IOWA COLLEGE AID

Teacher Shortage Loan Forgiveness Research Brief

An examination of retention among the first two cohorts of participants two, five, and 10 years after first receiving a Teacher Shortage Loan Forgiveness award.

SUMMARY

Due to considerable attrition, training costs, and decreased interest in the profession, retaining teachers is a substantial concern in the United States. States use various financial incentives to increase retention at the state and district levels. One financial incentive is forgiving and/or repaying a portion of a teacher's student loans. This research brief uses data from the Iowa Department of Education Bureau of Iowa College Aid (Iowa College Aid) and the Iowa Department of Education (IDE) to evaluate Iowa's Teacher Shortage Loan Forgiveness(TSLF) program. Using a weighted, matching technique, we find that TSLF recipients were seven and nine percentage points more likely to be retained five and 10 years, respectively, after their first year of teaching. Meanwhile, TSLF recipients were no more or less likely to be retained in their original school district.

BACKGROUND

There are 36,000 teacher vacancies and 163,000 underqualified teachers in the United States (Nguyen et al., 2022). Shortages are higher in science, technology, math, special education (SpEd), and English language learning and districts that are rural or with a greater percentage of students from marginalized backgrounds (Sutcher et al., 2019). Though Iowa does not track vacancies and unqualified teachers, retention of full-time teachers dropped from 94% in 2020-21 to 88% in 2021-22 (IDE, 2022). While the increasing use of underqualified teachers is a concern, teacher attrition is significant and costly for school districts (Carrol, 2007; Ronfeldt et al., 2013).

Many financial and non-financial interventions have been examined to increase the interest and retention of teachers (Podolski et al., 2019). One financial incentive is loan forgiveness or repayment (LFR) for teachers willing to teach hard-to-staff subject areas or districts. The idea behind the incentive is that it will keep teachers within those subject areas or districts. Despite LFR programs being popular in states (Aragon, 2018), only two published studies exist studying their effects on retention.

Steele et al. (2010) examined California teachers receiving loan forgiveness from the Assumption Program of Loans for Education (APLE). Teachers had the chance to receive $11,000 to $19,000 in loan forgiveness for teaching in subject-shortage areas and hard-to-staff schools over four years. A group receiving the merit-based Governor's Teaching Fellowship (GTF) received an additional $20,000 conditional scholarship for teaching at schools in the state's bottom half of its Academic Performance Index (API). Those teachers receiving both awards were significantly more likely to teach low-performing schools than those receiving the base award. However, they were no more or less likely to continue teaching in those schools after four years.

The other LFR program examined Florida Critical Teacher Shortage Program (FCTSP) (Feng & Sass, 2018). The FCTSP offered up to $10,000 in loan forgiveness over four years to teachers in hard-to-staff subject areas. They found that participation in LFR was positively related to yearly retention across multiple subject areas. Special education teachers had higher retention at only higher levels of LFR. Nevertheless, the association between receiving LFR begins to fade away six years after first receiving LFR.

We add to this field by examining teacher retention among Iowa's TSLF program awardees for the 2007-08 and 2008-09 academic years.

Iowa's Teacher Shortage Loan Forgiveness Program

The TSLF program had three purposes: to induce college students to pursue degrees in subject shortage areas and to encourage graduates to teach and retain qualified teachers in Iowa. The maximum award varied from year-to-year based on legislative appropriations and Iowa code. The most a teacher could receive in LFR was the lesser of (a) the average undergraduate tuition rate of an Iowa public four-year institution for the first year following graduation or (b) 20% of the teacher's total federal guaranteed Stafford loan balance (ITSLP, 2017). The program ran until the 2015-16 academic year.

Teachers receiving TSLF had to teach in an instructional shortage area as determined by the IDE (ITSLP, 2017).

Shortage areas included special education (SpEd), English as a second language, industrial technology, agriculture, family and consumer sciences (FCS), foreign language, music, mathematics, and science. For the analytical sample, the mean first-year salary of a TSLF recipient was $33,939.

The average first-year award of loan forgiveness of these recipients was $4,220, equivalent to a 12% increase in salary (see Appendix A for the number of awards and associated costs of the sample).

RESEARCH QUESTIONS

1.   Did first-year teachers participating in Iowa's TSLF program have higher within-state retention than non-participants two, five, and ten years after the first year of teaching?

2.   Did first-year teachers participating in Iowa's TSLF program have higher within-district retention than non-participants five and ten years after the first year of teaching?

DATA AND METHODS

Analyses use three data sets from two Iowa state agencies. Iowa College Aid provided data on TSLF recipients' names, subject areas, school districts/buildings, student loan amounts, and loans forgiven. The Iowa College Aid data was matched to the Fall Basic Education Data Survey (BEDS) from the IDE. The BEDS data system consists of teachers' names, demographic, education, pay, years of experience, and course information. District or building administrators document and submit the information to the state by mid-November. The final data set matched to the ICA and BEDS data is school building-level information concerning enrollment, racial-ethnic composition, and free or reduced-price lunch (FRPL).

We restrict the analyses to first-year, full-time teachers at public schools for the fall 2007-08 and 2008-09 school years. First, all teachers applying for TSLF in these cohorts received an award. Secondly, these two cohorts allow the exploration of retention ten years after the first year of teaching. Finally, the two cohorts comprised 63% of all recipients, and there were no new recipients for the 2009-10 academic year. We further narrow the focus to first-year teachers. The restrictions result in a dataset of 1,205 new first-year, full-time teachers, including 216 TSLF recipients and 989 non-TSLF recipients, for the 2007-08 and 2008-09 academic years.

Variables
Participation in TSLF was the independent variable. The

five dependent variables include retention within the state at two, five, and ten years and retention within the district at five and 10 years after the first year of teaching.[2] We define retention as still working in any teaching or leadership role. Teacher-level control variables include gender, age, salary (quartiles), first year of teaching, and the subject taught. School building-level controls include building grade level (elementary/middle/junior high school vs. junior-senior/senior high school),[3] percent of students with free or reduced-price lunch (quartile), percent of students that are White (quartile), rurality (urban/suburban vs. rural/towns), and the total number of students in the building (natural log). All controls are as observed during the teachers first year of teaching (i.e., 2007-2008 and 2008-2009). Additionally, quartiling of variables was done by the respective first-year of teaching.

Analyses
Because the types of teachers participating in the TSLF may also be the same type of teacher to be retained, we must address self-selection in the analysis (see Appendix B for a complete methods section, Appendix C for balance tests, and Appendix D for limitations). We rely on the doubly robust augmented inverse probability weighting (AIPW) method (Glynn & Quinn, 2010; Rubin & van der Laan, 2008). The technique addresses self-selection and allows us to understand how receiving the TSLF may or may not influence retention.

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[2] First-year retention could not be explored because of 100% first-year retention in three subject areas.
[3] Because many subject areas overlap in grade level taught and that there is no set standard grade level in Iowa for elementary, middle school, or secondary buildings, there are many differences across the state in how districts cluster their grade levels within buildings. Ultimately, the choice was to use the ascribed designation of the building's name to categorize the building-level.

Table 1: Descriptive Statistics

Variables	All Teachers		
	All	**TSLF Recipients**	**Non-TSLF Recipients**
Dependent Variables			
Retention 2 Year	85.3%	85.7%	85.2%
Retention 5 Year	76.0%	78.2%	75.5%
Retention 10 Year	66.3%	68.0%	65.9%
Retention within District 5 Year*	72.0%	71.0%	72.3%
Retention within District 10 Year*	56.8%	49.0%	58.3%
Independent Variable			
Received Award	17.9%		
Control Variable			
Female	68.9%	69.9%	68.7%
Non-White^	3.3%	2.8%	3.4%
Age	28.3 (7.6)	26.1 (5.5)	28.8 (7.9)
Salary Quartile			
First	25.1%	28.7%	24.3%
Second	25.0%	20.9%	25.9%
Third	25.4%	27.8%	24.9%
Fourth	25.6%	22.7$	25.0%

First year retention is not included in the analyses because the high number of teachers retained did not allow for enough variation for a complete analysis.

* Reflects a denominator of the total number of teachers still teaching in Iowa during that academic year as the denominator.

^ Due to low numbers of non-White teachers creating convergence problems and inverse propensity score weighting, we did not include race/ethnicity in our analyses. We include these for descriptive purposes only.

Table 1: Descriptive Statistics Continued

Variables	All Teachers		
	All	**TSLF Recipients**	**Non-TSLF Recipients**
Subject Area			
Special Education	41.2%	35.7%	42.4%
Foreign Language	7.0%	6.5%	7.1%
Music	4.2%	12.0%	2.4%
Science	13.6%	16.2%	13.0%
Vocational (Agriculture, FCS, and Industrial Technology)	15.1%	6.0%	17.1%
Mathematics	16.8%	20.8%	15.9%
English as a Second Language	2.2%	2.8%	2.1%
Percent FRPL Quartile			
First	25.6%	25.0%	25.7%
Second	24.5%	26.9%	24.0%
Third	25.4%	21.8%	26.2%
Fourth	24.6%	26.4%	24.2%
Percent White Quartile			
First	25.5%	25.0%	25.6%
Second	24.6%	21.3%	25.3%
Third	25.1%	25.5%	25.0%
Fourth	24.9%	28.2%	24.2%

Table 1: Descriptive Statistics Continued

Variables	All Teachers		
	All	**TSLF Recipients**	**Non-TSLF Recipients**
Building Level			
Elementary/Middle/Junior High	47.7%	41.7%	49.0%
Junior-Senior High School	52.3%	58.3%	51.0%
Building total (ln)	6.09 (.772)	6.11 (.777)	6.09 (.771)
Rurality	13.6%	16.2%	13.0%
Urban/Suburban	34.1%	33.8%	34.2%
Rural/Town	65.9%	66.2%	65.8%
Percent FRPL Quartile			
2007-08	51.0%	64.4%	48.0%
2008-09	49.0%	35.7%	51.2%
n=	1,205	216	989

ANALYSIS

Descriptively, there were some differences between TSLF recipients and non-recipients. Recipients averaged 2.7 years younger than non-recipients. Recipients were less likely to be new teachers in special education and vocational courses than non-recipients but more likely to teach music, science, and mathematics. Recipients were more likely to teach in schools with a smaller percentage of white students and in the third quartile of school-level FRPL rates. The TSLF recipients were no more or less likely to work in rural schools. They were 7.3 percentage points more likely to work in junior-senior/senior high schools.

After accounting for the various characteristics of teachers and their school buildings, there was no statistically significant difference in retention between TSLF recipients and non-recipients after two years of teaching (see Table 8). After five years, TSLF recipients were 6.6 percentage points more likely to remain as educators in Iowa. The TSLF recipients were 8.9 percentage points more likely to remain as educators in Iowa 10 years after the start of teaching. This increase amounts to an additional 14 teachers retained after five years and 19 additional teachers retained after 10 years had the TSLF not existed.[4] Of those retained teachers, TSLF recipients were no more or less likely than non-recipients to remain in the same school district.[5]

[4] Calculated using 216*.066 and 216*.089.
[5] See Appendix E for sensitivity checks using other quantitative analysis.

Table 2: TSLF and Teacher Retention

Retention	AIPW ATE	Sample Size
Two years	0.032 (0.024)	1,205
Five years	0.066 (.030)*	1,205
10 years	0.089 (.035)**	1,205
Five years within district	-0.011 (.044)	916
10 years within district	-0.042 (.047)	799

Dataset contains all new teachers in Iowa for the fall of the 2007-08 and 2008-09 school years.
*p<.05
**p<.01
***p<.001.

DISCUSSION AND CONCLUSION

The significant positive connection between receiving loan forgiveness and retention are similar to other programs offering financial incentives to teach in shortage areas (Bueno & Sass, 2018; Springer et al., 2016). Additionally, the positive effects of TSLF on retention strengthen over time. However, TSLF recipients are similar to other teachers in their likelihood of staying within their original district. Though district transfer was not a problem Iowa sought to solve, it is a rising concern within retention literature. The concern stems from many new teachers entering rural or lower socioeconomic districts to later transfer to suburban or higher socioeconomic districts (Aldeman et al., 2021). These transfers create teacher quality gaps, with suburban and affluent schools receiving a disproportionate share of high-quality teachers (Goldhaber et al., 2022).

Iowa paid $2.3 million to 216 TSLF recipients. Over 10 years, the state retained an additional 19 teachers. Meaning the cost was around $120,000 per extra teacher retained. Under estimates from The Learning Policy Institute (2017), the total administrative costs of replacing 19 teachers would be between $306,000 to $714,000. However, there is more to replacing a teacher than administrative costs alone. Suppose these 19 teachers were lost to other areas of employment. There might be long-term economic consequences of losing those teachers because school building teacher experience strongly correlates positively with students' educational outcomes (Graham & Flamini, 2021; Podolsky et al., 2019). The benefits of a single high-quality teacher can add

$426,000 to $780,000 to a classroom of 20 students' lifetime earnings (Chetty et al., 2014; Hanushek, 2011). Thus, the TSLF program becomes cost-neutral through future student earnings if only three-to-six teachers retained are of high quality.

Even throughout the Great Recession and recovery, the TSLF program proved to be a potentially effective way to reduce long-term teacher turnover among shortage areas. Though the cost-per-teacher retained is not a trivial amount, the program can pay for itself as long as the teachers retained are effective (Nguyen et al., 2020). Policymakers may want to find ways to ensure financial incentives go to the most effective teachers. The TSLF successor program, Teach Iowa Scholar (TIS), instituted a merit requirement of the top-25 percent of graduates within a teacher education program (TISP, 2015). As college performance via GPA and student teaching GPA is a significant predictor of overall teaching skill (D'Agostino & Powers, 2009), the TIS program's limiting to the top-25 percent may help safeguard against poor-performing beginning teachers (see Appendix F for a full overview of the TIS program).

On a final note, a LFR program without a requirement to remain within a district may have little effect on districts being able to retain their teachers. Suppose policymakers want to reduce in-state district transfer. In that case, Iowa policymakers may need to rethink program requirements to reduce transfer to other in-state school districts.

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[6] Researchers considered a teacher to be "high quality" if they performed in the top-16% of all teachers.

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APPENDICES

Appendix A: TSLF Program Awards and Cost

Number of Years	Teachers	Percent of awardees	Average total award	Avg. total award (inflation adj.)	Average award per year	Avg. award per year (inflation adj.)	Total	Total (inflation adj.)
1	57	26%	$3,997	$5,586	$3,842	$5,355	$227,829	$318,402
2	39	18%	$6,740	$9,286	$3,370	$4,643	$262,860	$362,154
3	21	10%	$9,786	$13,559	$3,262	$4,520	$205,506	$284,739
4	15	7%	$11,353	$15,324	$2,838	$3,831	$170,295	$229,860
5	82	38%	$16,695	$22,625	$3,339	$4,525	$1,368,990	$1,855,250
6	2	1%	$19,614	$26,738	$3,269	$4,456	$39,228	$53,476
Overall	**216**		**$10,531**	**$14,370**			**$2,274,696**	**$3,103,920**

Appendix B: Full Methods Section

The augmented inverse probability weighting (AIPW) method requires several steps. First, the analysis estimates the selection into treatment and predicts the treatment for all observations using logistic regression. Next, the method assigns the inverse probabilities of not being treated for the non-TSLF recipients and the inverse probabilities for TSLF recipients receiving TSLF. These weights are then reapplied to the outcome model for the final estimation with regression adjustment. The analyses are reflected in the following equation:

$$R_i = (L_i | T_i, S_i)\beta + T_i\gamma + S_i\omega + \varepsilon_i,$$

where R represents the probability of retention after two, five, or 10 years since the first year of teaching and within district retention after five and 10 years of teaching. All models use a binary indication of loan forgiveness (L) conditionally on the inverse probability weights contributing to the likelihood of individuals selecting into the TSLF program. These inverse probability weights are derived from the prediction of teacher- (T) and school-level (S) characteristics on selecting into the loan forgiveness program (L). The outcome model (predicting R) includes the main effects of loan forgiveness ($L_i\beta$) along with control variables for teacher- (T) and school-level (S). All standard errors are clustered at the school level in the models.

An AIPW analysis requires a balance between the treatment and control groups. Achieving balance ensures that comparisons based on control variables between TSLF recipients and non-recipients are similar. Except for one covariate in the within-district analyses' variance ratio tests, all analyses pass the standardized difference, variance ratio, and over identification balance tests (Imai & Ratkovic, 2014; Stuart et al., 2013).

Appendix C: Balance Test Results

	Overall Sample				Within district retention - 5 years				Within district retention - 10 years			
	Standardized Differences		Variance Ratio		Standardized Differences		Variance Ratio		Standardized Differences		Variance Ratio	
	Raw	WTD	Raw	WTD	Raw	WTD	Raw	WTD	Raw	WTD	Raw	WTD
Female	0.027	-0.014	0.981	1.011	0.054	-0.056	0.959	1.043	0.046	-0.044	0.965	1.036
Age	-0.405	0.041	0.491	0.937	-0.456	0.025	0.467	0.902	-0.41	0.062	0.506	0.983
Salary												
2nd quartile	-0.119	-0.01	0.863	0.989	-0.093	-0.014	0.899	0.984	-0.159	0.024	0.831	1.025
3rd quartile	0.066	-0.046	1.077	0.946	0.009	-0.081	1.016	0.894	0.007	-0.074	1.014	0.902
4th quartile	-0.054	0.082	0.939	1.091	-0.035	0.076	0.966	1.077	0.007	0.075	1.014	1.082
Subject area												
Foreign language	-0.024	0.016	0.925	1.053	0.049	0.051	1.195	1.193	0.039	0.036	1.169	1.146
Music	0.377	-0.013	4.488	0.933	0.309	-0.029	3.345	0.865	0.292	-0.026	3.411	0.866
Science	0.089	-0.019	1.201	0.96	0.053	-0.017	1.118	0.963	0.042	-0.023	1.096	0.953
Vocational	-0.351	0.006	0.401	1.011	-0.283	0.019	0.473	1.04	-0.301	0.021	0.445	1.044
Math	0.128	0.064	1.24	1.111	0.152	0.066	1.283	1.113	0.107	0.049	1.193	1.081
ESL	0.042	-0.014	1.304	0.912	-0.007	-0.043	0.952	0.71	0.038	0.026	1.331	1.208
Percent FRL												
2nd quartile	0.066	-0.053	1.082	0.935	0.028	-0.051	1.038	0.938	0.048	-0.065	1.063	0.919
3rd quartile	-0.104	-0.042	0.884	0.951	-0.082	-0.032	0.913	0.964	-0.038	-0.061	0.964	0.932
4th quartile	0.051	0.025	1.064	1.028	0.036	0.049	1.05	1.059	0.012	0.066	1.02	1.08

Appendix C: Balance Test Results

	Overall Sample				Within district retention - 5 years				Within district retention - 10 years			
	Standardized Differences		Variance Ratio		Standardized Differences		Variance Ratio		Standardized Differences		Variance Ratio	
	Raw	WTD	Raw	WTD	Raw	WTD	Raw	WTD	Raw	WTD	Raw	WTD
Percent White												
2nd quartile	-0.094	-0.06	0.891	0.927	-0.145	-0.081	0.834	0.903	-0.07	-0.085	0.922	0.897
3rd quartile	0.011	-0.056	1.017	0.933	0.024	-0.038	1.031	0.957	0.041	-0.063	1.049	0.928
4th quartile	0.093	0.017	1.11	1.02	0.099	0.02	1.131	1.025	0.093	0.008	1.119	1.009
Building size (ln)	0.033	0.056	1.016	0.896	0.063	0.054	1.018	0.904	0.026	0.069	0.982	0.861
School Level												
Junior-Senior/ Senior High School	0.148	-0.088	0.976	0.999	0.175	-0.07	0.987	0.993	0.121	-0.088	1.002	0.987
Rurality												
Rural/Towns	0.008	-0.066	0.998	1.039	-0.009	-0.053	1.01	1.03	0.036	-0.051	0.98	1.031
First Year of Teaching												
2008-09	-0.333	0.089	0.922	0.994	-0.331	0.1	0.929	0.991	-0.275	0.099	0.964	0.986
Number of Observations	1,205		1,205		916		916		799		799	
Treated Observations	216		620.7		169		470.7		147		413.3	
Control Observations	989		284.3		747		445.3		652		385.7	
Over-identification Test												
Chi2	26.6139				23.2689				25.45			
Prob>Chi2	.2263				.3867				.2760			

Appendix D: Limitations

Like Feng and Sass (2018), analyses do not contain controls for holding a student loan or accumulated student loans. Both factors may be problematic because sorting into the TSLF program requires a student loan. The BEDS variable for total years of teaching experience is for only within Iowa. Thus, BEDS may code a teacher new to Iowa with ten out-of-state years of teaching experience as a first-year teacher. Finally, the BEDS data set relies on building or district officials to accurately report teachers within their buildings and districts. It does not account for teachers that begin teaching after official submission dates.

Appendix E: Sensitivity Checks

Dependent Variable	Logistic Regression (dy/dx)	IPW	IPWRA	n
1st year retention	0.021 (.023)	0.036 (.022)	0.023 (.024)	1,202
5th year retention	0.052 (.030)^	0.070 (.029)*	0.066 (.029)*	1,202
10th year retention	0.046 (.035)	0.085 (.034)*	0.079 (.035)*	1,202
5th year within district retention	0.009 (.037)	-0.009 (.045)	-0.009 (.042)	913
10th year within district retention	-0.046 (.043)	-0.035 (.049)	-0.035 (.046)	1,202

Dataset contains all new teachers in Iowa for the fall of the 2007-08 and 2008-09 school years.

*p<.05, **p<.01, ***p<.001.

Appendix F: The Teach Iowa Scholar Program

The Teach Iowa Scholar (TIS) program is Iowa's current loan forgiveness or repayment for teachers. The TIS provides recent teacher education program graduates either loan repayment or a lump-sum payment of up to $4,000 a year over five years of teaching (TISP, 2015). Teachers, with or without student debt, can participate in the program. Similar to the TSLF, teachers participating in the TIS program must teach in a designated shortage area. Anyone completing a bachelor's or master's degree on or after January 1, 2013, is eligible. Unlike TSLF, TIS recipients must graduate in the top 25 percent of all students in their postsecondary institutions' teacher preparation program.[7]

By statute, Iowa College Aid prioritizes applicants by renewal status, graduation date nearest to the most recent academic year, the rank of eligible teaching fields, regional need, Iowa resident status, and date of application. Currently, the TIS has more applicants in a given year than it has funding to give to teachers entering the field. Of the 166 new applicants meeting the top-25percent performance threshold in 2022-23, Iowa College Aid had enough funding to admit 81 new applicants to the program alongside 67 renewals. The total of 148 TIS awards in 2022-23 is up from 82 awards in 2021-22.

[7] Iowa College Aid directs colleges and universities with the following statement regarding academic achievement: "This program leaves it up to each college/university to define what it means to be in the 'top 25 percent' of graduates. How you rank your graduating classes is up to you – what is critical is that a given applicant is compared with other students graduating from teacher preparation programs in the same academic year. In other words, your institution needs to identify all teacher preparation program graduates in a given academic year, then determine what constitutes the top 25% of graduates in the teacher preparation programs for that year, then determine if a particular applicant is in the top 25%. Many colleges and universities are finding that the staff in the Education Department on campus has the ability to academically rank students, so please feel free to utilize others on campus who can assist with this calculation."

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