

Science and Mathematics Teacher Retention: A Collective Analysis and Comparison Between Master Teachers and Other Teachers

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Abstract: Teacher retention has been a continuous challenge in the U.S. In this paper, we compared 84 Master Teaching Fellows (MTFs) and 83 non-MTFs in their self-efficacy, leadership skills, school-work environment, diversity dispositions, and professional network size. Using multinomial logistic regression, we also explored if these factors related to their retention. Results indicate that MTFs: (1) have higher levels of self-efficacy and diversity dispositions, and larger leadership networks; and (2) are more likely to shift to leadership positions. Findings provide insights for developing teacher leadership programs.

Introduction

Teacher turnover presents significant challenges for U.S. public schools for over decades, particularly for science and mathematics in high-need schools. Factors such as self-efficacy, leadership, autonomy, and social networks may help mitigate the adversities feeding into teacher turnover. In fact, because of the positive impacts of self-efficacy on instructional approaches and constructive learning, greater student motivation, and collaborating with other teachers (e.g., Boice, et al., 2021), many argue that higher self-efficacy can also yield other positive outcomes such as teacher retention (e.g., Polizzi et al., 2021). Related to leadership, mounting evidence suggests that K-12 school-based leadership can be one of the most successful forms of support to develop and sustain highly qualified teachers (e.g., Berg et al., 2014). Additionally, principal autonomy support and teacher-school fit have been associated with teachers' sense of belonging and job satisfaction (Youngs et al., 2015), which can, in turn, relate to teacher retention. Research indicates that teachers who have more connected networks are more likely to persist in teaching and develop leadership identities (Alemдар et al., 2022). Professional social networks are important assets for teachers in several ways including informal professional development by learning from each other, supporting each other on non-teaching related factors such as cultural and administrative, and developing strong teacher identities (Polizzi et al., 2021). Moreover, research indicates that teachers who have more connected networks are more likely to persist in teaching and develop leadership identities (Alemдар et al., 2022). The following research questions formally guided this study: (1) How do Master Teachers (MTFs) compare to non-MTFs in terms of their self-efficacy, leadership skills, diversity dispositions, school-work environment, network size, and retention? (2) To what extent do these factors relate to their retention? Is there a difference between MTFs and non-MTFs regarding this relation?

Methods

Data were collected from 84 MTFs and 83 non-MTFs across the nation (30% male and 70% female; 88% White and 12% from minoritized backgrounds). We define MTFs as science and mathematics teachers who participated in a five-year National Science Foundation Noyce Master Teaching Fellowship Program and taught in high-needs schools. Teachers completed self-reported comprehensive surveys comprising demographic and professional background questions; 4- or 5-point Likert-scale items about teaching self-efficacy (Klassen et al., 2009), leadership skills (Watt et al., 2010), person-organization (P-O) fit (Youngs et al., 2015), teacher autonomy (Baard et al., 2004), and diversity dispositions (Schulte et al., 2008); and social network (Polizzi et al., 2021). We used multinomial logistics regression analyses with retention as a four-level nominal outcome (stayer: continue teaching in the same school, mover: change schools, shifter: take a leadership position; and leaver). We explored the impact of independent variables on three retention levels compared to stayers.

Results

Findings indicated that MTFs' teaching self-efficacy ($t(165) = 2.23, p = .03$) and leadership network size ($t(165) = 3.18, p < .001$) are significantly greater than non-MTFs. Although not statistically significant, MTFs' availing diversity dispositions are slightly higher than non-MTFs ($t(165) = 1.81, p = .07$). There was no statistically significant difference between MTFs and non-MTFs on other factors. Regarding retention, there was no difference between MTFs and non-MTFs for being a mover or leavers. However, significant differences occurred between the two groups about staying ($t(165) = -3.22, p < .001$) and shifting ($t(165) = 2.24, p = .03$) to a leadership position. Interpreted collectively, we can infer that MTFs are more likely to assume a leadership role. Regarding the relation between retention and independent variables, results indicated that higher level of

engagement in teacher leadership and lower degrees of P-O fit were associated with shifting to a leadership position (see Table 1). Leadership network size is positively associated with shifting to a leadership position. Lastly, leavers, compared to stayers, tend to have slightly higher levels of self-efficacy. The relationship between the independent variables and retention did not differ by MTF-ness.

Table 1
Multinomial Regression Results with Retention as the Outcome.

Variables	Mover ^a			Shifter ^a			Leaver ^a		
	B	S.E	Exp(B)	B	S.E	Exp(B)	B	S.E	Exp(B)
Male	0.00	0.71	1.00	-0.29	0.56	0.75	-0.55	0.92	0.58
Teaching self-efficacy	0.48	0.65	1.62	0.32	0.54	1.38	1.79	0.99	6.01 [^]
Leadership activities	-0.96	0.57	0.38	1.76	0.54	5.81**	0.95	0.69	2.58
P-O fit	-0.26	0.45	0.77	-0.80	0.37	0.45*	-0.34	0.51	0.71
Autonomy support	-0.19	0.36	0.83	0.29	0.30	1.33	-0.53	0.37	0.59
Diversity dispositions	-0.09	1.74	0.91	-1.21	1.43	0.30	-3.82	2.43	0.02
Leadership network size	-0.04	0.10	0.96	0.14	0.07	1.15 [^]	0.14	0.11	1.15

^a The reference category: Stayer. * $p < .05$. ** $p < .01$. [^] $p < .1$

Discussion and conclusions

Our study revealed that MTFs tend to have higher levels of self-efficacy and availing diversity dispositions and larger leadership networks. Another significant difference between MTFs and non-MTFs is the likelihood of shifting to a leadership position. One important area of discussion is whether a teacher's shift to a leadership position hurts the teacher retention. Perhaps, shifting results in impacting other teachers and contributing positively to teacher retention. Shifters indeed feel having more impact on other teachers and students when they assume a leadership role (Ekmekci et al., 2022). These findings favoring MTFs provide evidence for the impact of NSF Noyce programs on teachers. Additionally, teacher leadership activities had a significant impact on shifting and P-O fit had a negative impact on shifting. In brief, long-term professional development for developing teacher leaders seems to produce positive outcomes for teacher self-efficacy and leadership. Thus, school and district administrators should promote and encourage teachers to engage in leadership activities.

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