesson is high, it can be expected that the anxiety of teaching will also increase" (Aytekin et al., 2017, p. 14). Yuruk (2011) reported that science teaching proficiency and the number of science courses taken at university were important predictors of ATST. In this study, the researcher also showed that science teaching experience and past perceptions about science have indirect effects on teaching anxiety. Again, Czerniak (1989) stated that teachers' negative experiences with science teaching performance, lack of time allocated to prepare for science teaching, lack of infrastructure to teach the subject effectively, lack of administrative support, and insufficient funding for materials or equipment have significant effects on teachers' science teaching concerns. In addition, the researcher stated that the science teacher's negative experiences with the student and low SE may cause high levels of ATST. In addition, the use of technology in science teaching as a teaching tool in the classroom and the integration of lessons with technology create fear and anxiety in teachers with low proficiency in these technologies. Moreover, teachers may be concerned about managing the lesson due to a lack of familiarity with technology-assisted teaching (Chiu & Churchill, 2016; Ertmer & Ottenbreit-Leftwich, 2010).

School Culture (SC)

Each school has a unique culture that reflects common values, norms and assumptions (Gruenert & Whitaker, 2015). Johnson et al. (1996) define the SC as "shared beliefs, visions, rituals, values or norms" (p. 139). The SC is often used to define unique working conditions within institutions and to distinguish one school from another (Carpenter, 2015). Moreover, SC governs what is valuable to a school and how members should think, feel and act. In addition, the mentality and behavior of school members affect the quality of schools (Prasetyo et al., 2019). From a different point of view, SC affects teachers' sense of identity, perceptions, behaviors and even their capacity to find and apply new knowledge (Marz & Kelchtermans, 2013; Min, 2019; Seashore Louis & Lee, 2016). SC represents a structure affected by many variables such as principal-teacher, teacher-teacher and teacher-student relations (Brezicha et al., 2015; Duan et al., 2018). It is extremely important for a reliable SC for colleagues to be able to help each other, share their experiences, give ideas and work together on things (Clement & Vandenberghe, 2000; Grosemans et al., 2015). Moreover, a reliable SC fosters the professional behavior of both teachers and other staff (Prasetyo et al., 2019). Carpenter (2015) says that "a positive SC focuses on improving teaching and learning to ensure all students achieve high levels of success" (p. 684). We emphasized the importance of effective science teachers and STEM education for students to acquire 21st century skills in the introduction part of the article. As a result of literature review, we saw that there were not enough studies, except for a few studies covering SC, STEM education and especially science teachers. In one of these studies, Heba et al. (2017) found that SC plays an important role in the implementation of STEM education in schools. Researchers stated, "STEM integration required a different SC than that in non-

STEM schools" (p. 2476). STEM teachers and students participating in the research of Bruce-Davis et al. (2014) emphasized the importance of a SC where all stakeholders share similar interests for effective STEM education. Literature review showed that the relationship between science teachers' professional characteristics and SC needs more attention in terms of research.

Studies on the Factors Associated with Teachers' JS

In the literature, there are studies examining the relationship between the variables mentioned above and teachers' JS. The research results, which are the basis for the teachers' JS, TSE, STSE, ATST and SC variables to be considered in the model, are presented below.

Studies show that there is a positive and significant relationship between teachers' JS and SC, and that teachers' JS mediates the effect of SC, which is an important determinant of school effectiveness (Duan et al., 2018). While SC and teacher's stress level explain 52.3% of teachers' JS, the remaining 47.7% are affected by other variables (Febriantina et al., 2020). There is a direct and positive relationship between the dimensions of school climate, teacher-student relations and participation between stakeholders and JS (Turker & Kahraman, 2021). The meta-analysis results of Kursun and Yilmaz (2020) showed that there is a moderate and significant relationship between SC and JS. Along with the partial mediation effect of self-efficacy, school climate has a positive effect on teachers' JS (Malinen & Savolainen, 2016). Anastasiou and Papakonstantinou (2014) determined that good working conditions, motivation of the school principal, and participation in school management and decision-making processes have a positive effect on teachers' JS and reduce emotional exhaustion.

There are studies showing that there is a positive relationship between the SE (teacher SE and teaching SE) included in the model and teachers' JS. It is emphasized that the relationship revealed in these studies is also valid in different personal characteristics and contextual conditions (Burić & Kim, 2021; Gkolia et al., 2014; Zee & Koomen, 2016). Studies have found that teachers' JS is related to three dimensions of self-efficacy (classroom management self-efficacy, teaching self-efficacy, and student participation self-efficacy). It has been revealed that the effect of teaching SE on JS is higher than other SE dimensions (Edinger & Edinger, 2018; Skaalvik & Skaalvik, 2014; Zakariya, 2020). According to the current literature, the SE is one of the variables related to teachers' JS, is closely related to dedication and satisfaction to teaching (Caprara et al., 2006; Tschannen-Moran & Woolfolk Hoy, 2001). Otanga and Mwangi (2015) found that teachers' higher teaching anxiety causes them to be less satisfied with their teaching. The results of some studies have shown that teaching anxiety is not a significant predictor of teachers' job satisfaction (Demir, 2018; Ferguson et al., 2012).

In summary, teachers' JS has important effects on both their well-being and the quality of education and learning outcomes of students. For this reason, it is important to determine the variables that affect teachers' JS and their relative importance levels. Based on the literature, variables that have a significant relationship with teachers' JS were selected. Personal factors such as teachers' SE (TSE), science teaching SE (STSE), anxiety toward science teaching (ATST), and contextual factors such as school culture are among the most important of these variables. Therefore, the study was shaped around these four variables with the teachers' JS. In addition, considering that

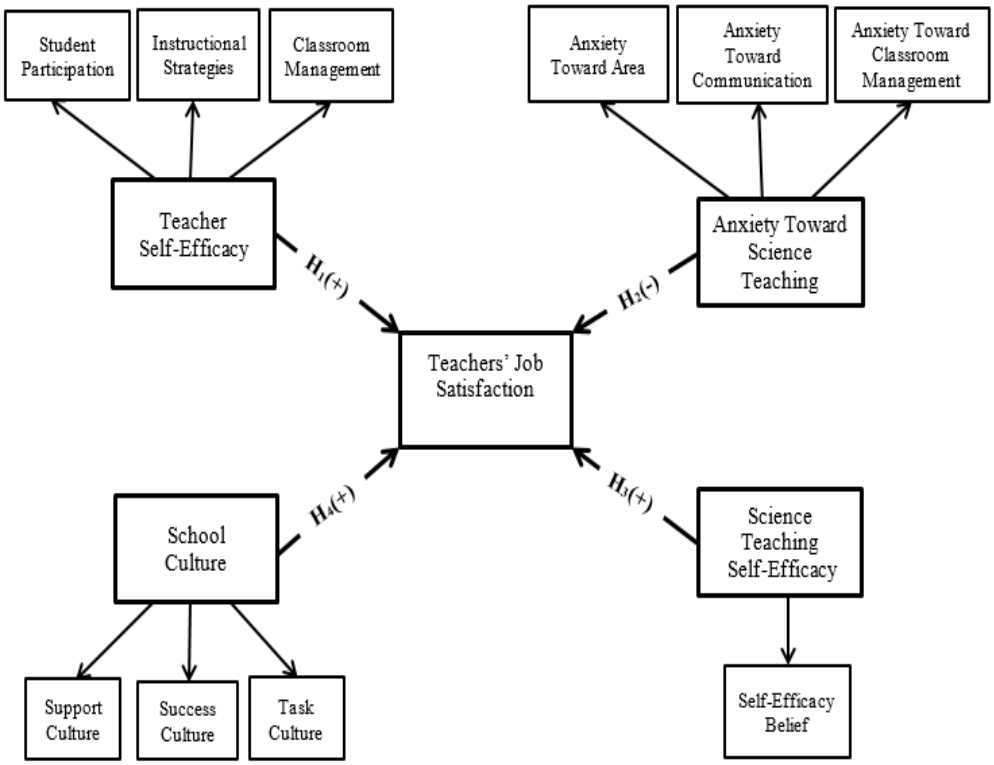
the factors affecting the science teachers' JS are inadequately researched and theorized, there is a need for evidence that can contribute to the efforts to theorize this concept in the context of science teachers. This study tries to contribute to explain the factors affecting the science teachers' JS.

Research Model and Hypotheses

Previous studies have examined the relationships between primary and secondary school teachers' JS, SE, ATST and SC regardless of their field (Duan et al., 2018; Febriantina et al., 2020; Klassen & Chiu, 2011; Manalo et al., 2020). However, these studies dealt with sometimes two (Federici & Skaalvik, 2012; Høigaard et al., 2012; Telef, 2011; Wang et al., 2015; You et al., 2017), sometimes three of the variables of our research (Aldridge & Fraser, 2016; Malinen & Savolainen, 2016; Skaalvik & Skaalvik, 2011; Song & Mustafa, 2015). Again, studies in the literature that included science teachers examined the relationships between only some of these variables (Bozeman et al., 2013; Yuruk, 2011; Zakariya, 2020). However, we found a limited number of studies in the literature examining the relationship between science teachers' JS and ATST (Yuruk, 2011), and between JS and SC (Mostafa & Pal, 2018). On the other hand, we did not find a study that revealed the relationship between these variables and the science teachers' JS. Considering this situation, we created a theoretical model that aims to examine the relationship between TSE, ATST, STSE and SC and science teachers' JS (see Figure 1). At the same time, we tried to test this model in research. The difference of this study from previous studies is that it includes science teachers in the scope of the study by making a field distinction, and it proposes a holistic model that explains the relationship between these teachers' TSE, ATST, STSE and SC perceptions and their JS. We created this model, which tries to explain the factors associated with science teachers' JS, from a synthesis of theoretical explanations, and the model presented here has never been tried before. Thus, in this research, we aimed to examine the theoretical framework for science teachers' JS in the context of these variables and to embody the theoretical structure proposed through this research. We presented the model and hypotheses of our research in Figure 1.

Figure 1

Theoretical Model of the Research



In this model, we defined science teachers' JS as the dependent variable and TSE, STSE, ATST and SC as the independent variable.

Considering the aim of the study, the following research questions were developed:

RQ: Is there a statistically significant relationship science teachers' JS with TSE, STSE, ATST and SC?

At the same time, we created the following hypotheses to test proposed model:

H1: TSE is a significant and positive predictor of science teachers' JS.

H2: ATST is a significant and positive predictor of science teachers' JS.

H3: STSE is a significant and positive predictor of science teachers' JS.

H4: SC is a significant and positive predictor of science teachers' JS.

Method

Research Design

This correlational research was carried out according to the prediction design. Correlational research is particularly useful in tackling problems in education because it allows simultaneous measurement of a number of variables and their relationships (Cohen et al., 2000, p. 199). In correlational research, "the researcher examines the relationship between one or more quantitative independent variables and one or more quantitative dependent variables" (Johnson & Christensen, 2014, p. 97). As a type of correlation research, the purpose of prediction research design is to determine the variables that will predict an outcome or criterion. In this type of research, the

researcher defines one or more predictor variables and a criterion (or outcome) variable (Creswell, 2012, p. 340). In the study, we tried to determine the predictors of science teachers' JS by using the prediction design. In this study, we defined TSE, STSE, ATST and SC as independent variables and JS as dependent variable. Using these independent variables as predictors, we tried to show their direct predictive effects on science teachers' JS. In line with the purpose of the study, a theoretical model is built based on the relevant literature and this model is tested with structural equation modeling (SEM). SEM is a multivariate statistical analysis method that allows the direct and indirect effects between observable and unobservable variables tested in a single model by defining observable and unobservable variables in a causal and relational model (Byrne, 2012).

Sampling

Secondary schools in Turkey were located in the city center, towns, villages of the city and villages of the town. This research was conducted in public schools in a city in eastern Turkey with a total population of less than 300.000. These schools were selected through convenience sampling in order for the researchers to have easy access to the schools and to deliver the questionnaires face-to-face to the teachers. The schools were in the city center with a population of about 118.000, in seven towns of this city with a population of 10.000-45.000, and in villages with a population of less than 2.000. The target group of the study included 217 science teachers in 165 secondary schools. A total of 185 (85%) science teachers from 150 (91%) secondary schools participated in this study. Stevens (2002) recommends that for social science research about 15 subject per predictor are needed for a reliable equation. Tabachnick and Fidell (2013, p. 123) give a formula for calculating sample size requirements, taking into account the number of independent variables that you wish to use: $N>50+8m$ (where m=number of independent variables). Since there are 12 independent variables in the model proposed in this study, it is sufficient to have a minimum of 180 participants. In addition, according to the Tabachnick and Fidell (2013) formula, it was evaluated that there should be 146 participants in total for 12 independent variables. According to these criteria, it can be said that the number of participants in the study is sufficient.

Each teacher voluntarily participated in this study. Table 1 included the distribution of science teachers participating in the research in terms of gender, professional career stage, duty region (location), and education degree. Of the teachers participating in this study, 119 (64.3%) were female and 66 (35.7%) were male. In this study, we chose Huberman's (1989) career stage model as a theoretical framework to represent teachers' career stages. Huberman's model characterized teacher development as five sequential stages closely related to individual teaching experience. The first was the "survival and discovery" stage, covering the first 3 years of the teaching profession. The second was the "stabilisation" phase, which took place in the 4-6 years of the profession. The third stage of the model, "experimentation/activism and stocktaking", covered the 7-18 years of the career. The fourth stage of the model spanned the 19-30 years of the career and had two possible orientations: (1) "serenity" or (2) "conservatism". The final stage of his teaching career was "withdrawal from the profession", which started with nearly 30 years of teaching experience (Richter et al., 2011). More than half of the participants (52.4%) were at the "survival and discovery"

stage. In addition, the number of participants in the "stabilisation" stage (23.2%) and the "experimentation/activism and stocktaking" (21.2%) stage was higher than those in the other career stages were. In terms of the place where they work, the participants mostly continued their teaching profession in the villages of the towns (41.6%). The vast majority of science teachers (92.4%, *n*=171) had a bachelor's degree.

Table 1

The Frequency Distribution of Participants According to Various Variables

Variable	Code	*f*	%
Gender	Female	119	64.3
	Male	66	35.7
Professional Career Stage	≤ 3 years (The stage of adherence to profession)	97	52.4
	4-6 years (The period of stability)	43	23.2
	7-18 years (The period of activity)	39	21.2
	19-30 years (The period of inactivity)	5	2.7
	> 30 years (The period of Withdrawal)	1	0.5
The place of duty	City Center (urban)	41	22.2
	County Town (suburban)	47	25.4
	The village affiliated the city center (rural)	20	10.8
	The village affiliated the county town (rural)	77	41.6
The level of education	Bachelor's Degree	171	92.4
	Master's Degree	14	7.6

Data Collection and Instrumentation

The data of the current research were collected in November-December 2019. Before the research, we obtained the necessary legal permissions for the application of the instrument from the National Education Directorate of the city where the research sample was located. Then, two researchers visited the schools in the sample. After meeting face-to-face with each secondary school science teacher and introducing the purpose of the research and the measurement tools, we handed over the paper version of the instrument to the teachers who declared that they would voluntarily participate in the research. We gave teachers two days to complete the six-part instrument. We visited the schools again on the days agreed in advance and received the completed instrument. In the present study, the instrument consisted of six parts. The first part was prepared to collect the demographic data of science teachers who participated in the research, including gender, professional career stage, region of duty and education degree. The other five parts aimed to collect data on the variables JS, TSE, STSE, ATST and SC. We have explained the structural features of these parts in detail in the following section.

Minnesota Job Satisfaction Scale (MJSS)

The MJSS was used to measure the science teachers' JS. The MJSS was developed by Weiss et al. (1967) and adapted into Turkish by Baycan (1985) in order to measure the JS levels of employees. The MJSS had 20 items that represent two dimensions of JS: "intrinsic satisfaction" (success, recognition or appreciation, job itself, job responsibility, promotion) and "extrinsic satisfaction" (business policy and management, type of governance, manager, relationships with employees and subordinates, working conditions, wages). The score obtained from these two subscales were the general JS score. The MJSS used a 5-point Likert-type scale, ranging from "very dissatisfied" to "very satisfied". CFA was conducted using data from the current study to examine the construct validity of the scale and it was confirmed that the scale had a two-factor model ($\chi 2$=599.75 *df*=170, p>.05, $\chi 2/df$=3.52, RMSEA=.06, IFI=.90, GFI=.91, SRMR=.06, AGFI=.82, NFI=.89 and CFI=.91). The standardized factor loads of the items ranged from .40 to .75, and the *t* values were between 11.52 and 5.46, and statistically significant (p<.01). Cronbach's alpha internal consistency coefficient was .85 for the whole scale.

Teachers Self Efficacy Scale (TSES)

The TSES developed by Tschannen-Moran and Woolfolk Hoy (2001) and adapted into Turkish by Capa et al. (2005) was used to measure the science teachers' SE. This scale had 24 items and three-dimensions. The scale included the dimensions of "student engagement" (8 items), "instructional strategies" (8 items) and "classroom management" (8 items). The scale had a 9-point scoring structure ranging from "Insufficient" to "Very Sufficient". In this study, CFA was performed to examine the construct validity of the scale and it was confirmed that the scale had a three dimensions structure ($\chi 2$=559.39, *df*=249, p>.05, $\chi 2/df$=2.24, RMSEA=.06, IFI=.96, GFI=.93, SRMR=.06, AGFI=.86, NFI=.93 and CFI=.96). The standardized factor loads of the items ranged from .49 to .83, and the *t* values were between 6.52 and 12.92 and statistically significant (p<.01). Cronbach's alpha internal consistency coefficient was .86 for the whole scale.

Science Teaching Self-Efficacy Belief Instrument (STSEBI)

The STSEBI developed by Riggs and Enochs (1990) and adapted into Turkish by Hazir-Bikmaz (2002) was used to measure the teachers' "science teaching self-efficacy". This scale had 21 items and two-dimensions. The scale included the dimensions of "science teaching self-efficacy beliefs (STSEB)" (13 items) and "classroom management (CM)" (8 items). The scale had a 5-point scoring structure ranging from "Strongly Agree" to "Strongly Disagree". Since the results of the analysis showed that the construct validity values of CM dimension of the original scale were low, this dimension was excluded from the analysis. CFA was performed to ensure the construct validity of the STSEB, and it was understood that the single-factor (STSEB) structure of the scale was compatible with the collected data set ($\chi 2$=117.88 *df*=54, p>.05, $\chi 2/df$=2.18, RMSEA=.06, IFI=.93, GFI=.90, SRMR=.07, AGFI=.81, NFI=.91 and CFI=.92). The standardized factor loads of the items ranged from .30 to .72, and the *t* values were between 2.61 and 10.30 and statistically significant (p<.01). Cronbach's alpha internal consistency coefficient was .86 for STSEB.

Science Teaching Anxiety Scale (STAS)

The STAS developed by Kahraman and Polat (2017) was used to determine the teachers' ATST. The STAS had 44 items that represent four dimensions of ATST: the "anxiety toward area (science and laboratory) competence" (18 items), "anxiety toward communication" (12 items), and "anxiety toward classroom management" (14 items). The scale had a 10-point scoring structure ranging from "I never feel anxiety" and "I always feel anxiety". In this study, CFA was performed to examine the construct validity of the scale and it was confirmed that the scale had a three-factor structure ($\chi 2$=4197.46 *df*=899, p>.05, $\chi 2/df$=4.66, RMSEA=.07, IFI=.96, GFI=.90, SRMR=.07, AGFI=.86, NFI=.94 and CFI=.96). The standardized factor loads of the items ranged from .47 to .85, and the *t* values were between 6.26 and 13.03 and statistically significant (p<.01). Cronbach's alpha internal consistency coefficient was .84 for the whole scale.

School Culture Scale (SCS)

The SCS developed by Terzi (2005) was used to determine the perceptions of science teachers about SC. The SCS had 29 items that represent four dimensions of SC: "support culture" (8 items), "achievement culture" (6 items), "task culture" (6 items), and "bureaucratic culture" (9 items). The scale used a 5-point Likert scale, ranging from "Never" to "Always". In this study, CFA was performed to examine the construct validity of the scale and the three-factor (Support, Success and Task) structure of the scale were verified ($\chi 2$=779.80, *df*=373, p>.05, $\chi 2/df$=2.09, RMSEA=.07, IFI=.92, GFI=.91, SRMR=.07, AGFI=.80, NFI=.88 and CFI=.93). The standardized factor loads of the items ranged from .47 to .72, and the *t* values were between 5.78 and 8.71 and statistically significant (p<.01). Cronbach's alpha internal consistency coefficient was .80 for the whole scale.

Data Analysis

The three main analysis methods performed in the current research were the multiple linear regression, CFA and SEM. The analyses were conducted using the SPSS 23.0 and LISREL 8.7 package. In this context, the measures of central tendency and dispersion (mean and standard deviation), univariate normality, the correlation between variables, the reliability of scales and multilinear regression analysis were performed with SPSS. The CFA and SEM analysis were performed with the LISREL 8.7. The main assumptions were evaluated to perform parametric tests before the analysis. Descriptive statistics were calculated, and Kolmogorov-Smirnov test was performed for the conformity of the scores of the variables and sub-dimensions of all variables to the univariate normal distribution. It was determined that the scores of the sub-dimensions of STAS and SCS did not comply with the normal distribution. Various data transformation methods are recommended according to the distribution patterns of the data to bring the skewed data closer to normal. Square root transformation was applied for moderately positively skewed scores, and logarithmic transformation was applied for those with extremely positive skewness (Pallant, 2001, p. 78; Tabachnick & Fidell, 2013, p. 86). Data conversion operations were performed using SPSS menus.

In this study, firstly the factor structures, validity and reliability studies of the measurement tools were analyzed. In this context, CFA was performed for each

measurement tool. As a result of the analysis, goodness of fit values, factor loads, and t-test significances of each scale were determined. Then, SEM analysis was performed to determine the predictors of the independent variables on the dependent variable. Chi-Square / degrees of freedom ($\chi 2/df$), RMSEA, NFI, GFI, CFI, IFI, SRMR and AGFI fit indices were used both in the CFA for measurement instruments and in the evaluation of SEM fit (Kline, 2016; Tabachnick & Fidell, 2013).

Ethical Procedures

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Before the study, the implementation of the scales was approved the Provincial Directorate of National Education in which the research sample is included (8 October 2019/No: 91782061-605.01-E.19302553). Informed consent was obtained from all individual participants included in the study. Verbal informed consent was obtained prior to the data collection process. Data tools in the study were applied only to volunteer participants.

Results

This section included the results from descriptive analysis of research data, multiple linear regression, CFA and established SEM analysis of the model. The results were presented under the headings in the following sections.

CFA and Reliability Analysis Results with Central Tendency and Dispersion of Variables

Table 2 included the factor load, mean, standard deviation and reliability coefficient values for the sub-dimensions forming the JS, TSE, STSE, ATST and SC scales.

Table 2

Descriptive Statistics and factor loadings yielded from CFA

Scale	Latent variable	Item	Factor loading	*M*	*sd*	*α*
MJSS	Intrinsic Satisfaction	1,2,3,4,7,8,9,10,11,15,19,20	.40 - .72	4.05	.49	.85
	Extrinsic Satisfaction	5,6,12,13,14,16,17,18	.45 - .75	3.68	.64	
TSES	Student engagement	1,2,4,6,9,12,14,22	.49 -. 70	7.03	.83	.86
	Instructional Strategies	7,10,11,17,18,20,23,24	.58 - .73	7.44	.81	
	Class Management	3,5,8,13,15,16,19,21	.58 - .76	7.43	.83	
STSEBI	Teaching Self-Efficacy Belief	1,3,4,6,10,14,15, 16,17,18,19,20	.30 - .72	4.20	.39	.71
STAS	Anxiety toward area	1,2,3,4,5,6,7,8,9,10,11, 12,13,14,15,16,17,18	.53 - .82	2.12**	.54	.84
	Anxiety toward communication	19,20,21, 22, 23, 24, 25, 26,27,28,29,30	.47 - .75	.48*	.27	

	Anxiety toward school management	31,32,33,34,35,36,37,38 39,40 41,42 43,44	.63 - .85	.49*	.29	
SCS	Support Culture	7,10,11,16,18,24,26,27	.60 - .70	1.43**	.23	.80
	Achievement Culture	9,17,21,22,25,28	.47 - .72	1.46**	.22	
	Task Culture	1,2,3,4,5,6	.50 - .67	1.41**	.20	

* Logarithmic transformation point average,

** Square root transformation point average

The results reported in Table 2 showed that the mean of the latent variables was above the midpoint of the score range of the scales. In addition, the standard deviation values were clustered close to the mean scores of the variables. These results indicated that science teachers participating in the present study did not differ much in terms of measured characteristics. We conducted the Kolmogorov-Smirnov univariate analysis of normality for the data from the instruments. Analysis results showed that ATST scores were moderately positively skewed. We conducted a repeat analysis of normality by applying the square root transformation to the ATST scores. Table 3 represented the results of the analysis of normality.

Table 3

The Results of Descriptive Statistics and Univariate Normality for Variables

Variable	*n*	Mean	Std. Deviation	Skewness	Kurtosis	Kolmogorov-Smirnov
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic
JS	185	3.908	.519	-.096	-.797	.063*
TSE	185	7.305	.730	.016	-.431	.038*
STSE	185	4.201	.386	-.217	-.296	.061*
ATST	185	1.974	.518	.276	-.795	.059*
SC	185	3.647	.437	-.083	-.460	.040*

* p>.05; Std. Error of Skewness=.179; Std. Error of Kurtosis=.355; JS: Job Satisfaction; TSE: Teachers' Self-Efficacy; STSE: Science Teaching Self-Efficacy; ATST: Anxiety toward Science Teaching; SC: School Culture

Skewness and kurtosis values were calculated for the scores of the variables. The calculated values were found in the range of 3 to -3 and were considered to provide a normal distribution (Tabachnick & Fidell, 2013, p. 79). The results indicated by Table 3 showed that the variables had univariate normality (p>.05). In other words, JS, TSE, STSE, ATST, and SC scores were assumed to be normally distributed for multivariate regression and SEM purposes. At the beginning of the analysis, we evaluated whether there was a linear relationship among the predictor variables and the predicted variable for the regression procedure using the scatter plot and calculated the correlation coefficients. Table 4 included correlations among variables in the model.

Table 4

Correlations among the Variables in the Model

Variables	TSE	STSE	SC	JS	ATST
TSE	1				
STSE	.422**	1			
SC	.265**	.251**	1		
JS	.374**	.333**	.575**	1	
ATST	-.162*	-.133	-.047	-.126	1

* The correlation is significant at .05 level (Two-tailed),

** The correlation is significant at .01 level (Two-tailed)

The results in Table 4 indicated a positive linear relationship between the JS variable and TSE, STSE and SC, and a weakly negative relationship with the ATST variable. In addition, the results showed that there was no multicollinearity problem among the predictor variables (r<.70). In addition, "collinearity diagnostic" was performed on the variables to control the multicollinearity problem. The tolerance values for independent variables are quite respectable, Tolerance>.20 and VIF<10 (Pallant, 2001, p. 143). The existing relationships among the variables showed that a predictive model could be constructed that included these variables. Outliers checked by inspecting the Mahalanobis distances that are produced by the multiple regression procedure. The maximum Mahalanobis distance value was calculated as 18.92 (Chi-square p value .0008). The number of independent variables was taken as degrees of freedom to determine which cases were outliers. By examining the extreme values, it was determined that there was only one case exceeding the chi-square critical value at the alpha level of .001 (Critical value=18.47, df=4, α=.001). We checked the residuals scatterplot and normal probability plot in the regression procedure for multivariate normality and linearity between the predictor variables and the predicted variable. We evaluated that the score on the scatterplot tend to cluster around zero point and this indicated that the linearity assumption was met. According to the normal probability plot of standardized residuals, the points lied in a reasonably straight diagonal line. This meant that there were no major deviations from the normality. Therefore, it was evaluated that there is no need to remove a case with an extreme value from the data set (Pallant, 2001, p. 145).

Results of the Relationships between Dependent and Independent Variables in the Model

In this section, we formulated the relationship of science teachers' JS with TSE, STSE, SC and ATST with a SEM and presented the results of the model fit analysis. After it is determined that the fit index values evaluated in SEM meet the acceptance cut-off points. The fit index values of the structural model are shown in Table 5. After determining the suitability of the fit index values for the model structure, we examined the predictive power of four variables related to the science teachers' JS.

Table 5

Fit Index Analysis Results in Model

Fit Index	Perfect fit *	Acceptable fit *	Fit Index Value of the Model	Decision
χ^2/sd	≤3	≤5	97.15/55=1.77	Perfect
RMSEA	.00 ≤ RMSEA ≤ .05	.05 ≤ RMSEA ≤ .10	.04	Perfect
NFI	.95 ≤ NFI ≤ 1.00	.90 ≤ NFI ≤ .95	.94	Acceptable
CFI	.95 ≤ CFI ≤ 1.00	.90 ≤ CFI ≤ .95	.97	Perfect
IFI	.95 ≤ IFI ≤ 1.00	.90 ≤ IFI ≤ .95	.97	Perfect
GFI	.95 ≤ GIFI ≤ 1.00	.90 ≤ GIFI ≤ .95	.92	Acceptable
SRMR	.00 ≤ SRMR ≤ .05	.05 ≤ SRMR ≤ .08	.05	Perfect
AGFI	.90 ≤ AGFI ≤ 1.00	.80 ≤ AGFI ≤ .90	.88	Acceptable

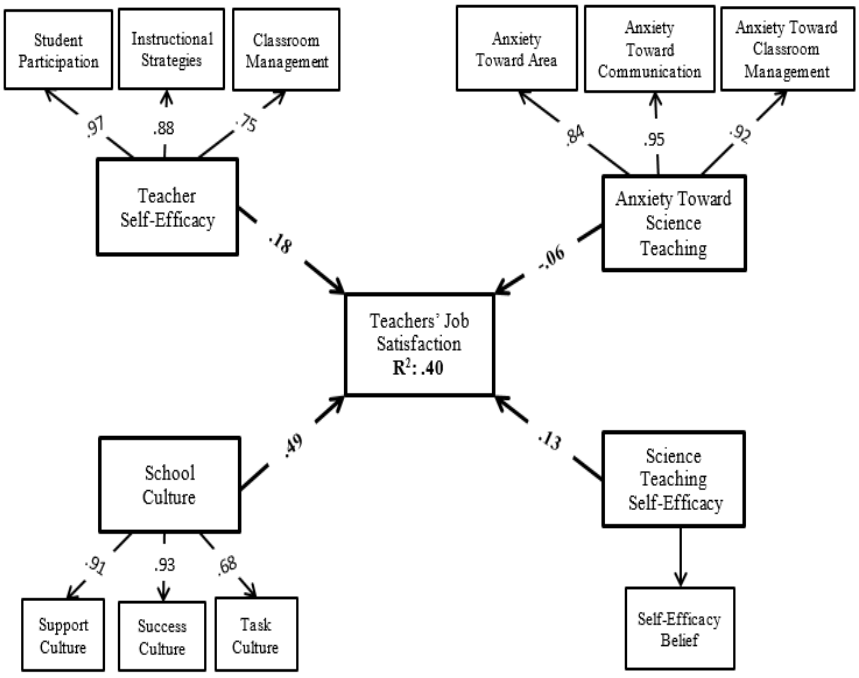
* (Hooper et al., 2008; Joreskog & Sorbom, 1993; Klem, 2000; Kline, 2016; Tabachnick & Fidell, 2013).

According to the fit indices in Table 5, it was determined that the established model met the necessary fit criteria. In other words, it can be said that the established model is compatible with the collected data (Model fit: $\chi 2/df$=1.77, CFI=.97, GFI=.92, NFI=.94, IFI=.97, AGFI=.88, RMSEA=.04 and SRMR=.05). We found that the five fit index values ($\chi 2/df$, RMSEA, CFI, IFI and SRMR) that we considered for the model correspond to good model fit, and three (NFI, GFI and AGFI) correspond to an acceptable level of model fit.

In this step, we examined the structural relationships of science teachers' JS with their TSE, STSE, SC and ATST (see Figure 2).

Figure 2

SEM Analysis Related to the Model



The results supported that science teachers' JS was significantly associated with several predictors tested. Science teachers' JS had the strongest association with SC (β=.49, r=.58, p<.01), followed by TSE (β=.18, r=.37, p<.01) and STSE (β=.13, r=.33, p<.01) (see Figure 3). In other words, it means that science teachers who have positive feelings in terms of SC are more likely to have higher JS when compared to SE (TSE and STSE). However, the results of the current study showed that the regression coefficient (β= -.06, r=-.13, p>.01) of the relationship between the ATST and JS was insignificant. This result showed that the amount of science teachers' ATST did not negatively affect their JS. These results confirmed H1 (t=2.77, p<.05), H3 (t=1.94, p<.05) and H4 (t=8.13, p<.01). On the other hand, they did not confirm H2 (t=0.98, p>.05). Table 6 shows the results of multiple linear regression.

Table 6

The Results of Multiple Linear Regression Analysis

Variables	*B*	Standard Error $_B$	β	*t*	Bilateral *r*	Partial *r*	Tolerance	VIF
Stable	.829	9.910		.084				
TSE	.107	.039	.181	2.772**	.374	.202	.784	1.275
STSE	.226	.116	.125	1.940*	.333	.143	.797	1.254
SC	.403	.050	.493	8.132**	.575	.518	.906	1.104
ATST	-.173	.177	-.057	-.978	-.126	-.073	.969	1.032

R=.63; R^2=.40; F=30.031**; n=185; *p<.05; **p<.01

Regression results showed that the predictive variables together explained approximately 40% of the variance in JS (R=.63, R^2=.40). Importance levels of independent variables according to standardized coefficients (β) were SC, TSE and STSE, respectively. Based on the analysis results, we represented the mathematical model for predicting science teachers' JS in Equation 1.

$$JS= 0.403SC+0.226STSE+0.107TSE+0.829 \quad (1)$$

Discussion

Current study aimed to examine the relationship between TSE, ATST, STSE and SC and science teachers' JS. For this aim, we created a theoretical model and tried to test this model through hypotheses.

The results of the current research showed that science teachers' JS was directly positively correlated with their SE and SC. In addition, the results of the structural model indicated that SC was a strong predictor of science teachers' JS. However, SE was less important in explaining science teachers' JS compared to SC. At the same time, these results met our expectation that science teachers' SC and SE beliefs were positively related to their JS. Science teachers' ATST did not have a direct negative significant relationship with their JS. This result did not meet our expectation that science teachers' ATSTs were negatively related to their JS. Capone and Petrillo (2020) found that poor TSE and JS were strongly associated with depression. This result underlines the role of work-related constructs such as SE and JS in influencing teachers'

psychological risks. You et al. (2017) showed that academic climate perception, peer support and supportive leadership, which are among the characteristics of TSE and SC, are important predictors of teachers' JS. Zakariya (2020) concluded that SC and TSE have a strong effect on JS. Katsantonis (2020) reported that SE and SC have a significant impact on teachers' satisfaction and resilience. In addition, he showed that the disciplinary climate perceived by the teachers, which is one of the school climate variables, has a negative effect on their SE, while the teacher-student relationship variable contains a positive internal meaning and therefore has a positive effect on TSE. Taxer and Frenzel (2018) found that high JS and SE levels as well as reduced anxiety support teacher happiness. According to Burić and Moe (2020), anxiety while performing a particular task can be seen by an individual as a sign of a lack of ability, which can result in low SE beliefs in a given situation. Huang et al. (2019) showed that SE was positively related to teaching performance and satisfaction, and negatively related to anxiety and depression. Contrary to the studies in the literature, the results of this study indicate that teaching anxiety is not a construct that affects science teachers' JS. However, the result that anxiety was negatively related to TSE was similar to the literature.

The results of testing the first and third hypotheses of this study revealed that science teachers' SEs (TSE and STSE) were a significant predictor of their JS. These results reiterate the positive correlation of teachers' JS with their SEs. Because the positive relationship between SE and JS has been documented in previous studies (Aldridge & Fraser, 2016; Canrinus et al., 2012; Skaalvik & Skaalvik, 2014; You et al., 2017). However, these results, which support previous studies, differed in terms of the sample studied. Previous research has mainly worked with teachers of different subjects at the secondary school level. This study, on the other hand, revealed the results of the relationships between the JSs and SEs of science teachers, which are not sufficiently covered in the literature. Contrary to our results, Wang et al. (2018) reported that science teachers' SEs were not a significant predictor of their JS. The reason for the inconsistency in the results can be explained by working with different samples. Because this study was conducted with middle school science teachers and their study was with high school science teachers. The fact that teachers are in different working conditions may be the source of this difference. Because it is stated that working conditions are related to teachers' SE beliefs and JSs (Duffy & Lent, 2009; Kahraman, 2014). As we mentioned in the previous section, knowing the positive relationship between the SEs of science teachers and their JSs, which play a key role in students' acquisition of 21st century skills and STEM education, can provide important contributions in practice. Won and Chang (2020) and Arslan (2019) reported that teachers with high SE levels have more JS than with low SE. On the other hand, Ghaffar et al. (2019) stated that low SE in science teachers triggered professional exhaustion and weakened the sense of belonging, which negatively affected student motivation and success. The result from this hypothesis may support the idea that science teachers' relatively modifiable SEs are beneficial in increasing their JS (Duffy & Lent, 2009). Thus, teachers with advanced SEs can get more satisfaction from their profession, which can foster the creation of an effective and positive teaching process.

The results of the second hypothesis of this study showed that science teachers' ATST did not have a direct significant relationship with their JS. The results of this

study that there was no significant relationship between science teachers' ATSTs and their JSs were consistent with the results of previous studies. For example, Ferguson et al. (2012) found that anxiety was not a significant predictor of teachers' JS. Similarly, Demir (2018) showed that there was no significant relationship between teachers' JS and their teaching anxiety. Although the past studies reviewed here presented results that included the relationship between ATST and JS for a mixed group of teachers without any field distinction, they did not reveal any results for this relationship for science teachers. Therefore, the result of this research points to a new result outside the relevant literature. This result indicates that ATST does not have a key role in advancing the JS of science teachers. It is understood that some of the studies in the literature evaluated the predictive power on JS by using the independent variables discussed in this study individually or using several of them together. Wang et al. (2015) determined that SE affects teachers' psychological satisfaction and their intention to withdraw from teaching through a large sample. Skaalvik and Skaalvik (2017) found that teacher anxiety and TSE were negatively related, and teacher anxiety was negatively associated with teacher JS and job engagement, and positively with burnout and teacher attrition. On the other hand, he reported that TSE was positively related to teacher JS and job engagement, and negatively related to burnout and teacher attrition. Gkolia et al. (2014) showed that teachers' JS has a positive effect on different dimensions of TSE. The results of both studies can be interpreted as teachers' JS and TSE mutually predict each other.

The results of the fourth hypothesis of this study revealed that SC predicted science teachers' JS positively. In addition, our results showed that SC was the relatively most important predictor of JS compared to TSE and STSE variables. Results revealed that the role of SC in promoting the psychological empowerment of science teachers is very clear. This study shows that both JS and SE of science teachers have a significant relationship with SC can be interpreted as indicating that teachers' professional well-being passes through a healthy school climate. However, the findings of the current study were inconsistent with the findings of Shaukat et al. (2019) that there was no significant relationship between TSE and JS. This difference between the findings of the current study and the studies of Shaukat et al. (2019) may be due to the sample and cultural differences. The results of the current research showing a direct positive relationship between teachers' SC and their JS were consistent with previous studies (Duan et al., 2018; Katsantonis, 2020; You et al., 2017; Zakariya, 2020). For example, the meta-analysis results of Kursun and Yilmaz's (2020) research on the relationships between teachers' JS and their SC showed that there is a moderate and significant relationship between SC and JS. However, the result of current study that SC is a more important variable in explaining teachers' JS compared to other predictor variables differed from previous studies. Because previous studies have shown that SE, one of the variables that we discussed in this study, is more important in explaining JS (Aldridge & Fraser, 2016; Febriantina et al., 2020; Malinen & Savolainen, 2016). However, in line with the results of our research, Turker and Kahraman (2021) revealed that SC is more important than SE in explaining teachers' JS. Therefore, results may support the idea that creating a supportive SC where teachers can work effectively and share their ideas and practices is more beneficial for them in terms of increasing JS. Capone and Petrillo (2020) emphasize that improving teachers' satisfaction can have

important effects on students' educational outcomes and their social and emotional development. Zakariya (2020) reported that understanding the relationships between teachers' SC, SE and JS plays a vital role in identifying, hiring and retaining effective teachers. Moreover, he emphasized that this is important for improving teachers' well-being, the quality of school management, and teaching and learning outcomes. Teachers' mental well-being in terms of JS is associated with their desired outcomes such as low depression, low burnout, and increased SE beliefs (Capone & Petrillo, 2020). The results of our study, when evaluated in the light of these studies, point out that the effect of individual science teachers' sense of SE and SC perceptions on their JS and practices is very important and a structure that should be considered. In other words, empirical studies in the context of these two independent variables on the way to improve the science teachers' JS can lead to better education policies. According to Ali et al. (2017), in a healthy school climate, the teacher finds his profession meaningful and takes more responsibility for his work. They emphasize that this situation has a positive effect on JS and leads to an increase in teachers' motivation and performance. However, science teachers should know that they have responsibilities in creating SC, which is one of the most important variables affecting their JS. Science teachers will feel happier when they think that they are valuable in their institution and make a meaningful contribution to their institution. When all variables are considered together, SC has the strongest effect on JS. This means that it is useful to consider factors within the SC and how they can be developed (Aldridge & Fraser, 2016). Kalman and Balkar (2018) assumes that teachers play a dominant role in the culture and effectiveness of the school, as they are one of the main actors that create and display values and beliefs in the school. Song et al. (2020) emphasize that teachers' perceptions of quality of life in schools reflect their subjective well-being, values and capacity to fulfill these values. The prominence of the SC variable as the most important predictor of science teachers' JS has been discussed in the light of some research and theoretical knowledge. In this context, when the studies are examined, it is understood that the important effects of the support culture dimension, one of the sub-dimensions of SC, on teachers' JS come to the fore more through both theoretical knowledge and research. Although limited in number, some studies in the literature confirm that the teacher-student relationship dimension of SC has a greater impact on JS than other dimensions (Veldman et al., 2013; You et al. 2017). When teachers face disturbing student behaviors, they have problems in managing it. This situation leads to a weakening of teachers' relationships with students, a perspective that does not care about students, a weakening of the culture of success and duty, and as a result, the probability of schools having teachers with low JS increases (Aldridge & Fraser, 2016). Collie et al. (2012) found that teachers' perceptions of students' motivation and behavior had the strongest influence on their teaching effectiveness and JS. They found that these variables significantly predicted teachers' sense of stress, teaching effectiveness and JS. In addition, teachers' perceptions of values in schools and value congruence (to what extent they feel that they share the norms and values that are valid at school) are significantly associated with JS and motivation to leave the teaching profession (Skaalvik & Skaalvik, 2011). In other words, it can be said that in a school that shares its values with its employees, teachers will strengthen the sense of belonging to their institution and work and can successfully manage the emotional exhaustion process related to their work. The SC is a rather

abstract concept that can be explained by many factors. However, it is shaped by shared institutional values. Especially in a good SC, the target of student success, that is, what kind of student you aim to raise and with which practices this will be done come to the fore (Aldridge & Fraser, 2016). Moreover, it can be said that in a strong SC, cooperation between teachers and other stakeholders, shared values and orientation towards common goals will increase, which will positively affect teachers' JS. Abdulahi (2020) showed that SC and TSE levels are predictors of JS in schools. In this study, it was understood that there is a significant relationship between teachers' JS and SC, especially with teachers' professional development and collaborative leadership practices. Therefore, it can be said that in order to increase teachers' JS, school leaders should strengthen and develop the professional development program and collaborative leadership practices in schools. It reveals that positive SC and climate are associated with stronger academic performance, higher graduation rates, decreased violence, increased teacher satisfaction and retention (Clifford et al., 2012). Torres (2019) stated that the support or cooperation aspects of SC are positively related to JS and student success. In a collaborative SC with a culture of shared responsibility and mutual support, teachers feel supported, realize that they have responsibilities that extend beyond the classroom to school-wide problems, and are more satisfied with their jobs and, as a result, with their school. The attitudes and behaviors of school administrators may have a significant effect on the positive relationship of school culture with both teacher job satisfaction and self-efficacy. Toropova et al. (2021) showed that there is a significant relationship between school working conditions and teacher JS. More specifically, they found that teacher perceptions of teacher workload, teacher collaboration, and student discipline at school were the factors most closely associated with teacher JS. Brezicha et al. (2020) showed that when principals provide opportunities for teachers to participate in meaningful decision-making opportunities, it leads teachers to feel a greater sense of ownership and commitment to their profession and school. Lambersky (2016) reported that principal behavior is an important factor in improving or worsening work feelings. The results of this study supported the idea that principals, who are an important stakeholder of SC, can play a role in increasing the performance of teachers by influencing their emotional states such as job satisfaction, burnout, anxiety, self-efficacy, organizational commitment and participation.

Conclusion and Recommendations

This study revealed that the professional satisfaction of science teachers is largely fed by SC and SE (TSE and STSE). Moreover, the results underline which variables need more attention in improving the science teachers' JS. The present study makes important theoretical contributions to the existing literature on the variables that shape the science teachers' JS through the proposed model. In addition, this study is one of the first studies aiming to determine the emotional and motivational variables related to the science teachers' JS in Turkey. The results of the present study shed light on the responsibilities of the stakeholders regarding these variables by revealing the factors directly related to the science teachers' JS.

The results of our research related to SE, SC, and ATST did not directly include an impact on either teachers' job performances or students' learning outcomes. That is, the results of this study did not reveal a causal effect. However, the fact that SC and SE

have strong positive associations with science teachers' JS and are important predictors of explaining JS may play a key role in retaining teachers with high satisfaction. When these results are taken into account in practice, opportunities for teachers to participate in activities promoting SE can be provided. In addition, stakeholders such as colleagues, families and administrators should try to create an effective school climate through mutually supportive relationships. Thus, it can be a basis for teachers who are trying to cope with various difficulties in their professional career process to be more satisfied and happier.

Previous studies have revealed that burnout, job stress and SE, which are significantly related to teachers' JS, are also related to anxiety (Demir, 2018; Senler, 2016). In this study, it was seen that there was a significant relationship between SE, SC and JS. However, we examined the relationship between JS and ATST without considering the mediating effect, and we saw that there was no direct significant relationship between the two variables. Future research can study whether ATST is a predictor of science teachers' JS, taking into account considering the mediating effect of the variables mentioned here. However, the theoretical model proposed by the current research can be retested in groups of teachers from different fields and in samples from different cultures. By adding different motivational and affective variables that are thought to affect the model, studies can be carried out on new models related to the professional satisfaction of science teachers, thus contributing to the development of the theoretical structure.

Limitations

The research has some limitations despite its valuable contributions. First of all, the conduct of this research in a single province in eastern Turkey is the main limitation. Therefore, a larger sample is needed to generalize the results. Since the participants of the present study were secondary school science teachers, the number of samples was limited. However, the results could be generalized to a wider range of teachers if teachers in other science fields such as physics, chemistry, and biology at the high school level were included in the study.

Statement of Responsibility

All authors contributed to the study conception and design. First author performed material preparation, data collection and analysis. Second author wrote the first draft of the manuscript and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Conflicts of Interest

The authors have no relevant financial or non-financial interests to disclose.

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References

Abdulahi, B. A. (2020). Determinants of teachers' job satisfaction: School culture perspective. *Humaniora*, *32*(2), 151-162.

Adeniyi, C. O., & Adeniyi, E. O. (2018). Determinants of job satisfaction among mathematics and science teachers in Kwara State Senior Secondary Schools, Nigeria. *KIU Journal of Humanities*, *3*(2), 179-185.

Admiraal, W., Veldman, L., Mainhard, T., & Van Tartwiijk, J. (2019). A typology of veteran teacher's job satisfaction: Their relationships with their students and the nature of their work. *Social Psychology of Education*, *22*, 337-355. https://doi.org/10.1007/s11218-018-09477-z

Aldridge, J. M., & Fraser, B. J. (2016). Teachers' views of their school climate and its relationship with teacher self-efficacy and job satisfaction. *Learning Environments Research*, *19*(2), 291-307. https://doi.org/10.1007/s10984-015-9198-x

Ali, N., Sharma, S., & Zaman, A. (2017). School culture and school effectiveness: Secondary schools in Pakistan. *Malaysian Online Journal of Educational Management*, *4*(4), 50-65. https://doi.org/10.22452/mojem.vol4no4.4

Alzyoud, A. A. Y., Othman, S. Z., & Mohad Isa, M. F. (2015). Examining the role of job resources on work engagement in the academic setting. *Asian Social Science*, *11*(3), 103-110. http://doi.org/10.5539/ass.v11n3p103

Anastasiou, S., & Papakonstantinou, G. (2014). Factors affecting job satisfaction, stress and work performance of secondary education teachers in Epirus, NW Greece. *International Journal of Management in Education*, *8*(1), 37-53. http://doi.org/10.1504/IJMIE.2014.058750

Anusiem, A. U., & Okoiye, O. E. (2015). The predictive influence of teaching anxiety and occupational stress on teaching efficacy of secondary school teachers in Owerri Municipal of Imo state Nigeria. *Journal of Research & Method in Education*, *5*(3), 10-14. https://doi.org/10.9790/7388-05341014

Ariani, D. W. (2013). The relationship between employee engagement, organizational citizenship behavior, and counterproductive work behavior. *International Journal of Business Administration*, *4*(2), 46-56. http://dx.doi.org/10.5430/ijba.v4n2p46

Arslan, A. (2019). The mediating role of prospective teachers' teaching self-efficacy between self-efficacy sources and attitude towards teaching profession. *International Journal of Educational Methodology*, *5*(1), 87-96. https://doi.org/10.12973/ijem.5.1.101

Avanzi, L., Miglioretti, M., Velasco, V., Balducci, C., Vecchio, L., Fraccaroli, F., & Skaalvik, E. M. (2013). Cross-validation of the Norwegian teacher's self-efficacy scale (NTSES). *Teaching and Teacher Education*, *31*, 69-78. https://doi.org/10.1016/j.tate.2013.01.002

Avery, L. M., & Meyer, D. Z. (2012). Teaching science as science is practiced: Opportunities and limits for enhancing preservice elementary teachers' self-efficacy for science and science teaching. *School Science and Mathematics*, *112*(7), 395-409. https://doi.org/10.1111/j.1949-8594.2012.00159.x

Aytekin, C., Turkmenoglu, H., & Arikan, N. (2017). Adaptation of math and science teaching anxiety scale to Turkish. *Journal of Kirsehir Education Faculty*, *18*(3), 2147-1037. https://doi.org/10.29299/kefad.2017.18.3.009

Baluyos, G. R., Rivera, H. L., & Baluyos, E. L. (2019). Teachers' job satisfaction and work performance. *Open Journal of Social Sciences, 7*(8), 206-221. https://doi.org/10.4236/jss.2019.78015

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191-215. https://doi.org/10.1037/0033-295X.84.2.191

Bandura, A. (1997). *Self-efficacy: The exercise of control.* Freeman.

Bandura, A. (2006). Adolescent development from an agentic perspective. In F. Pajares, & T. Urdan (Eds.), *Self-efficacy beliefs of adolescents* (pp. 1-43). Information Age Publishing.

Baycan, F. A. (1985). *Analysis of some aspects of job satisfaction among people working in different groups* [Unpublished master dissertation]. Boğaziçi University.

Bozeman, T. D., Scogin, S., & Stuessy, C. L. (2013). Job satisfaction of high school science teachers: Prevalence and association with teacher retention. *Electronic Journal of Science Education*, *17*(4), 1-19.

Brezicha, K., Bergmark, U., & Mitra, D. L. (2015). One size does not fit all: Differentiating leadership to support teachers in school reform. *Educational Administration Quarterly*, *51*(1), 96-132. https://doi.org/10.1177/0013161x14521632

Brezicha, K. F., Ikoma, S., Park, H., & LeTendre, G. K. (2020). The ownership perception gap: Exploring teacher job satisfaction and its relationship to teachers' and principals' perception of decision-making opportunities. *International Journal of Leadership in Education*, *23*(4), 428-456. https://doi.org/10.1080/13603124.2018.1562098

Bruce-Davis, M. N., Gubbins, E. J., Gilson, C. M., Villanueva, M., Foreman, J. L., & Rubenstein, L. D. (2014). STEM high school administrators', teachers', and students' perceptions of curricular and instructional strategies and practices. *Journal of Advanced Academics*, *25*(3), 272-306. https://doi.org/10.1177/1932202X14527952

Burić, I., & Kim, L. E. (2021). Job satisfaction predicts teacher self-efficacy and the association is invariant: Examinations using TALIS 2018 data and longitudinal Croatian data. *Teaching and Teacher Education*, *105*, 103406. https://doi.org/10.1016/j.tate.2021.103406

Burić, I., & Moe, A. (2020). What makes teachers enthusiastic: The interplay of positive affect, self-efficacy and job satisfaction. *Teaching and Teacher Education*, *89*, 103008. https://doi.org/10.1016/j.tate.2019.103008

Burke, R. J., & El-Kot, G. (2010). Work engagement among managers and professionals in Egypt: Potential antecedents and consequences. *African Journal of Economic and Management Studies*, *1*(1), 42-60. https://doi.org/10.1108/20400701011028158

Byrne, B. M. (2012). *Structural equation modeling with MPLUS*. Routledge.

Canrinus, E. T., Helms-Lorenz, M., Beijaard, D., Buitink, J., & Hofman, W. H. A. (2012). Self-efficacy, job satisfaction, motivation, and commitment: Exploring the relationships between indicators of teachers' professional identity. *European Journal of Psychology of Education*, *27*(1), 115-132. https://doi.org/10.1007/s10212-011-0069-2

Capa, Y., Cakiroglu, J., & Sarikaya, H. (2005). The development and validation of a

Turkish version of the teachers' sense of efficacy scale. *Education and Science, 30*(137), 74-81.

Capone, V., & Petrillo, G. (2020). Mental health in teachers: Relationships with job satisfaction, efficacy beliefs, burnout and depression. *Current Psychology, 39*(5), 1757-1766. https://doi.org/10.1007/s12144-018-9878-7

Caprara, G. V., Barbaranelli, C., Borgogni, L., & Steca, P. (2003). Efficacy beliefs as determinants of teachers' job satisfaction. *Journal of Educational Psychology, 95*(4), 821-832. https://doi.org/10.1037/0022-0663.95.4.821

Caprara, G. V., Barbaranelli, C., Steca, P., & Malone, P. S. (2006). Teachers' self-efficacy beliefs as determinants of job satisfaction and students' academic achievement: A study at the school level. *Journal of School Psychology, 44*(6), 473-490. https://doi.org/10.1016/j.jsp.2006.09.001

Carpenter, D. (2015). School culture and leadership of professional learning communities. *International Journal of Educational Management, 29*(5), 682-694. https://doi.org/10.1108/IJEM-04-2014-0046

Chaaban, Y., & Du, X. (2017). Novice teachers' job satisfaction and coping strategies: Overcoming contextual challenges at Qatari government schools. *Teaching and Teacher Education, 67*, 340-350. https://doi.org/10.1016/j.tate.2017.07.002

Chiu, T. K., & Churchill, D. (2016). Adoption of mobile devices in teaching: Changes in teacher beliefs, attitudes and anxiety. *Interactive Learning Environments, 24*(2), 317-327. https://doi.org/10.1080/10494820.2015.1113709

Clement, M., & Vandenberghe, R. (2000). Teachers' professional development: A solitary or collegial (ad) venture? *Teaching and Teacher Education, 16*(1), 81-101. https://doi.org/10.1016/S0742-051X(99)00051-7

Clifford, M., Menon, R., Gangi, T., Condon, C., & Hornung, K. (2012). *Measuring school climate for gauging principal performance: A review of the validity and reliability of publicly accessible measures*. American Institute of Research.

Cohen, L., Manion, L., & Morrison, K. (2000). *Research methods in education* (5th ed.). Routledge Falmer.

Collie, R. J., Shapka, J. D., & Perry, N. E. (2012). School climate and social–emotional learning: Predicting teacher stress, job satisfaction, and teaching efficacy. *Journal of Educational Psychology, 104*(4), 1189-1204. https://doi.org/10.1037/a0029356

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Pearson.

Cribbin, J. J. (1972). *Effective managerial leadership.* American Management Association.

Czerniak, C. M. (1989). *An investigation of the relationships among science teaching anxiety, self efficacy, teacher education variables, and instructional strategies* [Unpublished doctoral dissertation]. Ohio State University.

Czerniak, C. M., & Chiarelott, L. (1990). Teacher education for effective science instruction- A social cognitive perspective. *Journal of Teacher Education, 41*(1), 49-58. https://doi.org/10.1177/002248719004100107

Czerniak, C. M., & Haney, J. J. (1998). The effect of collaborative concept mapping on elementary preservice teachers' anxiety, efficacy, and achievement in physical science. *Journal of Science Teacher Education, 9*(4), 303-320. https://doi.org/10.1023/A:1009431400397

Czerniak, C. M., & Lumpe, A. T. (1996). Relationship between teacher beliefs and science education reform. *Journal of Science Teacher Education, 7*(4), 247-266. https://doi.org/10.1007/BF00058659

Demir, S. (2018). The relationship between psychological capital and stress, anxiety, burnout, job satisfaction and job involvement. *Eurasian Journal of Educational Research, 18*(75), 137-154. https://doi.org/10.14689/ejer.2018.75.8

Desouky, D., & Allam, H. (2017). Occupational stress, anxiety and depression among Egyptian teachers. *Journal of Epidemiology and Global Health*, *7*(3), 191-198. https://doi.org/10.1016/j.jegh.2017.06.002

Dicke, T., Marsh, H. W., Parker, P. D., Guo, J., Riley, P., & Waldeyer, J. (2020). Job satisfaction of teachers and their principals in relation to climate and student achievement. *Journal of Educational Psychology*, *112*(5), 1061-1073. https://doi.org/10.1037/edu0000409

Dinham, S., & Scott, C. (1998). A three-domain model of teacher and school executive career satisfaction. *Journal of Educational Administration, 36*(4), 362-378. https://doi.org/10.1108/09578239810211545

Du, W., Liu, D., Johnson, C. C., Sondergeld, T. A., Bolshakova, V. L., & Moore, T. J. (2019). The impact of integrated STEM professional development on teacher quality. *School Science and Mathematics, 119*(2), 105-114. https://doi.org/10.1111/ssm.12318

Duan, X., Du, X., & Yu, K. (2018). School culture and school effectiveness: The mediating effect of teachers' job satisfaction. *International Journal of Learning, Teaching and Educational Research*, *17*(5), 15-25. https://doi.org/10.26803/ijlter.17.5.2

Duffy, R. D., & Lent, R. W. (2009). Test of a social cognitive model of work satisfaction in teachers. *Journal of Vocational Behavior*, *75*(2), 212-223. https://doi.org/10.1016/j.jvb.2009.06.001

Edinger, S. K., & Edinger, M. J. (2018). Improving teacher job satisfaction: The roles of social capital, teacher efficacy, and support. *The Journal of Psychology*, *152*(8), 573-593. https://doi.org/10.1080/00223980.2018.1489364

Enochs, L. G., & Riggs, I. M. (1990). Further development of an elementary science teaching efficacy belief instrument: A preservice elementary scale. *School Science and Mathematics*, *90*(8), 695-706. https://doi.org/10.1111/j.1949-8594.1990.tb12048.x

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education*, *42*(3), 255-284. https://doi.org/10.1080/15391523.2010.10782551

Evans, L. (1997). Addressing problems of conceptualization and construct validity in researching teachers' job satisfaction. *Educational Research*, *39*(3), 319-331. https://doi.org/10.1080/0013188970390307

Febriantina, S., Suparno, M., & Aliyyah, R. R. (2020). How school culture and teacher's work stress impact on teacher's job satisfaction. *International Journal of Learning, Teaching and Educational Research, 19*(8), 409-423. https://doi.org/10.26803/ijlter.19.8.22

Federici, R. A., & Skaalvik, E. M. (2012). Principal self-efficacy: Relations with

burnout, job satisfaction and motivation to quit. *Social Psychology of Education*, *15*(3), 295-320. https://doi.org/10.1007/s11218-012-9183-5

Ferguson, K., Frost, L., & Hall, D. (2012). Predicting teacher anxiety, depression, and job satisfaction. *Journal of Teaching and Learning*, *8*(1), 27-42. https://doi.org/10.22329/JTL.V8I1.2896

Ghaffar, S., Hamid, S., & Thomas, M. (2019). The impact of teacher's self-efficacy on student's motivation towards science learning. *Review of Economics and Development Studies*, *5*(2), 225-234. https://doi.org/10.26710/reads. v5i2.540

Gibson, S., & Dembo, M. H. (1984). Teacher efficacy: A construct validation. *Journal of Educational Psychology*, *76*(4), 569-582. https://doi.org/10.1037/0022-0663.76.4.569

Gilbert, R. B., Adesope, O. O., & Schroeder, N. L. (2014). Efficacy beliefs, job satisfaction, stress and their influence on the occupational commitment of English-medium content teachers in the Dominican Republic. *Educational Psychology*, *34*(7), 876-899. https://doi.org/10.1080/01443410.2013.814193

Gkolia, A., Belias, D., & Koustelios, A. (2014). Teacher's job satisfaction and self efficacy: A review. *European Scientific Journal*, *10*(22), 321-342.

Grosemans, I., Boon, A., Verclairen, C., Dochy, F., & Kyndt, E. (2015). Informal learning of primary school teachers: Considering the role of teaching experience and school culture. *Teaching and Teacher Education*, *47*, 151-161. https://doi.org/10.1016/j.tate.2014.12.011

Gruenert, S., & Whitaker, T. (2015). *School culture rewired: How to define, assess, and transform it*. ASCD.

Gursoy, N. (2013). *The effect of job satisfaction and burn-out status on hospital employees' family life: The case of housekeeping personnel* [Unpublished master dissertation]. Hacettepe University.

Hasselquist, L., Herndon, K., & Kitchel, T. (2017). School culture's influence on beginning agriculture teachers' job satisfaction and teacher self-efficacy. *Journal of Agricultural Education*, *58*(1), 267-279. https://doi.org/10.5032/jae.2017.01267

Hazir-Bikmaz, F. (2002). Self-efficacy belief instrument in science teaching. *Educational Sciences and Practice*, *1*(2). 197-210.

Hean, S., & Garrett, R. (2001). Sources of job satisfaction in science secondary school teachers in Chile. *Compare: A Journal of Comparative and International Education*, *31*(3), 363-379. https://doi.org/10.1080/03057920120098491

Heba, E. D., Mansour, N., Alzaghibi, M., & Alhammad, K. (2017). Context of STEM integration in schools: Views from in-service science teachers. *Eurasia Journal of Mathematics, Science and Technology Education*, *13*(6), 2459-2484. https://doi.org/10.12973/eurasia.2017.01235a

Høigaard, R., Giske, R., & Sundsli, K. (2012). Newly qualified teachers' work engagement and teacher efficacy influences on job satisfaction, burnout, and the intention to quit. European *Journal of Teacher Education*, *35*(3), 347-357. https://doi.org/10.1080/02619768.2011.633993

Hooper, D., Coughlan, J., & Mullen, M. R. (2008, June). *Evaluating model ft: A synthesis of the structural equation modeling literature*. In Paper present at the 7th European conference on research methodology for business and management studies. Regent's College, London, United Kingdom.

Huang, S., Yin, H., & Lv, L. (2019). Job characteristics and teacher well-being: the mediation of teacher self-monitoring and teacher self-efficacy. *Educational psychology*, *39*(3), 313-331. https://doi.org/10.1080/01443410.2018.1543855

Huberman, M. (1989). The professional life cycles of teachers. *Teacher College Record*, *91*(1), 31-58.

Ingersoll, R. (2001). Teacher turnover and teacher shortages: An organizational analysis. *American Educational Research Journal*, *38*(3), 499-534. https://doi.org/10.3102/00028312038003499

Johnson, R. B., & Christensen, L. B. (2014). E*ducational research: Quantitative, qualitative, and mixed approaches* (5th ed.). Sage.

Johnson, W. L., Snyder, K. J., Anderson, R. H., & Johnson, A. M. (1996). Schoolwork culture and productivity. *Journal of Experimental Education*, *64*(2), 139-156. https://doi.org/10.1080/00220973.1996.9943800

Jöreskog, K. G., & Sörbom, D. (1993). *LISREL 8: Structural equation modeling with the SIMPLIS command language*. Scientific Software International.

Kahraman, M., & Polat D. (2017). Anxiety scale for science teachers' laboratory work and teaching: Validity and reliability analyses. *Journal of Uludag University of Faculty of Education*, *30*(2), 757-780. https://doi.org/10.19171/uefad.369240

Kahraman, N. (2014). Investigating the relationship between science teachers' self-efficacy, work environment and their job satisfaction based on TIMSS 2011. *Journal of Theory and Practice in Education*, *10*(4), 1091-1101.

Kalman, M., & Balkar, B. (2017). Shifting teachers' perceptions of school culture in Turkey: A mixed methods study. In *FIRE: Forum for International Research in Education* (pp. 39-65). Lehigh University Library and Technology Services.

Katsantonis, I. G. (2020). Investigation of the impact of school climate and teachers' self-efficacy on job satisfaction: A cross-cultural approach. *European Journal of Investigation in Health, Psychology and Education*, *10*(1), 119-133. https://doi.org/10.3390/ejihpe10010011

Kazempour, M. (2014). I can't teach science! A case study of an elementary pre-service teacher's intersection of science experiences, beliefs, attitude, and self-efficacy. *International Journal of Environmental & Science Education*, *9*(1), 77-96. https://doi.org/10.12973/ijese.2014.204a

Kazempour, M., & Sadler, T. D. (2015). Pre-service teachers' beliefs, attitudes, and self-efficacy: A multi-case study. *Teaching Education*, *26*(3), 247-271. https://doi.org/10.1080/10476210.2014.996743

Klassen, R. M., & Chiu, M. M. (2010). Effects on teachers' self-efficacy and job satisfaction: Teacher gender, years of experience, and job stress. *Journal of Educational Psychology*, *102*(3), 741-756. https://doi.org/10.1037/a0019237

Klassen, R. M., & Chiu, M. M. (2011). The occupational commitment and intention to quit of practicing and pre-service teachers: Influence of self-efficacy, job stress, and teaching context. *Contemporary Educational Psychology*, *36*(2), 114-129.

Klem, L. (2000). Structural equation modeling. In L. G. Grimm & P. R. Yarnold (Eds.), *Reading and understanding multivariate statistics*, (pp. 227-260). American Psychological Association.

Kline, R. B. (2016). *Principles and practice of structural equation modeling* (4th ed.). The Guilford Press.

Klusmann, U., Kunter, M., Trautwein, U., Lüdtke, O., & Baumert, J. (2008). Teachers'

occupational well-being and quality of instruction: The important role of self-regulatory patterns. *Journal of Educational Psychology*, *100*(3), 702-715. https://doi.org/10.1037/0022-0663.100.3.702

Kursun, A. T., & Yilmaz, E. (2020). Investigation of the relationship between school culture and job satisfaction: A meta-analysis study. *Research on Education and Psychology (REP), 4*(Special Issue), 1-17.

Kurt, N., & Demirbolat, A. O. (2019). Investigation of the relationship between psychological capital perception, psychological well-being, and job satisfaction of teachers. *Journal of Education and Learning*, *8*(1), 87-99. https://doi.org/10.5539/jel.v8n1p87

Lambersky, J. (2016). Understanding the human side of school leadership: Principals' impact on teachers' morale, self-efficacy, stress, and commitment. *Leadership and Policy in Schools*, *15*(4), 379-405. https://doi.org/10.1080/15700763.2016.1181188

Little, A. W., & Green, A. (2009). Successful globalisation, education and sustainable development. *International Journal of Educational Development*, *29*(2), 166-174. https://doi.org/10.1016/j.ijedudev.2008.09.011

Malinen, O. P., & Savolainen, H. (2016). The effect of perceived school climate and teacher efficacy in behavior management on job satisfaction and burnout: a longitudinal study. *Teaching and Teacher Education*, *60*, 144-152. https://doi.org/10.1016/j.tate.2016.08.012

Manalo, R. A., de Castro, B., & Uy, C. (2020). The mediating role of job satisfaction on the effect of motivation to organizational commitment and work engagement of private secondary high school teachers in Metro-Manila. *Review of Integrative Business and Economics Research*, *9*(1), 133-159.

Marz, V., & Kelchtermans, G. (2013). Sense-making and structure in teachers' reception of educational reform. A case study on statistics in the mathematics curriculum. *Teaching and Teacher Education*, *29*, 13-24. https://doi.org/10.1016/j.tate.2012.08.004

McKinnon, M., & Lamberts, R. (2014). Influencing STSEB of primary school teachers: A longitudinal case study. *International Journal of Science Education*, *4*(2), 172-194. https://doi.org/10.1080/21548455.2013.793432

Meiring, L. F. (2019). Foundation phase science teacher identity: Exploring evolutionary module development to promote STSE. *South African Journal of* Childhood Education, *9*(1), 1-11. https://doi.org/10.4102/sajce.v9i1.603

Menon, D., & Sadler, T. D. (2018). Sources of STSE for preservice elementary teachers in science content courses. *International Journal of Science and Mathematics Education*, *16*(5), 835-855. https://doi.org/10.1007/s10763-017-9813-7

Min, M. (2019). School culture, self-efficacy, outcome expectation, and teacher agency toward reform with curricular autonomy in South Korea: A social cognitive approach. *Asia Pacific Journal of Education*. https://doi.org/10.1080/02188791.2019.1626218

Morris, D. B., Usher, E. L., & Chen, J. A. (2017). Reconceptualizing the sources of teaching self-efficacy: A critical review of emerging literature. *Educational Psychology Review*, *29*(4), 795-833. https://doi.org/10.1007/s10648-016-9378-y

Mostafa, T., & Pal, J. (2018). Science teachers' satisfaction: Evidence from the PISA 2015 teacher survey. *OECD Education Working Papers*, No. 168, OECD Publishing. http://dx.doi.org/10.1787/1ecdb4e3-en

Nagar, K. (2012). Organizational commitment and job satisfaction among teacher during times of burnout. *Vikalpa: The Journal for Decision Makers*, *37*(2), 43-60. https://doi.org/10.1177/0256090920120205

Nayak, R. D. (2014). Anxiety and mental health of software professionals and mechanical professionals. *International Journal of Humanities and Social Science Invention*, *3*(2), 52-56

Nigama, K., Selvabaskar, S, Surulivel, S. T., Alamelu, R., & Joice, D. (2018). Job satisfaction among school teachers. *International Journal of Pure and Applied Mathematics*, *119*(7), 2645-2655.

Novak, E., & Wisdom, S. (2018). Effects of 3D printing project-based learning on preservice elementary teachers' science attitudes, science content knowledge, and anxiety about teaching science. *Journal of Science Education and Technology*, *27*(5), 412-432. https://doi.org/10.1007/s10956-018-9733-5

Otanga, H., & Mwangi, J. (2015). Student teachers' anxiety and satisfaction with teaching practice among university students in Kenya. *International Journal of Education and Research, 3*(8), 1-12.

Pajares, F. (2021, June 12). Self-efficacy beliefs in academic contexts: An outline. http://des.emory.edu/mfp/efftalk.html

Pallant, J. (2001). *SPSS Survival Manual: A step by step guide to data analysis using SPSS for Windows (Versions 10 and 11)*. Open University Press.

Prasetyo, A. P. B., Alimah, S., Angraito, Y. U., & Saptono, S. (2019). Exploring school culture experienced by science teacher in promoting scientific literacy in Central Java. *Journal of Physics: Conference Series, 1321*(3), 032054. https://doi.org/10.1088/1742-6596/1321/3/032054

Putwain, D., & Von der Embse, N. P. (2019). Teacher self-efficacy moderates the relations between imposed pressure from curriculum changes and teacher stress. *Educational Psychology*, *39*(1), 51-64. https://doi.org/10.1080/01443410.2018.1500681

Richter, D., Kunter, M., Klusmann, U., Lüdtke, O., & Baumert, J. (2011). Professional development across the teaching career: Teachers' uptake of formal and informal learning opportunities. *Teaching and Teacher Education*, *27*(1), 116-126. https://doi.org/10.1016/j.tate.2010.07.008

Riggs, I., & Enochs, L. (1990). Toward the development of an elementary teacher's science teaching efficacy belief instrument. *Science Education*, *74*(6), 625-638. https://doi.org/10.1002/sce.3730740605

Russell, E. M., Williams, S. W., & Gleason-Gomez, C. (2010). Teachers' perceptions of administrative support and antecedents of turnover. *Journal of Research in Childhood Education*, *24*(3), 195-208. https://doi.org/10.1080/02568543.2010.487397

Sahito, Z., & Vaisanen, P. (2020). A literature review on teachers' job satisfaction in developing countries: Recommendations and solutions for the enhancement of the job. *Review of Education: An international Journal of Major Studies in Education, 8*(1), 3-34. https://doi.org/10.1002/rev3.3159

Sandholtz, J. H., & Ringstaff, C. (2014). Inspiring instructional change in elementary

school science: The relationship between enhanced self-efficacy and teacher practices. *Journal of Science Teacher Education*, *25*(6), 729-751. https://doi.org/10.1007/s10972-014-9393-0

Seashore Louis, K., & Lee, M. (2016). Teachers' capacity for organizational learning: The effects of school culture and context. *School Effectiveness and School Improvement, 27*(4), 534-556. https://doi.org/10.1080/09243453.2016.1189437

Senler, B. (2016). Pre-service science teachers' self-efficacy: The role of attitude, anxiety and locus of control. *Australian Council for Educational Research*, *60*(1), 26-41. https://doi.org/10.1177/0004944116629807

Shaukat, S., Vishnumolakala, V. R., & Al Bustami, G. (2019). The impact of teachers' characteristics on their self-efficacy and job satisfaction: A perspective from teachers engaging students with disabilities. *Journal of Research in Special Educational Needs, 19*(1), 68-76. https://doi.org/10.1111/1471-3802.12425

Skaalvik, E. M., & Skaalvik, S. (2011). Teacher job satisfaction and motivation to leave the teaching profession: Relations with school context, feeling of belonging, and emotional exhaustion. *Teaching and Teacher Education*, *27*(6), 1029-1038. https://doi.org/10.1016/j.tate.2011.04.001

Skaalvik, E. M., & Skaalvik, S. (2014). Teacher self-efficacy and perceived autonomy: Relations with teacher engagement, job satisfaction, and emotional exhaustion. *Psychological Reports*, *114*(1), 68-77. https://doi.org/10.2466/14.02.PRO.114k14x

Skaalvik, E. M., & Skaalvik, S. (2016). Teacher stress and teacher self-efficacy as predictors of engagement, emotional exhaustion, and motivation to leave the teaching profession. *Creative Education*, *7*(13), 1785-1799. https://doi.org/10.4236/ce.2016.713182

Skaalvik, E. M., & Skaalvik, S. (2017). Teacher stress and teacher self-efficacy: Relations and consequences. In *Educator stress* (pp. 101-125). Springer, Cham.

Skaalvik, E. M., & Skaalvik, S. (2019). Teacher self-efficacy and collective teacher efficacy: Relations with perceived job resources and job demands, feeling of belonging, and teacher engagement. *Creative Education, 10*(7), 1400-1424. https://doi.org/10.4236/ce.2019.107104

Song, H., Gu, Q., & Zhang, Z. (2020). An exploratory study of teachers' subjective wellbeing: understanding the links between teachers' income satisfaction, altruism, self-efficacy and work satisfaction. *Teachers and Teaching*, *26*(1), 3-31. https://doi.org/10.1080/13540602.2020.1719059

Song, S., & Mustafa, M. (2015). Factors impacting on teachers' job satisfaction related to science teaching: A mixed methods study. *Science Education International*, *26*(3), 358-375.

Stevens, J. (2002). *Applied multivariate statistics for the social sciences*. Lawrence Erlbaum Associates, Inc., Publishers.

Suebsing, S., & Nuangchalerm, P. (2021). Understanding and satisfaction towards STEM education of primary school teachers through professional development program. *Jurnal Pendidikan IPA Indonesia*, *10*(2), 171-177. https://doi.org/10.15294/jpii.v10i2.25369

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics*. Pearson.

Taxer, J. L., & Frenzel, A. C. (2018). Inauthentic expressions of enthusiasm: Exploring the cost of emotional dissonance in teachers. *Learning and Instruction, 53*, 74-88.

Teig, N., Scherer, R., & Nilsen, T. (2019). I know I can, but do I have the time? The role of teachers' self-efficacy and perceived time constraints in implementing cognitive-activation strategies in science. *Frontiers in Psychology*, *10*, 1-17. https://doi.org/10.3389/fpsyg.2019.01697

Telef, B. B. (2011). The study of teachers' self-efficacy, job satisfaction, life satisfaction and burnout. *Elementary Education Online*, *10*(1), 91-108.

Telman, N., & Unsal, P. (2004). *Çalışan memnuniyeti* [*Employee satisfaction*]. Epsilon Publisher.

Terzi, A. R. (2005). *Organizational culture in primary schools*. *Educational Administration: Theory and Practice*, *43*(43), 423-442.

Thibaut, L., Knipprath, H., Dehaene, W., & Depaepe, F. (2018). The influence of teachers' attitudes and school context on instructional practices in integrated STEM education. *Teaching and Teacher Education*, *71*, 190-205. https://doi.org/10.1016/j.tate.2017.12.014

Thomas, B. (2006). *Composition studies and teaching anxiety: A pilot study of teaching groups and discipline- and program-specific triggers* [Unpublished doctoral dissertation]. Bowling Green University.

Toropova, A., Myrberg, E., & Johansson, S. (2021). Teacher job satisfaction: The importance of school working conditions and teacher characteristics. *Educational Review*, *73*(1), 71-97. https://doi.org/10.1080/00131911.2019.1705247

Torres, D. G. (2019). Distributed leadership, professional collaboration, and teachers' job satisfaction in US schools. *Teaching and Teacher Education*, *79*, 111-123. https://doi.org/10.1016/j.tate.2018.12.001

Tschannen-Moran, M., & Woolfolk Hoy, A. (2001). Teacher efficacy: Capturing an elusive concept. *Teaching and Teacher Education*, *17*(7), 783-805. https://doi.org/10.1016/S0742-051X(01)00036-1

Tschannen-Moran, M., Woolfolk Hoy, A., & Hoy, W. (1998). Teacher efficacy: Its meaning and measure. *Review of Educational Research*, *68*(2), 202-248. https://doi.org/10.3102/00346543068002202

Turker, Y., & Kahraman, U. (2021). School climate and self-efficacy as predictor of job satisfaction. *Journal of Theoretical Educational Science*, *14*(4), 548-569. http://doi.org/10.30831/akukeg.901457

Ucak, E., & Say, S. (2019). Examining the reasons of science course anxiety in secondary school students. *Mehmet Akif Ersoy University Journal of Education Faculty*, *50*, 71-89. https://doi.org/10.21764/maeuefd.393854

Vieluf, S., Kunter, M., & van de Vijver, F. J. R. (2013). Teacher self-efficacy in cross-national perspective. *Teaching and Teacher Education*, *35*, 92-103. https://doi.org/10.1016/j.tate.2013.05.006

Wang, H., Hall, N. C., & Rahimi, S. (2015). Self-efficacy and causal attributions in teachers: Effects on burnout, job satisfaction, illness, and quitting intentions. *Teaching and Teacher Education*, *47*, 120-130. https://doi.org/10.1016/j.tate.2014.12.005

Wang, H., Moore, T. J., Roehrig, G. H., & Park, M. S. (2011). STEM integration: Teacher perceptions and practice. *Journal of Pre- College Engineering Education Research*, *1*(2), 1-13. https://doi.org/10.5703/1288284314636

Wang, K., Chen, Z., Luo, W., Li, Y., & Waxman, H. (2018). Examining the differences between the job satisfaction of STEM and non-STEM novice teachers with leaving

intentions. *EURASIA Journal of Mathematics, Science and Technology Education*, *14*(6), 2329-2341. https://doi.org/10.29333/ejmste/89516

Wang, K., Li, Y., Luo, W., & Zhang, S. (2019). Selected factors contributing to teacher job satisfaction: A quantitative investigation using 2013 TALIS data. *Leadership and Policy in Schools*, *19*(3), 512-532. https://doi.org/10.1080/15700763.2019.1586963

Weiss, D. J., Dawis, R. V., England, G. W. (1967). Manual for the Minnesota Satisfaction Questionnaire. *Minnesota Studies in Vocational Rehabilitation, 22*, 120.

Won, S. D., & Chang, E. J. (2020). The relationship between school violence-related stress and quality of life in schoolteachers through coping self-efficacy and job satisfaction. *School Mental Health, 12*(1), 136-144. https://doi.org/10.1007/s12310-019-09336-y

Veldman, I., van Tartwijk, J., Brekelmans, M., & Wubbels, T. (2013). Job satisfaction and teacher–student relationships across the teaching career: Four case studies. *Teaching and Teacher Education*, *32*, 55-65. https://doi.org/10.1016/j.tate.2013.01.005

Yang, W., Wu, R., & Li, J. (2021). Development and validation of the STEM Teaching Self-efficacy Scale (STSS) for early childhood teachers. *Current Psychology*, 1-9. https://doi.org/10.1007/s12144-021-02074-y

Yang, X. & Wang, Q. (2019). Factors influencing science teachers' self-efficacy. *International Journal of Environmental & Science Education, 14*(8), 445-454.

You, S., Kim, A. Y., & Lim, S. A. (2017). Job satisfaction among secondary teachers in Korea: effects of teachers' sense of efficacy and school culture. *Educational Management Administration & Leadership*, *45*(2), 284-297. https://doi.org/10.1177/1741143215587311

Yuruk, N. (2011). The predictors of pre-service teachers' anxiety about teaching science. *Journal of Baltic Science Education, 10*(1), 17-26

Zakariya, Y. F. (2020). Effects of school climate and teacher self-efficacy on job satisfaction of mostly STEM teachers: A structural multigroup invariance approach. *International Journal of STEM Education*, *7*(10), 1-12. https://doi.org/10.1186/s40594-020-00209-4

Zee, M., & Koomen, H. M. (2016). Teacher self-efficacy and its effects on classroom processes, student academic adjustment, and teacher well-being: A synthesis of 40 years of research. *Review of Educational Research*, *86*(4), 981-1015. https://doi.org/10.3102/0034654315626801

Zembylas, M., & Papanastasiou, E. (2006). Sources of teacher job satisfaction and dissatisfaction in Cyprus. *Compare: A journal of Comparative and International Education, 36*(2), 229-247. http://dx.doi.org/10.1080/03057920600741289

Zhang, J., & Yuan, R. (2020). How can professional learning communities ınfluence teachers' job satisfaction? A mixed-method study in China. *Teachers and Teaching, 26*(3-4), 229-247. https://doi.org/10.1080/13540602.2020.1806049