Technology and Engineering Education Teacher Commitment: An Analysis of Educator Supports and Demands

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ABSTRACT

In Technology and Engineering Education, teacher retention has been consistently highlighted as one of the foremost issues facing the discipline (Moye, 2009; Moye, 2017; Newberry, 2001; Ritz 1999, 2006; Weston, 1997), and understanding variables impacting teacher commitment to the profession is necessary to retain a prepared and expert educator workforce. This research employs the 2011-2012 Schools and Staffing Survey Teacher Questionnaire to assess variables that may influence Technology and Engineering Education teachers' commitment to teaching. Variables examined include leadership support, peer support, student problems, resources, paperwork, new teacher status, teacher certification route, caseload of English language learners, caseload of students with individualized education plans, poverty, and urbanicity. Findings show four variables to be statistically significant predictors of commitment: principal support, student problems, paperwork, and the caseload of students with individualized education plans. These four variables accounted for approximately 33 % of variance in teacher commitment.

Keywords: Teacher commitment; Technology and Engineering Education; Schools and Staffing Survey

INTRODUCTION

The recruitment and retention of quality teachers is an ongoing concern for educational leaders at all levels, and researchers are working to find whether the issue lies with a shortage of teachers entering the field or in the retention of those teachers (Cochran-Smith, 2004; Hunt & Carroll, 2003; Ingersoll, 2001; National Education Association, 2005). Previous research has found this 'revolving door' (Ingersoll, 2001) of teachers arriving and leaving creates "an environment that can be a major inhibitor to school efficiency in promoting student development and attainment" (Shaefer, Long, & Clandinin, 2012, p. 106). With nearly 22% of all teachers leaving the profession within the first three years (DePaul, 2000), the early career period has a particularly high attrition rate. This attrition is attributed to both individual and contextual factors (Shaefer et al., 2012). Research shows that resilience, personal demographic features, administrative support, salary, school poverty rate, and rural and urban school designations contribute to teacher attrition (Billingsley, 2004; Borman & Dowling, 2008; Freedman & Appleman, 2009; Haun & Martin, 2004; Guarino, Santibañez, & Daley, 2006; Johnson & Birkeland, 2003; Shaefer et al., 2012).

Although this wide-ranging research on teacher attrition in general is a starting point, research shows us that the discipline of Technology and Engineering Education and Technical Education is inherently different and possesses unique factors (Camp & Heath-Camp, 1989). While it is known that a teacher's area of expertise or content knowledge and age are strongly related to turnover (Ingersoll, 2001), little research has been conducted with Technology and Engineering Education teachers relating to attrition. In fact, Moye (2017) recommended a more detailed study on the supply and demand of Technology and Engineering Education teachers to determine why students were not choosing the profession and to find best practices for recruitment.

In 2015-2016, institutions produced 206 new technology teachers; just over a quarter of the graduates produced 20 years earlier in 1995-1996 (Moye, 2017). While recruitment is important, the author's conclusions left out the essential variable of retention. Cochran-Smith addressed retention in 2004, pointing out that "Teacher shortage is in large part a demand problem that can be solved only if we decrease demand by increasing retention" (p. 390). As such, research in this article explores retention as the other half of the equation for the Technology and Engineering Education teacher shortage.

Retention is particularly critical in the field of Technology and Engineering Education. Since many of these teachers come to classrooms from industry, it is difficult to replace them when they are lost to attrition (Kersaint, Lewis, Potter, & Meisels, 2007). Studies have shown that job-related stress is the most cited reason for a teacher's leaving Technology and Engineering Education-related disciplines (Ruhland, 2001). This variable is all-encompassing and does not provide detailed feedback on what actions administrators can take to retain Technology and Engineering Education teachers specifically. Nonetheless, teacher retention is a major issue in Technology and Engineering Education and commitment to the profession could be impacted to some extent by job-related stress.

RESEARCH QUESTIONS

The purpose of this study was to examine whether supports and demands on Technology and Engineering Education teachers could be used to predict commitment to teaching. Our analysis focused on a single research question:

R1: What is the relationship between the demands and supports placed on Technology and Education teachers and their commitment to the field?

The research team hypothesized that teachers who experienced stronger supports and fewer demands would express a stronger commitment to teaching. Conversely, the researchers hypothesized, given the clear connections with teacher persistence and school-based support, that those Technology and Engineering Education teachers who experienced weaker supports and heavier demands would express a lower level of commitment to the profession of teaching.

METHODOLOGY

Participants

For this study, Schools and Staffing Survey Teacher Questionnaire (SASS TQ) data for all public school Technology and Engineering Education teachers were utilized. Participants are categorized as Technology and Engineering Education teachers if they responded with codes of 246 (Construction trades, engineering, or science technologies (including CADD and drafting), 247 (Manufacturing and precision production (electronics, metalwork, textiles, etc.), 250 (Communications and related technologies (including design graphics, or printing; not including computer science), or 255 (Industrial arts or technology education). This resulted in a weighted sample size of 50,610.

Of those 50,610 teachers, 92 percent were white and 75 percent were male. The mean number of years of teaching experience was approximately 15.5 years. The mean age in years of the participants was approximately 46.7 years. Eighty-six percent were fully certified and 78 percent took a traditional route to certification. Fifty-four percent of the sample reported having a bachelor's degree or less as the highest degree attained.

Instrumentation

This study employed data from the most recent Schools and Staffing Survey (SASS). The SASS is conducted by the National Center for Education Statistics (NCES) on behalf of the U.S. Department of Education in order to collect extensive data on American public and private elementary and secondary schools. The SASS is composed of the following questionnaires: a School District Questionnaire, Principal Questionnaire, School Questionnaire, Teacher Questionnaire, School Library and Media Center Questionnaire, and the School's and Staffing Survey Teacher Questionnaire (SASS TQ). We used teacher responses to the SASS TQ to determine the level of commitment for Technology and Engineering Education teachers in the United States.

This study analyzed data from the restricted-use data files of the SASS TQ, which contains variables and information not available in the public-use data set and provides a rich insight into the characteristics and qualifications of teachers. As noted by Tourkin et al. (2010, p.1):

> SASS provides data on the characteristics and qualifications of teachers and principals, teacher hiring practices, professional development, class size, and other conditions in schools across the nation. The overall objective of SASS is to collect the information necessary for a comprehensive picture of elementary and secondary education in the United States. The SASS was designed to produce national, regional, and state estimates for public elementary and secondary schools and related components and is an excellent resource for analysis and reporting on elementary and secondary educational issues.

Variables Analyzed

This study examined variables that may affect Technology and Engineering Education teachers' level of commitment. Table 1.

provides information on the SASS TQ questions used in the analyses and in the creation the composite variables used in this study. The composite variables created from SASS TQ questions were commitment, leadership support, peer support, student problems, and time and resources. Paper work interference, new teacher status, caseload of English language learners (ELL) students, caseload of Individualized education program (IEP) students, certification route, poverty, and urbanicity were questions that were taken directly from the SASS TQ.

Table 1. Variables used in the analysis.

VARIABLE TYPE	SASS TQ QUESTION
Dependent Variable Commitment (Composite Variable)	• Stress and disappointments involved in teaching at this school aren't really worth it. • If I could get a higher paying job I'd leave teaching as soon as possible. • I don't seem to have as much enthusiasm now as I did when I began teaching.
Independent Variables Principal Support (Composite Variable)	• Principal enforces rule for student conduct/back me up. • Principal knows what kind of school he/she wants and communicated it • Staff recognized for a job well done. • The school administration's behavior toward the staff is supportive and encouraging.
Peer Support (Composite Variable)	• Most of my colleagues share my beliefs about central mission of school. • Great deal of cooperative effort among teachers. • I make a conscious effort to coordinate content of courses with other teachers.
Student Problems (Composite Variable)	• Student tardiness is a problem in this school. • Student absenteeism a problem at this school. • Student class cutting a problem at this school.
Materials	• Necessary materials such as textbooks, supplies, and copy machines are available as needed by the staff.
Paperwork	• Routine duties and paperwork interfere with my job of teaching.
IEP Caseload	• Of all the students you teach at this school, how many have an Individualized Education Program (IEP) because they have disabilities or are special education students?
LEP Caseload	• Of all the students you teach at this school, how many are of limited-English proficiency or are English-language learners (ELLs)? (Students of limited-English proficiency [LEP] or English-language learners [ELLs] are those whos native or dominant language is other than English and who have sufficient difficulty speaking, reading, writing, or understanding the English language as to deny them the opportunity to learn successfully in an English-speaking-only classroom.)
Beginning Teacher	• NEWTEACH. Flag that identifies teachers who have three or fewer years of experience.
School Poverty	• NSLAPP_S. Of schools that participate in the National School Lunch Program (NSLP), the percentage of their K–12 enrollment that was approved for free or reduced-price lunches.
Certification Route	• Did you enter teaching through an alternative certification program? (An alternative program is a program that was designed to expedite the transition of non-teachers to a teaching career, for example, a state, district, or university alternative certification program.)
Urbanicity	• URBANS12. Categories include: City, Suburb, Town, and Rural. Recoded to Urban and Rural.

Procedure

This study analyzed data from the SASS TQ restricted-use dataset. A restricted-use license was applied for and access was authorized by the NCES. Specific Institute for Education Sciences (IES) reporting protocols were followed where the results were sent to IES for approval and authorization for release. The results were authorized by IES for release.

The primary variable of interest in this study was the dependent variable teacher commitment. It was a composite variable that was the sum of three questions asking teachers about workplace and personal factors related to commitment: (a) Stress and disappointments involved in teaching at this school aren't really worth it; (b) If I could get a higher paying job I'd leave teaching as soon as possible; and (c) I don't seem to have as much enthusiasm now as I did when I began teaching. Responses for each question were answered on a four-point Likert scale: (1) Strongly agree, (2) Somewhat agree, (3) Somewhat disagree, and (4) Strongly disagree. Summed scores could range from 3 to 12, and higher scores indicated a higher level of commitment.

Principal support, peer support, and student problems were composite variables using a Likert scoring system: (1) Strongly disagree, (2) Somewhat disagree, (3) Somewhat agree, and (4) Strongly agree. The variables materials and paperwork were individual questions using the same Likert scale indicated above. IEP caseload, LEP caseload, and school poverty were continuous variables with scores that that ranged from zero to 231. Beginning teacher status, certification route and urbanicity were dichotomous variables. Table 2. provides a descriptive analysis of the variables examined.

Stata 13 was employed to evaluate teacher commitment using multiple regression. Multiple regression was appropriate because the study examined the relationship between one continuous dependent variable and two or more independent variables. Probability levels of .05 or less were deemed to be statistically significant Data were weighted using the Teacher Final Sampling Weight (TFNLWGT) variable and the SASS TQ supplied 88 replicate weight variables. A balanced repeated replication procedure was utilized as required by IES (Cox, Parmer, Strizek, & Thomas; 2016; Tourkin et al., 2010). All analyses were completed with weighted data and all weighted data and degrees of freedom were rounded to the nearest 10 per IES protocol. Table 3. shows the correlation matrix for the independent variables used in the analysis as they relate to the dependent variable commitment.

RESULTS

No multiple comparisons or interaction effects were examined in this study. The results reported do not present an exhaustive list of all statistically significant results possible, because this study was an exploratory effort to identify features that may contribute to Technology and Engineering Education teacher commitment. It was found that principal support, student problems, paperwork and IEP caseload were statistically significant

Table 2. Descriptive Statistics.

Variable	Mean	SD	Minimum	Maximum
Commitment	9.008	2.265	3	12
Principal Support	12.784	3.034	4	16
Peer Support	9.338	1.752	3	12
Student Problems	7.047	2.439	3	12
Materials	3.201	0.877	1	4
Paperwork	2.700	0.934	1	4
Poverty	41.485	0.934	0	100
Rural Location	0.368	0.482	0	1
Urban Location	0.171	0.377	0	1
Beginning Teacher	0.149	0.356	0	1
IEP Caseload	16.830	19.952	0	231
LEP Caseload	5.935	17.603	0	200
Certification Route	1.769	0.4211	1	2

Table 3. Correlation matrix.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Commitment	1.0												
2. Principal Support	.44	1.0											
3. Peer Support	.31	.55	1.0										
4. Student Problems	-.24	-.27	-.23	1.0									
5. Materials	.20	.37	.29	-.19	1.0								
6. Paperwork	-.25	-.21	-.19	.15	-.15	1.0							
7. Beginning Teacher	.06	.11	.05	.04	-.02	-.06	1.0						
8. IEP Caseload	-.12	-.08	-.05	-.02	-.09	.03	-.08	1.0					
9. LEP Caseload	-.05	-.06	-.02	.05	-.14	.03	-.02	.27	1.0				
10. School Poverty	-.02	-.02	-.01	.19	-.12	-.02	.02	-.03	.19	1.0			
11. Certification Route	-.03	.00	-.06	.00	-.05	.00	-.15	.12	.04	-.03	1.0		
12. Rural Location	-.03	-.06	-.03	-.08	.03	-.01	-.04	-.11	-.10	.01	.05	1.0	
13. Urban Location	.06	.03	.05	.08	.00	-.01	.10	.03	.09	.17	-.05	-.35	1.0

predictors of Technology and Engineering Education teachers' level of commitment. Principal support, student problems, paperwork, and IEP caseload explained a statistically significant proportion of variance in commitment scores, $R2 = .329$, $F(10, 80) = 11.02$, $p < .001$. Table 4. shows the coefficients and standard errors for each variable in the model and the associated *t* and *p* values. The results show that a higher level of principal support was a statistically significant indicator of a higher level of teacher commitment. Fewer student problems, less paperwork, and a smaller caseload of students with individualized education plans were also statically significant predictors of teacher commitment.

CONCLUSION

The identification and exploration of factors influencing the commitment and retention of quality Technology and Engineering Education teachers are vital for the sustainability and growth of its programs (Ruhland, 2001). It is not surprising that principal support, student problems, paperwork, and the caseload of students with individualized education plans serve as central retention factors. Although prepared for diverse educational applications and student learning abilities, Technology and Engineering Education teachers can be fatigued by the continual need for adaptation (Li, Ernst, & Williams, 2015).

Technology and Engineering Education teachers have the highest IEP and overall caseload (LEP and IEP combined) of all STEM educator designations and many general education designations (Williams, Ernst, & Kaui, 2015). There is a separation between being uniquely positioned to make a positive impact on students of special populations and being overtasked. Without adequate support and understanding from school administration, teacher retention is adversely impacted (Ernst, Williams, Clark, Kelly, & Sutton, 2018).

Safety, compliance, and federal funding paperwork often falls to Technology and Engineering Education teachers serving in technology director and career center director capacities. Equipment safety and training plans (Love, 2013) as well as Carl D. Perkins funding requests are often generated by Technology and Engineering Education faculty or generated in collaboration with local education agency personnel. These high-stakes responsibilities have district-level and state-level implications from both operations and legal lenses.

Table 4. Regression results for commitment.

Variable	Coefficient	*SE*	*t*-value	*p*-value
Principal Support	.256	.040	6.39	0.000
Peer Support	.090	.071	1.25	0.213
Student Problems	-.124	.051	-2.41	0.018
Materials	.045	.168	0.27	0.791
Paperwork	-.490	.121	-4.04	0.000
School Poverty	.001	.004	0.38	0.736
Rural Location	-.200	.269	-0.75	0.458
Urban Location	.619	.338	1.83	0.071
Beginning Teacher	-.148	.388	-0.38	0.703
IEP Caseload	-.009	.004	-2.31	0.023
LEP Caseload	.004	.007	0.55	0.593
Certification Route	-.227	.280	-0.81	0.420

Note. SE is standard error.

It is apparent from the teachers' responses reported on the SASS TQ that these demands are weighing on the Technology and Engineering Education teachers. Administrators need to find ways to better support Technology and Engineering Education teachers to help protect them from burnout. After all, the growing shortage of qualified and credentialed Technology and Engineering Education teachers underscores the need for retention of these educators (Moye, 2017). There is no one way to address the issues identified in this research. Further examination on identifying and providing appropriate principal support, as well as ways to mitigate student behavior problems, reduce paperwork, and provide assistance with above-average IEP caseloads are recommended courses of action. Addressing known problems surrounding commitment and retention factors identified through this study can be a starting point in the broader systemic issues of the retention and commitment of Technology and Engineering Education teachers.

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