MODESTUM
OPEN ACCESS

EURASIA Journal of Mathematics, Science and Technology Education, 2018, 14(6), 2329-2341
ISSN:1305-8223 (online) 1305-8215 (print)
Research Paper https://doi.org/10.29333/ejmste/89516

Examining the Differences between the Job Satisfaction of STEM and Non-STEM Novice Teachers with Leaving Intentions

Ke Wang [1*], Zhuo Chen [1], Wen Luo [1], Yeping Li [1], Hersh Waxman [1]

[1] Texas A&M University-College Station, Texas, USA

Received 26 October 2017 ▪ Revised 5 January 2018 ▪ Accepted 18 February 2018

ABSTRACT

This paper examines the differences between the job satisfaction of STEM and non-STEM novice teachers with leaving intentions (hereafter STEM NTLI) by analyzing School and Staffing Survey 2011–12 data. The results of multiple regression analyses and various Z-tests show that support from the school and collaboration with colleagues are strong predictors for STEM and non-STEM NTLI. STEM NTLI focus more on professional development, autonomy in teaching, and the behavior of their students, whereas non-STEM NTLI focus more on participation in school policies. The implications for teachers and teacher educators are also discussed.

Keywords: job satisfaction, leaving intentions, non-STEM teachers, STEM teachers

INTRODUCTION

In the past decade, the need for and significance of employing highly qualified teachers in the United States has been addressed in the educational literature (e.g., Berry, Hoke, & Hirsch, 2004; Darling-Hammond & Sykes, 2003; Mollenkopf, 2009). Nevertheless, many schools continue to encounter an insufficiency of teachers, including qualified teachers. According to Liu and Meyer (2005), the turnover rate for American teachers was relatively higher than that of other professions. Statistics from Goldring, Taie, and Riddles (2014) indicated that, although the rate of teacher leaving decreased slightly from 8.0% to 7.7% between 2008 and 2012, the rate actually increased from 5.6% to 7.7% between 1988 and 2012. A total of 259,300 teachers left their teaching positions in the 2012–2013 academic year. Novice teachers in particular have shown a higher tendency of leaving. Ingersoll (2003) noted that approximately 40% to 50% of novice teachers left their positions within the first five years of their careers. Consequently, and also because of the increasing student population and oncoming teacher retirement wave, the national shortage of qualified teachers is now one of the most urgent issues for schools and educational organizations (e.g., Edgar & Pair, 2005; Ingersoll, 2003; Tickle, Chang, & Kim, 2011). The solution will depend on finding ways to reduce the leaving rate, especially for novice teachers, and achieving a sustainable balance of teacher supplement and attrition.

Though many studies have examined various factors influencing teachers' leaving intentions, limited research has addressed the issue with respect to science, technology, engineering, and mathematics (STEM) teachers. Likewise, the shortage of future certified STEM teachers is a serious problem in the United States (Hutchison, 2012). STEM education has received increased attention over the past decade (e.g., Jones, Dana, LaFramenta, Adams, & Arnold, 2016; Stevenson, 2014), largely because of increased national-international developments in science, technology, engineering, and mathematics. Recognizing the need for the United States to stay competitive, a number of studies are being conducted to improve STEM education such as the National Science Foundation's Special Programs for Undergraduate Students. A report by the Committee on STEM Education National Science and Technology Council emphasizes investment in five areas: (a) increasing STEM instruction in PreK-12, (b) encouraging more people to pursue STEM, (c) providing more opportunities for undergraduate students to experience STEM, (d) serving groups underrepresented in the STEM field, and (e) designing appropriate courses for STEM graduate education (National Science and Technology Council, 2013).

✉ kewangtamu@gmail.com **(*Correspondence)** ✉ zhuoyue87@tamu.edu ✉ wluo@tamu.edu
✉ yepingli@tamu.edu ✉ hwaxman@tamu.edu

Contribution of this paper to the literature

- This paper examines the differences in job satisfaction between STEM and non-STEM novice teachers, and compares the differences in job satisfaction among elementary, lower secondary, and higher secondary STEM and non-STEM novice teachers.
- STEM NTLI focus more on professional development, autonomy in teaching, and the behavior of their students, whereas non-STEM NTLI focus more on participation in school policies. The findings will help schools and educational organizations identify the key factors for improving the experiences of STEM novice teachers and create appropriate policies for novice-teacher retention.

Teacher quantity and quality play key roles in improving STEM education, yet many schools and educational authorities encounter difficulties in recruiting certified STEM teachers (Hutchison, 2012). According to national data from the Schools and Staffing Survey (2012), only 38% of mathematics teachers (*N*=144,800), 27% of science teachers (*N*=126,300), 35% of biology teachers (*N*=51,900), 62% of physical science teachers (N=64,600), 66% of chemistry teachers (*N*=12,400), 68% of earth sciences teachers (*N*=12,400), and 63% of physics teachers (*N*=13,300) have no major or minor in their main assignment or certification (Marder, Brown, & Plisch, 2017).

To improve the rate of teacher retention, administrators should focus on teacher job satisfaction since a highly positive correlation exists between teachers' job satisfaction and retention (Perrachione, Rosser, & Petersen, 2008; Wang, Hall, & Rahimi, 2015). The challenge, however, is to improve teachers' job satisfaction. Specifically, what factors contribute to teachers' job satisfaction and what are the differences between STEM and non-STEM teachers' job satisfaction? School administrators and policymakers can create and implement appropriate strategies to moderate and solve the shortage of certificated STEM teachers when they clearly understand the factors contributing to teachers' job satisfaction and teacher retention. For example, the Science Teacher and Research Program (Founded and implemented in 2007 by the Cal Poly Center for Excellence in Science and Mathematics Education on behalf of the California State University system),which focuses on strengthening STEM education for pre-service and early-career teachers, has three main goals: (a) increasing recruitment of high-quality teachers, (b) improving teacher education and in-service teachers' professional development, and (c) increasing the rate of teacher retention (Baker & Keller, 2008).

Although many studies have investigated possible factors and their relationships to teachers' job satisfaction (e.g., Liu, 2007; Liu & Meyer, 2005; Pearson & Moomaw, 2005; Shen, Leslie, Spybrook, & Ma, 2012; Smith & Ingersoll, 2004; Tickle et al., 2011), few studies have investigated the possible association between teacher background (teaching subjects, teaching grade levels) and job satisfaction. Motivated by the lack of research, this paper examines the effect of various factors that influence teachers' job satisfaction by analyzing a nationally representative database from the Schools and Staffing Survey (SASS) and targeting (a) STEM and non-STEM novice teachers with leaving intentions, and (b) elementary, lower secondary, and higher secondary STEM and non-STEM novice teachers with leaving intentions.

LITERATURE REVIEW

The imbalance of supplement and attrition has led many researchers to investigate possible factors that influence teachers' decisions about continuing in their professions (Liu, 2007; Liu & Meyer, 2005; Pearson & Moomaw, 2005; Shen et al., 2012; Smith & Ingersoll, 2004; Tickle et al., 2011). Among the observed factors, job satisfaction has been identified as having a direct impact on teachers' decision-making (Liu & Meyer, 2005; Stockard & Lehman, 2004). Generally speaking, job satisfaction refers to the quality of working life (Shen et al., 2012). A positive attitude toward various aspects of the work experience and conditions such as school policy, working climate and classroom management, can effectively reduce stress levels and stimulate working motivations (Pearson & Moomaw, 2005).

Extensive studies have explored the factors associated with teachers' job satisfaction (e.g., Liu, 2007; Liu & Meyer, 2005; Pearson & Moomaw, 2005). Possible reasons for low job satisfaction among teachers have been attributed to working- and teacher-related factors, (Liu, 2007; Shen et al., 2012). Working-related factors are associated with a school's contextual and organizational features, including working climate, administrative and curriculum policies, available support, student characteristics, and school problems. Teacher-related factors are associated with teacher-perceived knowledge and competence in teacher-related activities such as teaching experiences, teaching self-efficacy, educational background, and professional development.

The contribution of school- or working-related factors has identified the significance of support from the school, working climate (e.g., student behavior and staff collegiality), and school policies (e.g., teacher autonomy in teaching and power in terms of school policies) in promoting teachers' job satisfaction (Shen et al., 2012; Tickle et al., 2011). According to Borman and Dowling (2008), administrative support refers to "the school's effectiveness in

assisting teachers with issues such as student discipline, instructional methods, curriculum, and adjusting to the school environment" (p. 380). Tickle et al. (2011), who investigated the impact of administrative support on job satisfaction among 34,810 regular full-time certified public school teachers, used a path model analysis with the variables of teaching experience, student behavior, teacher salary, administrative support, teachers' job satisfaction, and intent to stay in teaching. They found that administrative support was the most significant predictor of teachers' job satisfaction. They also reported the role of administrative support in mediating the effect of other variables (i.e., teaching experience, student behavior, and teaching salary) on teachers' job satisfaction.

The strong association between student behavior (i.e., the level or frequency of students' misbehavior) and job satisfaction has also been explored (Harrell & Jackson, 2004; Liu & Meyer, 2005; Smith & Ingersoll, 2004). Analyzing the SASS and Teacher Follow-Up Survey, Liu and Meyer (2005) explored the association between teachers' job satisfaction and factors such as discipline problems, school climate, professional support, compensation, and working conditions. The results of their hierarchical linear modeling indicated that student discipline problems were a major reason for dissatisfaction among teachers.

School-related factors of autonomy in teaching and distributed leadership in the school have also been identified as important indicators of job satisfaction. Teacher autonomy is concerned with the freedom to select teaching materials, teaching strategies, and teaching goals related to teachers' personal educational beliefs (Skaalvik & Skaalvik, 2014). Recent studies have identified a positive relationship between teacher autonomy and job satisfaction (Avanzi, Miglioretti, Velasco, Balducci, Vecchio, Fraccaroli, et al., 2013; Skaalvik & Skaalvik, 2009, 2010, 2014). Using regression analysis, Skaalvik and Skaalvik (2014) examined data related to 2,569 Norwegian teachers in elementary and middle schools. They found that teacher autonomy positively predicted job satisfaction.

Teachers are more satisfied with their jobs when they have more opportunities to participate in school policies (Bogler, 2001). According to Liu (2007), if first-year teachers knew they would be able to participate in administrative decision-making, they would prefer to stay longer in their jobs. For instance, Angelle (2010) reported that frequent distribution of leadership would improve teacher's intent of staying. Cerit (2009), who examined the effects of servant leadership of primary school principals on teachers' job satisfaction by collecting job satisfaction data from 595 teachers and 29 principals, found a strongly positive relationship between servant leadership and teachers' job satisfaction.

Several studies have investigated teacher-related factors for job satisfaction. Evidence from existing studies indicates that teachers' software, including colleague/staff collaboration, teacher self-efficacy, educational background, and professional development, may have an essential role in promoting teachers' job satisfaction (Cohen, McCabe, Michelli, & Pickeral, 2009; Shen et al., 2012; Taylor & Tashakkori, 1995). With respect to colleague/staff collaboration, the ability to communicate and collaborate with other teachers is a strong indicator for teachers to adapt to a new teaching environment (Tschannen-Moran, 2001). Analyzing 2,967 teachers and 178 principals from the Teaching and Learning International Survey (TALIS) 2008 data, Duyar, Gumus, and Bellibas (2013) found that teacher collaboration was the strongest predictor of job satisfaction.

In terms of teacher self-efficacy, prior studies have pointed to the existence of an unstable relationship between teacher self-efficacy and teachers' job satisfaction because teacher self-efficacy does not directly predict teachers' job satisfaction. According to Ware and Kitsantas (2011), self-efficacious teachers are more likely to be intrinsically motivated, actively participating in curriculum design and providing meaningful teaching activities for students. Consequently, teachers will exhibit good job performance and probably remain committed to their professions. Similarly, Wang et al. (2015) found that Canadian teachers with a higher self-efficacy level have greater job satisfaction. Reilly, Dhingra, and Boduszek (2014), however, who examined the role of teacher self-efficacy, self-esteem, and job stress in predicting the elementary teachers' job satisfaction, found no significant association between self-efficacy and job satisfaction.

Although several studies have investigated the relationship between certain teacher-related factors and teachers' job satisfaction, some aspects remain unexplored. Few studies have examined the possible influence of educational background on teachers' job satisfaction. As one aspect of teacher-related factors, the education experience and professional training in universities and colleges can be considered an indicator of teacher competence or efficacy. Thus, teachers with relevant educational background and strong training may experience less working pressure when preparing and conducting teaching activities. Shen et al. (2012) investigated the effect of a principal's background and school factors on teachers' job satisfaction. Although the study focused on the principal and school features, their theoretical model incorporated teacher and school background variables. Results from Hierarchical Linear Modeling found that school-level factors are strongly associated with job satisfaction among teachers. In addition, teacher factors, including teaching experience and teaching certificates, also have been found significant for job satisfaction (Shen et al., 2012). Regarding professional development, prior research has demonstrated that the frequency or opportunity of professional development was a significant factor for promoting job satisfaction (e.g., Kushman, 1992; Meek, 1998; Shann, 1998). A study by Guskey (2002) found that

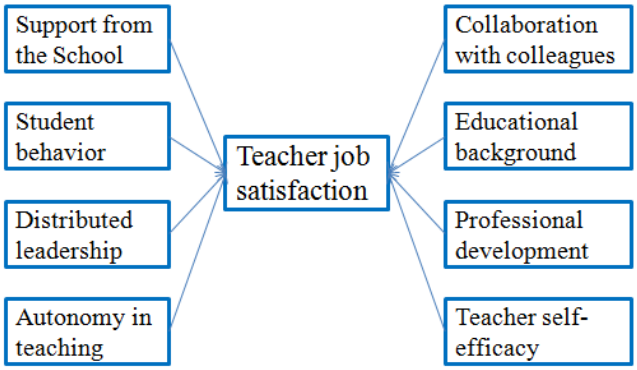

Figure 1. The conceptual model of teacher job satisfaction

an effective systematic program on teachers' professional development helped to improve teachers' classroom teaching, teachers' attitudes and beliefs, and students' achievement.

Certain areas of teachers' turnover rate and job satisfaction remain largely uninvestigated, most prior studies have investigated either school-related factors or teacher-related factors, and relatively limited research has examined and compared the effects of school- and teacher-related factors on job satisfaction. Moreover, few studies have explored job satisfaction or leaving intentions among specific teachers (e.g., STEM teachers). Thus, differences in teaching subject, combined with factors such as school policy, educational background and teaching experience, may influence the preference of factors for job satisfaction among different teacher groups. Finally, only a handful of studies have examined teachers' job satisfaction with grade level (e.g., Klassen & Chiu, 2010; Perie & Baker, 1997; Skaalvik & Skalvik, 2011). It may be possible that teachers from various grade levels exhibit different levels of job satisfaction and preferences in specific school- or teacher-related factors.

Purpose of the Study

The purpose of this study is to provide evidence so that policymakers and program developers can effectively address the shortage of STEM teachers and non-STEM teachers. The study expands upon the extant literature on teachers' job satisfaction as follows. First, as mentioned in the previous section, novice teachers were reported to have a relatively high tendency to leave their professions. Therefore, this study investigates novice teachers with leaving intentions who have less than two years of experience, and explores factors that may particularly influence their leaving intentions. Second, dividing novice teachers into STEM teachers and non-STEM teachers makes it possible to investigate the differences in factors and teachers' job satisfaction between the two groups, thereby providing insights into improving job satisfaction among STEM novice teachers. Third, subdividing the two novice groups into elementary teachers, lower secondary teachers, and higher secondary teachers makes it possible to examine the influence of grade level on the relationship between selected factors and teachers' job satisfaction.

The factors used in this study are based on a rich set of items in the national dataset, SASS 2011–12. School-related factors include school support, student behavior, autonomy in teaching, and participation in school policies. Teacher-related factors include teacher self-efficacy, educational background, and teachers' professional development. The conceptual model of job satisfaction shown in **Figure 1** is based on prior studies of the relationships between teachers' job satisfaction and school or teacher factors.

We fully explore the significant predictors for STEM novice teachers with leaving intentions (hereafter STEM NTLI) and compare the differences in job satisfaction between STEM and non-STEM NTLI to improve STEM NTLI job satisfaction. We pose three research questions: (a) Which factors are strongly associated with novice teachers' job satisfaction? (b) Do any differences exist between STEM NTLI and non-STEM NTLI in terms of the relationship between the factors and job satisfaction? (c) Do any differences exist between elementary, lower secondary, or higher secondary STEM NTLI and non-STEM NTLI in terms of the relationship between the predictors and job satisfaction?

METHOD

Data Source and Samples

The Schools and Staffing Survey (SASS) is an integrated study of public and private school districts, schools, principals, and teachers. SASS was conducted in the United States by the National Center for Education Statistics (NCES) seven times between 1987 and 2011. Its purpose was to provide the descriptive data necessary to create a

Table 1. Selected Factors, Measurements, and Reliabilities

Factor	Representation (items)	Coding	α
Jb	Teacher job satisfaction (T0451 T0466 T0467)	Recode by using "1=4, 2=3, 3=2, 4=1, else=0," then, compute the mean. Continuous	.852
Sup	Support from the school (T0435 T0439 T0441 T0442 T0444 T0449)	Recode by using "4=0, 3=1, 2=2, 1=3, else=0," then compute the mean. Continuous	.814
Sbe	Student behavior (T0455 T0456 T0457 T0459 T0460 T0462 T0463 T0464)	Recode by using "1=4, 2=3, 3=2, 4=1, else=0," then, compute the mean. Continuous	.865
Dls	Distributed leadership in the school (T0420 T0421 T0422 T0423 T0424 T0425 T0426)	Compute the mean of all original variables. Continuous	.805
Aut	Autonomy in teaching (T0427 T0428 T0429 T0430 T0431 T0432)	Compute the mean of all original variables. Continuous	.755
Eff	Teacher Self-efficacy (T0211 T0212 T0213 T0214 T0215 T0216 T0217 T0218)	Compute the mean of all original variables. Continuous	.836
Pro	Professional development (T0339 T0340 T0342 T0343 T0345 T0346 T0348 T0349 T0351 T0352 T0354 T0355 T0356)	Recode T0356 by using "1=1, 2=0;" recode the others by using "1=1, 2=2, 3=3, 4=4, else=0, then compute the mean. Continuous	.766
Edu	Educational background (T0160 T0162 T0164 T0176 T0170 T0180 T0205 T0207 T0209)	Recode T0207 and T0209 by using "4=0, 3=1, 2=2, 1=3, else=0;" recode others by using "1=1, 2=0," then compute the mean. Continuous	.580
Coc	Collaboration with colleagues (T0364 T0365 T0366 T0452 T0445 T0443)	Recode T0443 T0445 T0452 by using "4=0, 3=1, 2=2, 1=3, else=0;" recode the others by using "1=1, 2=0," then compute the mean. Continuous	.540

Note. T0023 is the coder of the item in the *Teacher Questionnaire School and Staffing Survey 2011-12 School Year*

complete picture of American elementary and secondary education (NCES, 2016). This study is based on the Teacher Questionnaire-Schools and Staffing Survey 2011–12 School Year, which is part of the national dataset, SASS 2011–2012 available on the Institute of Education Sciences website (https://nces.ed.gov/surveys/sass/question1112.asp). From it we obtained general information, class organization, education and training, certification, professional development, working conditions, school climate, and teacher attitudes.

The sample is restricted to new teachers with leaving intentions from public schools. The new teachers had to meet three conditions: (a) They had to be regular full-time teachers, (b) Their work experience had to be less than two years, and (c) They had to have the intention of leaving the position of teacher. All teachers in the sample chose one of four options (until a specific life event occurs, until a more desirable job opportunity comes along, definitely plan to leave as soon as I can, undecided at this time) to answer the question: "How long do you plan to remain in teaching?" in the Teacher Questionnaire. We divided the teachers into STEM and non-STEM by using the questions: "This School year, what is your MAIN teaching assignment field at THIS school?" and "During your most recent FULL WEEK of teaching, approximately how many hours did YOU spend teaching each of the following subjects at the THIS school?" To classify the sample into three grade stages, we used: "Do you currently teach students in any of these grades at THIS school?" The final sample consists of 933 teachers (388 STEM and 545 non-STEM; 136 Pre-K-G5 teachers, 262 G6-G8 teachers, and 535 G9-12 teachers) without any missing data.

Variables, Measures, and Descriptive Statistics

Table 1 lists the selected variables. All variables are composite scores. We created the composite variable of teachers' job satisfaction based on three items selected from the section "School Climate and Teacher Attitudes" in the Teacher Questionnaire Schools and Staffing Survey 2011-12 School Year. The establishment of student behavior is based on eight items related to the question: "To what extent is each of the following a problem in this school?" Support from the school is based on six items related to the question: To what extent do you agree or disagree with each of the following statements?" **Table 1** also lists the reliability measures for the composite variables. Internal consistencies of all variables are measured by the Cronbach alpha coefficient. All variables' coefficients are more than .75 except the variables of collaboration with colleagues and educational background. Their coefficients are .540 and .580, respectively. The relatively low coefficients might be due to the different scales of the items in the scales.

Data Analysis Approach

We used multiple regression analysis and structure coefficient to find the factors strongly associated with novice teachers' job satisfaction. To compare the differences in two multiple regression models among different groups

Table 2. The Multiple Regression Weights, Structure Coefficients, and *p*-value from Overall Sample

Predictor	β	r_s	% of $R^2(r^2_s)$	*p*-value
Sup	.564	.965	.932	.000
Sbe	-.122	-.588	.346	.000
Dls	.054	.583	.340	.036
Aut	.051	.432	.187	.031
Eff	.024	.289	.084	.275
Pro	.046	.187	.035	.031
Edu	-.003	.063	.004	.879
Coc	.143	.683	.466	.000
R^2	61.2%	R^2_{adj}	60.8%	

(STEM teachers and non-STEM teachers, grade stages, and both of them), we used Fisher's Z-test to examine whether the predictors contribute significantly differently to teachers' job satisfaction in two models, and Hotelling's T/ Steiger's Z-test to examine the differences in the structures of the two models (Hotelling, 1940; Steiger, 1980). We selected the most common formulas for $SE_{b\text{-}difference}$ (Clogg, Petkova, & Haritou, 1995; Paternoster, Brame, Mazerolle, & Piquero, 1998) to examine the differences in the weights from the different models. The Fisher's Z-test and Steiger's Z-test were used to address the two research questions: (b) Do any differences exist between STEM NTLI and non-STEM NTLI in terms of the relationship between the factors and job satisfaction? and (c) Do any differences exist between elementary, lower secondary, or higher secondary STEM NTLI and non-STEM NTLI in terms of the relationship between the predictors and job satisfaction?

Multiple regression analysis determines which explanatory variables are statistically significant. We entered the following variables into the model: distributed leadership in the school, student behavior, autonomy in teaching, support from the school, collaboration with colleagues, teacher self-efficacy, educational background, and professional development. We checked the *p*-values of all predictors and obtained a multiple regression model. Regarding the differences in teachers' job satisfaction between STEM and non-STEM NTLI groups, we ran the multiple-group linear regression model to determine the differences between the two models' structures and weights. Although we easily found the different contributions of each predictor between the two models, we also used different *Z*-tests to determine whether the different were statistically significant.

RESULTS

Significant Predictors of Novice Teachers' Job Satisfaction

Table 2 reports the results from the overall regression model. The multiple regression model with eight predictors explained the variation in teachers' job satisfaction ($p<.001$) well. All eight predictors explained approximately 61% of the variance in teachers' job satisfaction. The standardized coefficients of teacher self-efficacy and educational background were .024, and -.003, respectively, but they were not statistically significant ($p=.275$, $p=.879$). The standardized coefficient of student behavior was -.122 ($p<.001$). A significant negative relationship existed between teachers' job satisfaction and student behavior. The other predictors (support from the school, collaboration with colleagues, distributed leadership in the school, autonomy in teaching, and professional development in the past year) had positive significant relationships to teachers' job satisfaction. The most important contributor to teachers' job satisfaction was support from the school; the standardized coefficient of support from the school was 0.564. Collaboration with colleagues was also an important contributor; its standardized coefficient was 0.143.

Table 2 also shows the structure coefficients of all predictors. A regression structure coefficient is the bivariate Person correlation coefficient of a measured predictor with the latent Y-hat scores (not with the Y scores, unless $R^2=1.0$). Variables' collinearity does not affect the structure coefficient. Therefore, we could easily check the real contributions of all predictors. For example, even if the beta value of teacher self-efficacy in this model was not statistically significant, the value of the structure coefficient contributed 8.4% ($.289^2$) to R^2. On the other hand, the value of the structure coefficient on professional development was .187, but its contribution was significant. From the perspective of structure coefficients, teacher self-efficacy was still an important predictor, while educational background slightly contributed to the R^2. It suggests that educational background was not a significant factor affecting novice teachers' job satisfaction.

Differences between STEM NTLI and Non-STEM NTLI Job Satisfaction

Table 3 lists the results of the multiple regression models for the STEM and non-STEM groups. According to the beta weights and p values, support from the school, student behavior, collaboration with colleagues, autonomy

Table 3. Beta Weights, Structure Coefficients, and *p*-value from STEM and non-STEM Groups

Factor	STEM				Non-STEM			
	R^2 (62.2%)		R^2_{adj} (61.4%)		R^2 (61.3%)		R^2_{adj} (60.7%)	
	β	r_s	% of R^2(r^2_s)	*p-value*	β	r_s	% of R^2(r^2_s)	*p-value*
Sup	.517	.944	.891	.000	.615	.978	.957	.000
Sbe	-.200	-.640	.409	.000	-.053	-.545	.297	.088
Dls	.022	.544	.296	.570	.085	.607	.368	.012
Aut	.085	.400	.160	.016	.011	.443	.196	.739
Eff	.021	.330	.109	.541	.026	.254	.065	.374
Pro	.072	.254	.065	.030	.024	.132	.017	.392
Edu	-.024	.072	.005	.470	.011	.036	.001	.691
Coc	.155	.700	.490	.000	.129	.667	.444	.000

Table 4. The Values of SEb-diff, Z-value, and *p*-value from Brame/Colgg *Z*-test

Factor	STEM		Non-STEM		$SE_{b\text{-}diff}$	Z value	p-value
	b	SE_b	b	SE_b			
Sup	.595	.050	.744	.047	.06862	2.171	.030
Sbe	-.238	.043	-.062	.036	.05608	3.138	.002
Dsl	.030	.052	.109	.044	.06812	1.160	.246
Aut	.134	.056	.014	.042	.07000	1.714	.087
Eff	.032	.051	.035	.039	.06420	0.047	.963
Pro	.101	.046	.031	.036	.05841	1.198	.231
Edu	-.063	.087	.030	.076	.11552	0.805	.421
Coc	.269	.068	.240	.062	.09202	0.315	.753

in teaching, and professional development were statistically significant for STEM NTLI job satisfaction. In contrast, only support from the school, collaboration with colleagues, and distributed leadership in the school were statistically significant for non-STEM NTLI job satisfaction. According to the structure coefficient, distributed leadership in a school was an important predictor for STEM NTLI job satisfaction, while student behavior, autonomy in teaching, and professional development were significant for non-STEM NTLI job satisfaction.

Differences between R^2 values. The Fisher's *Z*-test showed that there was no statistically significant difference in the R-squared between the STEM and non-STEM models (Z=-.236, p>.05), which indicates that the set of predictors predicted job satisfaction equally well for STEM and non-STEM teachers.

Differences between model structures. After use of Hotelling's T/Steiger's *Z*-test to compare structures for both models, the result (Z=2.90, p= .002) indicated that the multiple regression models of STEM and non-STEM NTLI had different structures, i.e., STEM and non-STEM novice teachers with leaving intentions emphasized different factors.

Differences between predictors' contributions. Although the difference in the weights of the two models was small, we used the Brame/Colgg Z-test to examine whether the differences were statistically significant. **Table 4** reports the results. Both student behavior and support from the school had significantly different regression weights in the STEM NTLI and non-STEM NTLI, while all other predictors had equivalent regression weights in the two groups. It suggests that education administrators should implement policies to improve STEM and non-STEM NTLI job satisfaction in terms of support from the school and student behavior.

Differences between STEM/Non-STEM NTLI across Grade Stages

To further examine the moderation effect of grade levels, we tested the differences between STEM and non-STEM NTLI in the elementary, lower secondary, and higher secondary stages. **Table 5** reports the results. According to the beta weights from the STEM group, support from the school and student behavior significantly affected elementary teachers' job satisfaction; support from the school, student behavior, and collaboration with colleagues were statistically significant factors for lower secondary teachers' job satisfaction; and autonomy in teaching, support from the school, and student behavior were significant contributors to higher secondary teachers' job satisfaction. For the non-STEM group, support from the school, student behavior, and collaboration with colleagues were statistically significant factors for elementary teachers' job satisfaction; the contribution of support from the school was significant for lower secondary teachers' job satisfaction; and support from the school, distributed leadership in the school, and collaboration with colleagues were statistically significant factors for higher secondary teachers' job satisfaction.

Table 5. Beta Weights, Structure Coefficients, and *p*-value from Three Groups

	Factor	Elementary			Lower secondary			Higher Secondary		
		R^2 (68.3%)			R^2 (70.0%)			R^2 (59.2%)		
		β	r_s	*P*	β	r_s	*p*	β	r_s	*p*
STEM	Sup	.536	0.928	.000	.429	0.885	.000	.536	0.939	.000
	Sbe	-.251	-0.712	.003	-.264	-0.692	.000	-.196	-0.615	.000
	Dls	-.095	0.429	.234	.006	0.492	.935	.070	0.599	.225
	Aut	.072	0.367	.347	.040	0.374	.523	.081	0.406	.122
	Eff	.007	0.373	.924	.054	0.395	.388	.003	0.233	.950
	Pro	.135	0.409	.112	.049	0.295	.399	.077	0.144	.109
	Edu	.058	0.167	.421	-.074	0.015	.214	-.006	0.046	.893
	Coc	.132	0.741	.138	.291	0.761	.000	.098	0.613	.087
		R^2 (78.0%)			R^2 (70.5%)			R^2 (57.3%)		
Non-STEM	Sup	.713	0.934	.000	.710	0.983	.000	.542	0.955	.000
	Sbe	.002	-0.548	.987	-.112	-0.677	.057	-.048	-0.504	.246
	Dsl	.047	0.622	.659	.008	0.564	.892	.124	0.620	.007
	Aut	-.057	0.394	.517	.016	0.354	.745	-.002	0.493	.963
	Eff	-.247	-0.046	.005	.056	0.287	.256	.067	0.293	.092
	Pro	.115	0.518	.182	-.051	-0.125	.287	.042	0.200	.267
	Edu	.106	0.183	.197	.051	0.146	.293	-.026	-0.047	.493
	Coc	.198	0.612	.039	.040	0.649	.500	.160	0.683	.000

Table 6. The *Z*-value and *p*-value from Fisher's Z-test

Group	R_{G1}	N_{G1}	R_{G2}	N_{G2}	*Z*-value	*p*-value
L1	.826	86	.883	50	1.171	0.121
L2	.837	105	.839	157	0.053	0.479
L3	.770	197	.757	338	0.346	0.365

Note. L1 = elementary STEM and non STEM NTLI; L2 = lower secondary STEM and non STEM NTLI; L3 = higher secondary STEM and non STEM NTLI

Table 7. The *Z*-value and *p*-value from Steiger's *Z*-test

Group	Direct R_{G1}	Crossed R_{G2}	Model correlation	*N*	*Z*-value	*p*-value
L1	.754	.826	.912	86	2.672	.004
L2	.754	.802	.889	157	2.111	.017
L3	.757	.740	.978	338	2.253	.012

According to the structure coefficient in the STEM group, all factors except educational background were important for elementary and lower secondary teachers' job satisfaction, while all factors except educational background and professional development were important for higher secondary teachers' job satisfaction. Based on the structure coefficient in the non-STEM group, all factors except educational background were important for elementary teachers' job satisfaction, while all factors except educational background and professional development were important for secondary teachers' job satisfaction. In general, educational background did not play an important role in predicting novice teachers' job satisfaction.

Differences between R^2 values. Table 6 reports the *Z*-value and *p*-value; all *p* values are more than 0.05. It suggests that the predictors in three different grade levels did equally well for STEM NTLI and non-STEM NTLI.

Differences between model structures. Table 7 reports the results. Different structures existed among the multiple regression models for predicting job satisfaction for elementary, lower secondary, and higher secondary STEM and non-STEM NTLI job satisfaction.

Differences between predictors' contributions. Table 8 reports the results. Teacher self-efficacy made significantly different contributions to job satisfaction between elementary STEM and non-STEM NTLI. Support from the school, student behavior, and collaboration with colleagues had significantly different regression coefficients between lower secondary STEM and non-STEM models. Student behavior had significantly different effects on job satisfaction between higher secondary STEM and non-STEM NTLI. The results provide evidence of the necessity to implement differentiated support and administration policies based on different field novice teachers as well as different grade stages.

Table 8. The Values of SEb-diff, *Z*-value, and *p*-value from Brame/Colgg *Z*-test

Factor	L1			L2			L3		
	$SE_{b\text{-}diff}$	*Z*	*p*	$SE_{b\text{-}diff}$	*Z*	*p*	$SE_{b\text{-}diff}$	*Z*	*p*
Sup	0.202	1.585	0.113	0.125	2.608	0.009	0.094	0.374	0.708
Sbe	0.193	1.830	0.067	0.107	2.010	0.044	0.078	2.198	0.028
Dls	0.187	1.067	0.286	0.121	0.033	0.974	0.096	0.540	0.589
Aut	0.172	-1.116	0.264	0.124	-0.322	0.748	0.102	-1.336	0.182
Eff	0.164	-2.360	0.018	0.112	0.009	0.993	0.095	0.854	0.393
Pro	0.177	-0.006	0.995	0.117	-1.293	0.196	0.081	-0.644	0.520
Edu	0.373	0.485	0.628	0.219	1.629	0.103	0.156	-0.308	0.758
Coc	0.259	0.887	0.375	0.163	-2.577	0.010	0.128	0.837	0.402

DISCUSSION

The results from the multiple regression model demonstrate that degrees of support from the school, student behavior, and collaboration with colleagues are strong indicators of the job satisfaction of novice teachers with leaving intentions, thus confirming the significance of school or contextual features. Although the results identify the significance of one teacher-related factor of collaboration with colleagues, most of the significant factors are school-related. The present study confirms earlier findings of the significance of school-related factors (e.g., Borman & Dowling, 2008; Stockard & Lehman, 2004). In our study, given limited teaching efficacy and experience, novice teachers appear to be more concerned about support from the school and a "less-stressful" working climate.

We also find that the two most significant factors contributing to teachers' job satisfaction are support from the school and student behavior. Our results indicate that novice teachers may emphasize school environment in their profession. Thus, for novice teachers who are still developing teaching efficiency (e.g., teaching approach and classroom management), they are more willing to work in a less stressful, safe and comfortable environment. Therefore, supports in facilitating teaching and strengthening student rules from school are of great significance in helping them adapt to new working circumstances and promote their teaching efficacy and confidence (Baker & Keller, 2010; Kelly, 2004).

Collaboration with colleagues, which has also been identified as a strong component of job satisfaction, emphasizes the ability to communicate and collaborate with other teachers and staff. According to Kelly (2004), collaboration with colleagues plays an essential role in evaluating work satisfaction. Clearly, mutual understanding and cooperation with colleagues can boost working motivation, comfort and quality. Novice teachers' ability to communicate and collaborate with other teachers is significant for teaching-related problem solving (Baker & Keller, 2010).

Our finding that self-efficacy and educational background do not significantly associate with job satisfaction differs from Klassen and Chiu (2000), who found a negative relationship between levels of teacher self-efficacy and levels of teaching grade and a positive relationship between teacher self-efficacy and teacher job satisfaction. The reason for the difference in findings may be attributed to different samples. As mentioned in the previous section, novice teachers valued working and contextual features (school factors) rather than individual factors because they were starting their teaching careers (Stockard & Lehman, 2004). Our findings support the idea that schools should reinforce service-oriented support for novice teachers, cultivate a friendly teaching and learning environment (i.e., well-behaved students) and strengthen cooperation and mutual help among teachers.

Do STEM and Non-STEM NTLI Require Differentiation Strategies?

Comparing the differences in predictors' contributions to STEM and non-STEM NTLI job satisfaction, results show that support from the school and collaboration with colleagues are strong indicators for both groups of teachers. In both groups of teachers, teacher-related factors including self-efficacy and educational background are not significant in determining job satisfaction. There are also differences in significant factors for job satisfaction between the groups; student behavior, teaching autonomy and professional development are strong indicators for job satisfaction among STEM teachers, while distributed leadership is strong among non-STEM teachers. The differences may be caused by teaching different types of subjects. Considering that STEM teachers teach calculation, high-level reasoning and problem solving, possibly they are more concerned about teaching delivery (e.g., classroom management, teaching design/plan, and teaching quality), whereas non-STEM teachers who teach social facts, history, and politics are more concerned about social climate, management and leadership. This finding may help school administrators understand the differences in career planning between STEM and non-STEM NTLI, but also poses a dilemma: Should administrators develop special support plans for STEM and non-STEM teachers, respectively? STEM NTLI appears more worried about the problem of student behavior unlike non-STEM novice

teachers. It suggests that the overall model can be divided into different sub-categories (e.g., STEM and non-STEM teachers, see Hodge, Jupp, & Taylor, 1994; Walker, Garton, & Kitchel, 2004), but more studies are needed.

Comparing the differences in each factor's contribution to job satisfaction for the two groups shows that the effect on job satisfaction of the strong predictor of support from the school is significantly stronger for non-STEM NTLI than for STEM NTLI. On the other hand, as previously mentioned, the effect of the predictor of student behavior on job satisfaction for STEM NTLI is significantly stronger than for non-STEM NTLI. It suggests that STEM education received more attention and support from the school and that STEM teachers addressed student behavior, which is a strong indicator for classroom management and teaching quality.

Should Strategies Be Differentiated across Grade Levels?

Based on our three comparisons of the differences in predictors' contributions in the models of elementary, lower secondary, and higher secondary STEM and non-STEM NTLI, support from the school is the strongest factor affecting teachers' job satisfaction in all grade levels, and educational background and professional development are not statistically significant. It suggests that individual factors (educational background, professional development) have limited effects on the degree of job satisfaction. Our comparisons also show that the STEM and non-STEM NTLI models contain different structures at each stage. At the elementary level, student behavior strongly associates with job satisfaction in STEM NTLI, whereas self-efficacy and collaboration with colleagues are significant in non-STEM NTLI. At the lower secondary level, in addition to support from the school, student behavior and collaboration with colleagues strongly associate with job satisfaction in STEM-NTLI. At the higher secondary level, STEM teachers are more concerned about student behavior, whereas non-STEM teachers pay more attention to distributed leadership and collaboration with colleagues. As mentioned in the previous section, given the disparities of subject teaching, STEM teachers who teach calculation, high-level reasoning, and problem solving may be more concerned about classroom management. Elementary and lower secondary non-STEM teachers are more sensitive to support from the school on job satisfaction. It suggests that non-STEM teachers tend to leave their teaching positions when they obtain little support from the school. Differences in the model of teachers' job satisfaction between STEM NTLI and non-STEM NTLI across grade levels suggests the possibility of using "differentiation strategies" for STEM and Non-STEM teachers at different grade levels. Further studies should consider the role of grade levels (i.e., classifying teachers from different grade levels) on job satisfaction (e.g., Brackett, Palomera, Mojsa-Kaja, Reyes, & Salovey, 2010; Byrne, 1994).

CONCLUSION

This study examined the relationships relating to job satisfaction in novice teachers with leaving intentions. Eight predictors were used for job satisfaction (support from the school, student behavior, leadership, teaching autonomy, teacher self-efficacy, professional development, previous education and training background, and collaboration with colleagues) for the STEM and non-STEM NTLI groups. The study explored predicting models with consideration of grade differences (i.e., elementary, lower secondary, and higher secondary levels).

Regarding novice teachers with leaving intentions, support from the school, student behavior, autonomy in teaching, professional development, and collaboration with colleagues were strong predictors of teachers' job satisfaction, with support from the school being the strongest factor predicting job satisfaction. Support from the school, distributed leadership, and collaboration with colleagues were strong predictors of job satisfaction for the non-STEM NTLI. Support from the school differed significantly between the STEM and non-STEM NTLI groups, i.e., STEM teachers placed more value on support from the school for their job satisfaction. Results from the predicting models across different grades revealed that support from the school was a significant factor affecting job satisfaction for elementary, lower secondary, and higher secondary STEM and non-STEM NTLI groups. Student behavior was a strong predictor of job satisfaction only for the STEM group across grades.

The findings provide several suggestions and implications for stakeholders (school administrators and policymakers) and researchers. School administrators and policymakers should provide a comfortable and safe school/working climate, and support teaching and strengthen school discipline for novice teachers adapting to a new working environment. Specifically, novice STEM teachers tended to be more sensitive to school environment and student behavior, with the consideration of limited teaching experiences and a strong emphasis on STEM at schools. Furthermore, administrators and school authorities should consider implementing different strategies for promoting teachers' job satisfaction at the various grade levels. For example, they could provide more opportunities for teachers to build collaborative relationships across subject and same subject across grade levels. Differentiated policies for different subjects and grade levels could help teachers' individualized professional development and teaching preferences. For example, non-STEM teachers could participate in school policies which foster a supportive school climate.

This paper has two limitations. First, only the mean was used to create composite scores for latent variables; and the reliabilities of collaboration with colleagues and educational background were somewhat low. Second, the data analysis showed only the linear regression results; thus, causal interpretation should be avoided. Therefore, researchers can further explore the issues that mentioned in the discussion. Studies can examine the relationship between different factors and job satisfaction with the consideration of grade level. Evidence from the present study indicates the different job satisfaction models for both STEM and non-STEM groups at different grade levels. Thus, the role of the grade level need to be further investigated using the latest national data. If the variables of educational background were categorical, future research could identify the differences in teachers' job satisfaction according to educational background. Finally, the present study only applied linear regression models, research can employ more advanced modeling (SEM or HLM) to explore the complicated relations and compare the differences and similarities of job satisfaction.

REFERENCES

Angelle, P. S. (2010). An organizational perspective of distributed leadership: A portrait of a middle school. *Rmle Online*, *33*(5), 1-16. https://doi.org/10.1080/19404476.2010.11462068

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

Baker, W., & Keller, J. (2010). Science Teacher and Researcher (STAR) Program: Strengthening STEM education through authentic research experiences for preservice and early career teachers. *Peer Review, 12*(2), 22-26.

Berry, B., Hoke, M., & Hirsch, E. (2004). The search for highly qualified teachers. *Phi Delta Kappan*, *85*(9), 684-689.

Bogler, R. (2001). The influence of leadership style on teacher job satisfaction. *Educational Administration Quarterly*, *37*, 662-683.

Borman, G. D., & Dowling, N. M. (2008). Teacher attrition and retention: A meta-analytic and narrative review of the research. *Review of Educational Research*, *78*(3), 367-409. https://doi.org/10.3102/0034654308321455

Brackett, M. A., Palomera, R., Mojsa-Kaja, J., Reyes, M. R., & Salovey, P. (2010). Emotion-regulation ability, burnout, and job satisfaction among British secondary-school teachers. *Psychology in the Schools*, *47*(4), 406-417. https://doi.org/10.1002/pits.20478

Byrne, B. M. (1994). Burnout: Testing for the validity, replication, and invariance of causal structure across elementary, intermediate, and secondary teachers. *American Educational Research Journal*, *31*, 645-673.

Cerit, Y. (2009). The effects of servant leadership behaviors of school principals on teachers' job satisfaction. *Educational Management Administration & Leadership*, *37*(5), 600-623. https://doi.org/10.1177/1741143209339650

Clogg, C. C., Petkova, E., & Haritou, A. (1995). Statistical methods for comparing regression coefficients between models. *American Journal of Sociology*, *100*(5), 1261-1293.

Cohen, J., McCabe, E. M., Michelli, N. M., & Pickeral, T. (2009). School climate: Research, policy, practice, and teacher education. *Teachers College Record*, *111*(1), 180-213.

Darling-Hammond, L., & Sykes, G. (2003). Wanted, a national teacher supply policy for education: The right way to meet the" highly qualified teacher" challenge. *Education Policy Analysis Archives*, *11*(33). Retrieved from http://epaa.asu.edu/epaa/v11n33/

Duyar, I., Gumus, S., & Bellibas, M. S. (2013). Multilevel analysis of teacher work attitudes: The influence of principal leadership and teacher collaboration. *International Journal of Educational Management*, *27*(7), 700-719. https://doi.org/10.1108/IJEM-09-2012-0107

Edgar, E., & Pair, A. (2005). Special education teacher attrition: It all depends on where you are standing. *Teacher Education and Special Education: The Journal of the Teacher Education Division of the Council for Exceptional Children*, *28*(3-4), 163-170.

Goldring, R., Taie, S., & Riddles, M. (2014). *Teacher attrition and mobility: Results from the 2012–13 teacher follow-up survey*. Washington, DC: National Center for Education Statistics. Retrieved from http://nces.ed.gov/pubs2014/2014077.pdf

Guskey, T. R. (2002). Professional development and teacher change. *Teachers and Teaching*, *8*, 381-391.

Harrell, P. E., & Jackson, J. K. (2004). Redefining teacher quality: Myths of No Child Left Behind. *Teacher Education and Practice*, *17*(2), 131-145.

Hodge, G. M., Jupp, J. J., & Taylor, A. J. (1994). Work stress, distress and burnout in music and mathematics teachers. *British Journal of Educational Psychology*, *64*(1), 65-76.

Hotelling, H. (1940). The selection of variates for use in prediction with some comments on the general problem of nuisance parameters. *The Annals of Mathematical Statistics*, *11*(3), 271-283.

Hutchison, L. F. (2012). Addressing the STEM teacher shortage in American schools: Ways to recruit and retain effective STEM teachers. *Action in Teacher Education*, *34*(5-6), 541-550. https://doi.org/10.1080/01626620.2012.729483

Ingersoll, R. (2003). Is There Really a Teacher Shortage? *CPRE Research reports*. Retrieved from http://repository.upenn.edu/cpre_researchreports/37

Jones, G., Dana, T., LaFramenta, J., Adams, T. L., & Arnold, J. D. (2016). STEM TIPS: Supporting the beginning secondary STEM teacher. *TechTrends*, *60*(3), 272-288. https://doi.org/10.1007/s11528-016-0052-5

Kelly, S. (2004). An event history analysis of teacher attrition: Salary, teacher tracking, and socially disadvantaged schools. *The Journal of Experimental Education*, *72*(3), 195-220.

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

Kushman, J. W. (1992). The organizational dynamics of teacher workplace commitment: A study of urban elementary and middle schools. *Educational Administration Quarterly*, *28*(1), 5-42.

Liu, X. S. (2007). The effect of teacher influence at school on first-year teacher attrition: A multilevel analysis of the Schools and Staffing Survey for 1999–2000. *Educational Research and Evaluation*, *13*(1), 1-16. https://doi.org/10.1080/13803610600797615

Liu, X. S., & Meyer, J. P. (2005). Teachers' perceptions of their jobs: A multilevel analysis of the teacher follow-up survey for 1994-95. *Teachers College Record*, *107*, 985-1003.

Marder, M., Brown, R. C., & Plisch, M. (2017). *Recruiting teachers in high-needs STEM fields: A survey of current majors and recent STEM graduates*. Retrieved from American Physical Society: http://www.aps.org/policy/reports/popa-reports/upload/POPASTEMReport.pdf https://doi.org/10.1119/1.4981053

Meek, A. (1998). America's Teachers: Much to Celebrate. *Educational Leadership*, *55*(5), 12-16.

Mollenkopf, D. L. (2009). Creating highly qualified teachers: Maximizing university resources to provide professional development in rural areas. *The Rural Educator, 30*(3), 34–39.

National Center for Education Statistics (NCES) (2016). *Schools and staffing survey* (SASS). Retrieved from https://nces.ed.gov/statprog/handbook/pdf/sass.pdf

National Science and Technology Council (2013). *Federal science, technology, engineering, and mathematics (STEM) education 5-year strategic plan*. Retrieved from https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/stem_stratplan_2013.pdf

Paternoster, R., Brame, R., Mazerolle, P., & Piquero, A. (1998). Using the correct statistical test for the equality of regression coefficients. *Criminology*, *36*, 859-866.

Pearson, L. C., & Moomaw, W. (2005). The relationship between teacher autonomy and stress, work satisfaction, empowerment, and professionalism. *Educational Research Quarterly*, *29*(1), 37-54.

Perie, M., & Baker, D. P. (1997). Job satisfaction among America's teachers: Effects of workplace conditions, background characteristics, and teacher compensation. *Statistical Analysis Report*. Washington, DC: U.S. Department of Education. Retrieved on August 4 2017 from http://files.eric.ed.gov/fulltext/ED412181.pdf

Perrachione, B. A., Petersen, G. J., & Rosser, V. J. (2008). Why do they stay? Elementary teachers' perceptions of job satisfaction and retention. *The Professional Educator, 32*(2), 25-41.

Reilly, E., Dhingra, K., & Boduszek, D. (2014). Teachers' self-efficacy beliefs, self-esteem, and job stress as determinants of job satisfaction. *International Journal of Educational Management*, *28*(4), 365-378. https://doi.org/10.1108/IJEM-04-2013-0053

Shann, M. H. (1998). Professional commitment and satisfaction among teachers in urban middle schools. *The Journal of Educational Research*, *92*(2), 67-73.

Shen, J., Leslie, J. M., Spybrook, J. K., & Ma, X. (2012). Are principal background and school processes related to teacher job satisfaction? A multilevel study using schools and staffing survey 2003-04. *American Educational Research Journal*, *49*(2), 200-230. https://doi.org/10.3102/0002831211419949

Skaalvik, E. M., & Skaalvik, S. (2009). Does school context matter? Relations with teacher burnout and job satisfaction. *Teaching and Teacher Education*, *25*, 518-524. https://doi.org/10.1016/j.tate.2008.12.006

Skaalvik, E. M., & Skaalvik, S. (2010). Teacher self-efficacy and teacher burnout: A study of relations. *Teaching and Teacher Education*, *26*, 1059-1069. https://doi.org/10.1016/j.tate.2009.11.001

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*, 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.PR0.114k14w0

Smith, T. M., & Ingersoll, R. M. (2004). What are the effects of induction and mentoring on beginning teacher turnover? *American Educational Research Journal*, *41*, 681-714.

Steiger, J. H. (1980). Tests for comparing elements of a correlation matrix. *Psychological Bulletin*, *87*(2), 245-251.

Stevenson, H. J. (2014). Myths and motives behind STEM (science, technology, engineering, and mathematics) education and the STEM-worker shortage narrative. *Issues in Teacher Education*, *23*(1), 133-146.

Stockard, J., & Lehman, M. B. (2004). Influences on the satisfaction and retention of 1st-year teachers: The importance of effective school management. *Educational Administration Quarterly*, *40*, 742-771.

Taylor, D. L., & Tashakkori, A. (1995). Decision participation and school climate as predictors of job satisfaction and teachers' sense of efficacy. *The Journal of Experimental Education*, *63*(3), 217-230.

Tickle, B. R., Chang, M., & Kim, S. (2011). Administrative support and its mediating effect on US public school teachers. *Teaching and Teacher Education*, *27*(2), 342-349. https://doi.org/10.1016/j.tate.2010.09.002

Tschannen-Moran, M. (2001). Collaboration and the need for trust. *Journal of Educational Administration*, *39*(4), 308-331.

Walker, W. D., Garton, B. L., & Kitchel, T. J. (2004). Job satisfaction and retention of secondary agriculture teachers. *Journal of Agricultural Education*, *45*(2), 28-38.

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

Ware, H. W., & Kitsantas, A. (2011). Predicting teacher commitment using principal and teacher efficacy variables: An HLM approach. *The Journal of Educational Research*, *104*(3), 183-193. https://doi.org/10.1080/00220671003638543