



**Wisconsin Center for
Education Research**
SCHOOL OF EDUCATION
UNIVERSITY OF WISCONSIN-MADISON

Teachers on the Market: A Typology of Teachers' Philosophy, Mission, Vision, and Values

WCER Working Paper No. 2019-2
March 2019

**Peter Goff, Xin Xie, Minseok Yang, Lena Batt, Lydia Gandy-Fastovich,
Yasmin Rodriguez-Escutia, Hyunwoo Yang, and Eunji You**

Wisconsin Center for Education Research
University of Wisconsin-Madison
xin.xie@wisc.edu

Suggested citation: Goff, P., Xie, X., Yang, M., Batt, L., Gandy-Fastovich, L., Rodriguez-Escutia, Y., Yang, H., & You, E. (2019). *Teachers on the market: A typology of teachers' philosophy, mission, vision, and values* (WCER Working Paper No. 2019-2). Retrieved from University of Wisconsin-Madison, Wisconsin Center for Education Research website: <http://www.wcer.wisc.edu/publications/working-papers>

© 2019 by Peter Goff, Xin Xie, Minseok Yang, Lena Batt, Lydia Gandy-Fastovich, Yasmin Rodriguez-Escutia, Hyunwoo Yang, and Eunji You. All rights reserved. Any opinions, findings, or conclusions expressed in this paper are those of the author and do not necessarily reflect the views of the funding agencies, WCER, or cooperating institutions. Readers may make verbatim copies of this document for noncommercial purposes by any means, provided that the above copyright notice appears on all copies. WCER working papers are available on the Internet at <https://wcer.wisc.edu/publications/working-papers>

**Teachers on the Market:
A Typology of Teachers' Philosophy, Mission, Vision, and Values**

Abstract

This study develops, validates, and applies a typology of teachers using labor market data. We construct our typology by applying a correlated topic model to 17,000 personal statements teachers submitted as part of their applications to open positions in Wisconsin public schools. We identify seven types of teachers active on the labor market: Inclusivists, Idealists, Nurturers, Generalists, Classroom Experts, Guides, and External Experts. Using a combination of quantitative and qualitative methods, we explore trends within and among types as well as demographic relationships and labor market behaviors. This research provides novel insights into the philosophies, mission, vision, and values of teachers; links these characteristics to teachers' job market preferences; and provides a sound psychometric foundation for these measures of teacher type to be applied in subsequent research.

Keywords: teacher labor market, typology, selection, distribution, application, correlated topic model, Wisconsin

Teachers on the Market: A Typology of Teachers' Philosophy, Mission, Vision, and Values

**Peter Goff, Xin Xie, Minseok Yang, Lena Batt, Lydia Gandy-Fastovich,
Yasmin Rodriguez-Escutia, Hyunwoo Yang, and Eunji You**

Teachers play a pivotal role in students' performance and success (Darling-Hammond, 2000; Krieg, 2006; Rivkin, Hanushek, & Kain, 2005). Despite increased focus on teacher effectiveness, many schools and districts have difficulty recruiting and retaining qualified teachers (Cowan, Goldhaber, Hayes, & Theobald, 2016; Jackson, 2013; Kukla-Acevedo, 2009). For example, urban and rural school districts face chronic staffing challenges, while suburban districts usually avoid such complications because they offer higher salaries, provide a strong professional culture to teachers, and serve higher achieving, more affluent students (Rutledge, Harris, Thompson, & Ingle, 2008). These hiring and staffing disparities contribute to the inequitable distribution of teachers, where teachers with fewer credentials and less experience are more likely to work in schools serving underrepresented students (Loeb, Kalogrides, & Horng, 2010). Although this systematic teacher sorting predictably exacerbates educational inequity, little evidence exists on how the sorting occurs. This gap creates the need to investigate applicant characteristics and understand how they map onto labor market preferences and behaviors.

To investigate the matchmaking between applicants and schools, our study categorizes applicants into types based on their job statements. Our typology helps us link salient teacher characteristics—beyond typical demographic and professional measures—to their behaviors on the labor market (Goff & Bowers, 2016). This study constructs a teacher typology that illuminates teachers' philosophies and values by drawing from professional statements on over 83,000 application forms for open positions in Wisconsin public schools. These professional statements reflect nuanced information about applicants, such as their instructional philosophies, beliefs, teaching experience, and professional goals. The correlated topic modeling approach, which has been used in quantitative analyses of textual data, makes the analysis of statements by 17,000 teacher applicants logistically feasible.

Using applicants' professional statements, application submissions, and applicant/vacancy characteristics, we address the largely unexamined questions of:

- (1) Can teacher application data be used to create a valid typology of teachers on the labor market?
- (2) What insights does this typology reveal about teacher preferences and the distribution of teachers?

To support our inquiry, we begin by reviewing a broader line of research on the teacher labor market, focusing on the hiring process and teacher distribution. Our paper also documents the validity and reliability of our typology. It identifies teacher characteristics that predict job market behaviors and illustrates how our typology can be used to better understand the distributional challenges facing the teacher labor market. Throughout the paper we provide a guided example of how researchers can apply correlated topic modeling to textual data in education. Finally, we identify seven types of teachers on the job market: Inclusivist, Idealist, Nurturer, Generalist,

Classroom Expert, Guide, and External Expert. We describe the typology prevalence across Wisconsin, identify correlations with other teacher traits and vacancy characteristics, and explore differential labor market preferences among teacher types.

Literature Review

Measures of Teachers on the Job Market

Teacher sorting is a consequence of a series of selection processes between teachers and schools. Farley-Ripple, Raffel, and Welch (2012) explicated labor market decisions for school leaders using a “push-pull” framework, whereby applicants respond to personal and organizational features as they navigate the job market. Cannata (2010) extended this framework to teacher applicants, as teachers also consider individual and school characteristics during the application process. Winter, Ronau, and Muñoz (2004) proposed a similar two-way process in which schools and applicants interact and evaluate each other in the job market. Schools decide whether to extend job offers based on their evaluations of applicants’ résumés, references, and interviews, while applicants apply to desirable vacancies and decide whether to accept offers based on their knowledge of workplace conditions, salary, and extra-professional living considerations. This two-way process necessitates an examination of personal perspectives and characteristics, as well as school contexts (Liu & Johnson, 2006; Rutledge et al., 2008).

The preferences of individual teachers have contributed to mobility in the U.S. teacher labor market. By analyzing a teacher application dataset in New York, Boyd, Lankford, Loeb, Ronfeldt, and Wyckoff (2010) show that teacher applicants prefer schools with smaller enrollments and lower crime rates, and are less likely to prefer positions at schools and districts with larger shares of minority, low-income, or low-achieving students. They also find that, compared to elementary and high schools, middle schools not only received significantly fewer applicants, many more teachers requested to transfer away from middle schools (Boyd et al., 2010). In addition, teachers take into account subjective school features such as principal supports, opportunities for growth, and social and cultural collegiality among colleagues (Johnson & Birkeland, 2003; Smith & Ingersoll, 2004). Teacher preferences may also systematically vary due to their own characteristics. For instance, female teachers tend to prefer working closer to home within their local communities (Clark, Huang, & Withers, 2003; Engel, Jacob, & Curran, 2014); Black and Hispanic teachers are more likely to transfer to schools serving more students of same race and/or ethnicity, while White teachers prefer schools serving more majority students (Hanushek & Rivkin, 2007).

While cover letters, professional statements, and similar measures may be highly informative, when considering the maldistribution of teachers and learning about teachers’ job market behaviors, few studies have leveraged such data, largely due to challenges associated with obtaining job application and hiring data at scale. Instead, labor market studies have relied on analysis of administrative data, often comparing a position where a teacher worked one year with the position where the same teacher taught the following year (Ni, Sun, & Rorrer, 2015; Loeb, Kalogrides, & Beteille, 2012; Ronfeldt, Loeb, & Wyckoff, 2012). While highly informative, these studies cannot fully capture job market phenomena, such as how applicants

portray themselves, where they were more likely to submit applications, or how the depiction by applicants affected the probability of being hired. Thus, statewide teacher application data enriches our understanding of the matchmaking process between teachers and schools while our professional typology allows us to observe differential sorting as this matchmaking unfolds.

Teacher Typologies

The construction of teacher typologies has also been a reliable strategy for learning about the teachers' perspectives and characteristics. Prior research has constructed teacher typologies using personal attributes and professional perspectives, typically collected through surveys/interviews and analyzed using methodologies such as clustering analysis and latent class analysis (Goldring, Huff, May, & Camburn, 2008; Pierson, 2014; Urick, 2012). In contrast to low-stakes survey measures, using high-stakes application data for typology construction may be advantageous. The theory of job market signaling, identified by Spence (1973), reinforces the legitimacy of using cover letters and professional statements to construct a teacher typology since job applicants portray their knowledge and skills in a manner that coincides with the abilities and attributes they feel employers value. Because employers may use professional statements to screen applicants and to construct interview questions (Liu & Johnson, 2006; Patrick & Yick, 2005), applicants have an incentive to craft statements that are as honest and informative as possible. Professional statements are thus a valuable source for us to better understand applicants' behaviors and preferences on the job market.

Within the literature that identifies typologies for teachers, principals, and students, two studies have attempted to define typology. Capecchi (1968) described typology as "the selection of a certain number of combinations of groups of variables" (p. 9). Urick (2012) categorized typology with synonyms such as types, classes, groups, subgroups, and subpopulation. She distinguished the difference between typology and style by describing type as "a group of participants who respond or behave in a similar way, person-centered" (p. 8). She then defined style as "a composite of related behaviors used to describe leadership, variable-centered" (p. 8). Although typology lacks clear definition, the term has been used broadly within education research to capture the systematic classification of educators, principals, and students.

Scholars have approached categorizing teachers by organically creating typologies or by using existing types in the limited studies on teacher typology. Some scholars tapped qualitative methodology. For example, Duncan-Andrade's 2007 longitudinal study used ethnographic research methods to identify three overall types of successful and unsuccessful teachers in Los Angeles working toward social justice. First, Gangstas were often unhappy in their jobs and resented the students and their families. Wankstas were the most common of all teachers and always talked about what they were doing, but their practices did not lead to student success. Finally, Ridas routinely succeeded due to their deep emotional investment with students and surrounding community.

Mixed-method studies used surveys with follow-up interviews or vice versa to create or apply existing teacher typologies to theory. Thomson, Turner, and Nietfeld (2012) employed cluster analysis of questionnaire responses, then followed up with semi-structured interviews to

identify three typologies of prospective teachers and six categories of motivations to join the profession. Based upon analysis of the students enrolled in a traditional teacher-educator program, they categorized the participants as pragmatic, enthusiastic, or conventional. Using observations, interviews, and quantitative analysis (i.e., cluster analysis and multi-level modeling), Bidwell, Frank, and Quiroz (1997) adopted predetermined teacher types—the rigorist, the moral agent, and the pal—to understand how these categories link school control systems (e.g., bureaucratic, market, autocratic) and how teachers do their jobs.

Previous studies utilizing quantitative methods all rely on survey data. For example, in a study using predefined types, Rushton, Morgan, and Richard (2007) analyzed responses on the Myers-Briggs personality profile to understand which teachers were most likely to be selected into Florida's highly effective leadership groups, those considered to be the best teachers in the state. Myers-Briggs (Myers & Briggs Foundation, 2018) creates types of personalities based on four areas: extravert or introvert; intuitive or sensing; thinking or feeling; judging or perceiving. The authors found that teachers who are profiled as extraverted-intuitive-feeling-perceptive are most likely to be in a leadership group. Another study created a typology for preservice teachers in three education programs in Australia (Watt & Richardson, 2008). Their results were based on a cluster analysis conducted on quantitative and (coded) qualitative answers to questionnaires given at the beginning and ending of the program. Similar to the Rushton, Morgan, and Richard (2007) study, they identified three types of prospective teachers and labeled them as highly engaged persisters, highly engaged switchers, and lower engaged desisters.

Previous teacher typology studies used various methodologies, each with its own limitations. In-depth research using qualitative approaches such as ethnography can provide detailed evidence of each type of teacher, but the small sample may only represent the particular site or sites studied during the particular time period. This limitation of small sample size and lack of generalizability across time and space is shared by many mixed-method and quantitative studies. Studies using predefined teacher categories may run the risk of forcing data into certain buckets rather than exploring all aspects of available data. In our study, correlated text modeling provides a new way to examine large-scale qualitative data to create an organic teacher typology without the limitations of previous methods used in the studies described.

Correlated Topic Modeling

While the majority of empirical typologies have been derived from quantitative measures on teachers, often collected through research surveys, such measures are not always available nor are they uniformly desirable. While the external nature of survey research can be a strength (e.g., ensuring anonymity), typologies constructed through survey measures are often external to teachers' practice and can be subject to bias induced by the artificiality of research and related phenomena, such as Hawthorne and John Henry effects. Similar reasoning has shown that performance and response quality can differ markedly depending on the perceived importance of the measure (Corcoran, Jennings, & Beveridge, 2011). Genuine, practice-relevant qualitative data sources—such as through teachers' reflections on their own teaching practices, mentors' summary of mentees' progress, or job application letters—present a novel opportunity to create

an authentic typology of teachers, yet the scale of the data makes traditional qualitative coding strategies logistically infeasible. Correlated topic modeling provides a strategy to integrate qualitative data into a meaningful typology at scale.

Initially developed by David Blei and John Lafferty (2007), correlated topic modeling is an extension of latent Dirichlet allocation (Blei, Ng, & Jordan, 2002), an earlier text-based classification model. The goal of latent Dirichlet allocation, and, later, correlated topic modeling, has been to identify a set of common topics within a corpus of text(s). The premise is that people writing on the same topics are more likely to use certain words rather than others. Therefore, the probability of words appearing in a given text determines the topics. If we knew the topics and the words that defined them *a priori*, then assigning membership to the appropriate topic would be a trivial task. The power and elegance of correlated topic modeling is that the topics are emergent; the method empirically identifies them from relationships among words within a collection of documents. In this way correlated topic modeling is exploratory, providing an inductive approach to classification. This approach is most powerful when knowledge regarding the number and/or content of the topics is limited, nascent, or contested. The approach can identify topics and provide statistical evidence by which to evaluate the extent to which topics are distinct and well-defined, but it is incumbent upon the researchers to make meaning of the groupings of terms that typify each topic.

Topic modeling, like all exploratory techniques, is predicated on a set of assumptions and decisions inherent in the modeling process (Hurley et al., 1997). In the same way that regression modeling can uncover relationships that are a product of chance rather than an underlying structural relationship, correlated topic modeling may construct topics based on spurious correlations rather than identifying a robust set of conceptually coherent topics. The advantage of correlated topic modeling over latent Dirichlet allocation is that correlated topic modeling permits correlations among topics, a sensible adjustment given that topics generated using data collected from a similar sample (e.g., teachers) writing for a similar purpose (e.g., professional statements on an application) cannot be reasonably seen to be independent. Understanding the underlying correlation among topics can buttress the validity of the constructs by facilitating interpretation of topics. This feature of correlated topic modeling facilitates the construction of more meaningful topics and more reliable assignment of documents to topics thereby helping to mitigate the threat of spurious topic construction. Several manuscripts have engaged the properties and construction of topic models from a statistical perspective (Chang, Gerrish, Wang, Boyd-Graber, & Blei, 2009; Lee, Song, & Kim, 2010). However, we lack formal guidance as to how the validity of a topic model is best ascertained in practice. Following the example set forth in Blei and Lafferty (2007), the key decision points around which a correlated topic modeling is implemented consist of modifying the corpus of words (e.g., eliminating high and low-frequency terms), identifying the optimal number of topics via tenfold cross-validation, inspection of key-terms (words most highly associated with each topic), establishing conceptual alignment of documents with their assigned topics, and exploring correlations among topics. While correlated topic modeling has been broadly applied to explore text data, such as historical newspapers (Yang, Torget, & Mihalcea, 2011), speech documents (Quinn, Monroe, Colaresi, Crespin, &

Radev, 2010), and scientific articles (Wang & Blei, 2011), little attention has been paid to education research (Wang, Bowers, & Fikis, 2017).

Method

Data and Sample

Three data sources—vacancy/application data, administrative staffing records, school demographic/achievement data—were linked for the present study. First, all teacher application information was collected from the Wisconsin Education Career Access Network, which is an application portal that kindergarten through 12th-grade (K–12) public schools and teachers use in Wisconsin. Through the network, districts and schools post vacancies, and teacher applicants subsequently apply for those jobs. The network data enable us to track Wisconsin teacher labor market activities by providing information regarding vacancies (e.g., what positions schools and/or districts posted, when the positions were opened, and how many applicants applied to each) and applicants (e.g., professional statements, educational backgrounds, teaching experience, and certifications). The Wisconsin Education Career Access Network data encompass 348 of Wisconsin’s 424 school districts (82%) and 88% of all Wisconsin teaching positions.¹ The network data are non-public, with access permitted only for verified researchers to study Wisconsin’s teacher labor market.

Our second data source is administrative staffing records provided by the Wisconsin Department of Public Instruction. The data cover teachers’ gender, race, teaching experience, and certification. Third, school-level data were collected from the Wisconsin Information System for Education, including total enrollment, the percentage of students receiving free and reduced-price lunch, student demographics, achievement scores, location, and level of schools. Using district and school identifiers, the school-level data were matched with Wisconsin Education Career Access Network data to examine relationships between teacher types and characteristics of public schools to which applicants apply. Teacher and school data are publicly available through the Wisconsin Department of Public Instruction (2017) website.

The matched sample was narrowed to applicants and vacancies active during the job market seasons from March to August in 2015 and 2016. To exclude unexpected and temporary job postings, we focused on the public school vacancies with contracts starting in August. Our analytic data set contained 17,207 applicants submitting a total of 83,551 applications to 4,288 vacancies in Wisconsin. The Wisconsin Education Career Access Network limits applicants’ professional statements to 2,200 characters, or roughly 300 words. Assuming statements with extremely few words did not contain any meaningful values, we excluded eight applicants who wrote statements with fewer than 15 words to strengthen the validity of our findings. The median length of the remaining statements was 252 words. Applicants’ professional statements tended to be fairly detailed portrayals of how they characterize their teaching styles and philosophies. Applicants know their statements will be attached to their applications and therefore sent to

¹ The districts that do not to participate in WECAN are among the smallest in the state. Some did not participate because they were not seeking teachers in this particular hiring cycle.

every vacancy to which they apply. As a result, a statement is not tailored to a specific vacancy but represents the applicant to all potential vacancies. Some applicants provide narratives of their experiences and accolades while others emphasize their plans. Despite our careful approach, we bear one limitation: The sample includes some applicants who applied for non-teaching positions such as counselor and psychologist. Although the network data have a category that distinguishes positions, some districts posted these two vacancies on the category of K–12 teachers. However, we verified such cases were very few and did not change main findings.

Analytic Process

On the basis of previous studies (Wang et al., 2017; Goff & Bowers, 2016), we divided our validation process into four steps: measurement, interpretation, description, and correlations with external measures. Measurement employed correlated topic modeling to determine a teacher typology based on applicants' professional statements. In the interpretation step, we explored the distinguished types through quantitative and qualitative strategies to understand the perspectives the applicants espoused and to ensure the measured types were reliable. In the description step, we indicated descriptive characteristics such as the distribution of topics and probability that applicants were assigned to each type. Last, the “correlations with external measures” show statistical relationships between teacher types and individual characteristics (e.g., gender, race, and teaching experience), and between teacher types and vacancy characteristics to which they applied (e.g., locale, proportion of students receiving free or reduced-price lunch).

Measurement

Correlated topic modeling generated teacher typologies from applicants' professional statements. The method breaks professional statements into a matrix of documents by terms. Next it removes from the matrix the most and least frequent words (e.g., “and,” “the,” and “Ashwaubenon”). After establishing a documents-by-topics matrix and a topics-by-terms matrix, we applied a n -fold cross validation to identify optimal number of latent topics, or teacher types. To illustrate, this method randomly splits the data into n -subsets, reserves one subset, and trains the analysis on all other subsets. After testing the analysis on the first subset and recording the prediction error, the n -fold cross validation repeats this process n times and calculates the average of the errors, suggesting that the smaller errors indicate the more accurate model. James, Witten, Hastie, and Tibshirani (2013) recommend using $n=10$, as these values yield estimates that provide lower bias and variance. With that, we implemented 10-fold cross validation and drew a perplexity plot based on the average of the recorded errors to determine optimal number of types (Arlot & Celisse, 2010; Hornik & Grün, 2011). Throughout this paper we use the terms “topic” and “type” to both describe the individual groupings of teachers' professional statements that collectively form our typology. To be consistent with correlated topic modeling, we use “topic” when discussing our methods and shift to “type” when discussing the substantive nature of the constructs.

Interpretation

Correlated topic modeling produces three primary results:

- (1) probabilities that each professional statement will be allocated to specific types,
- (2) correlations among types, and
- (3) a list of terms that are most representative of each type.

We used the list of terms that characterize each type to formulate a working title for each type. We began by inspecting the 20 most representative terms for each type, making sense of the terms collectively and constructing type titles that were emblematic of the terms. We next selected 20 statements from each type for a close reading. We selected statements with the highest probabilities of being classified into each one type, as these exemplars likely best represented each type and illustrated how the 20 terms were being used in context.

Since correlated topic modeling does not provide any clues to interpret types such as word order, tone, synonyms, or connotations, we used a qualitative content analysis to investigate the types further (Hsieh & Shannon, 2005). In three rounds, at least two of us independently read statements from each group. For these close readings we selected 20 statements from each type, choosing statements that had the highest probability of being sorted into their particular type. Our rationale was that these high-probability statements would be most emblematic of the type, allowing for a clearer identification and understanding of the emergent themes. In the first round, the statements were read blind, without knowledge of the correlated topic modeling lists of representative terms, and broad trends across statements were found within each type. In the second round, our team focused on similar usages of terms and common expressions within the statements. In the third round, we investigated how the listed terms were used in context using the correlated topic modeling term list. After completing this process, titles for each type were revised and finalized. In each of the three rounds, when the whole team did not agree upon themes or titles, we selected another 20 high-probability statements and repeated the process.

Description

Our content analysis allowed us to identify conceptually coherent themes within each type. Next, we examined relevant descriptive characteristics across the teacher types. The information included the portion of each type in the total sample, basic statistical values within each type (e.g., mean, minimum, and maximum probability assigned to each type), key terms, and phrases.

Although the correlated topic modeling assigned applicants to the most probable type, we also extracted the probabilities associated with the other, non-primary, types. Using the correlations among types along with secondary and tertiary topic classification probabilities, we created a visualization (Figure 3, presented in the Findings section) to better convey relationships among types.

Correlations with External Measures

Having created our typology (measurement) and established our understanding within (interpretation) and among (description) types, we next sought to determine how our typology related to external factors. In this stage, we modeled the relationship between teacher types and their backgrounds (e.g., gender, race, teaching experience, number of submitted applications, and

college grade-point average, etc.), along with the relationships between teacher types and the characteristics of the vacancies to which they applied (e.g., school achievement, size, the proportions of free and reduced-price-lunch students and minority students, location, and level of school). We employed a series of analytic models (e.g., ordinary least squares and logit) to estimate the relationships between each teacher type and characteristics of the applicant or the vacancy after controlling for confounding factors. as shown in (1).

$$(1) \quad \beta_{ij} = \beta_0 + \beta_1 \text{Teacher Type}_{ij} + \beta_2 \text{Vacancy Characteristics}_{ij} + \epsilon_{ij}$$

In the model, one of the teacher (vacancy) β 's characteristics (β_{ij}) is a function of teachers' types (Teacher Type_{ij}), other teacher (vacancy) characteristics ($\text{Vacancy Characteristics}_{ij}$) except for the dependent variable, and the error term (ϵ_{ij}). For intuitive understanding, we calculate marginal values on β_1 and standardized them. This work provides evidence on how reliable the typology is for predicting individual characteristics of teachers and modeling their job search behaviors.

Modeling

To find the suitable number of latent topics (k) within our sample of teachers, we applied a tenfold validation approach, in keeping with the recommendations of previous topic modeling studies (Blei & Lafferty, 2007; Wang et al., 2017). When determining the number of topics in a topic model, perplexity plots serve a function analogous to scree plots for visualizing eigenvalues when determining the optimal number of factors in an exploratory factor analysis. We explored the topic structure using perplexity plots where the number of topics ranged from 2 to 15. The perplexity plot plateaued notably from $k=8$ to $k=10$. We then conducted the interpretation step illustrated above for each k to identify the optimal number of topics. When making sense of the various topic models we also utilized log-ratio graphs that provided the paired-comparisons of the probabilities that the top 10 terms belonging to each topic. As we sought to understand how one topic was distinct from another, these graphs allowed us to identify terms that were highly probable for one topic and not in the other (and vice-versa). A comparison of these graphs, in conjunction with the content analyses, allowed us to identify the topic structure with the most distinctive and coherent topics.

Our analysis led us to determine the optimal number of latent topics (k) was 10. Examining the typology further, we found that none of the 17,207 professional statements were assigned to Topic 10 because none of the statements' probabilities of being assigned into Topic 10 exceeded the statements' likelihood of being assigned into any of the other nine topics. Also, we excluded Topic 8 and Topic 9 since the number of the statements classified as these topics was extremely small (Topic 8: one statement, Topic 9: 13 statements). Using the remaining seven topics, we moved forward with the description, visualization, and statistical investigation stages of our analysis.

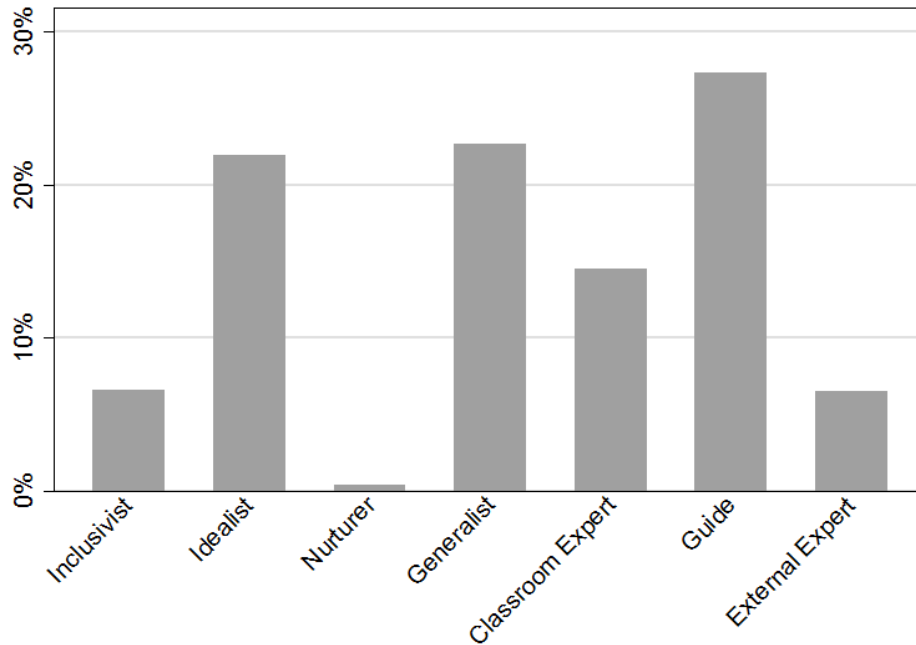
Validation

Typology Distribution

Our strategy revealed seven types of teachers: Inclusivists, Idealists, Nurturers, Generalists, Classroom Experts, Guides, and External Experts. The representation of these teachers among

those active on the labor market is shown in Figure 1. The Guide accounted for the largest portion of the sample (27.4%), while 0.4% of teacher applicants were classified as Nurturers. Together with the Guide, the Generalist and the Idealist make up 72% of job-searching teachers. The remaining 28% of job seekers are the Classroom Expert (15%), the Inclusivist (7%), and the External Expert (6%).

Figure 1: Distribution of Teacher Applicants across the Seven Types



Description of Teacher Typology

In this section we provide narrative summaries of our content analysis, describing each of the seven teacher types. The description of each type contains the defining terms that correlated topic modeling generates and notable words or phrases that stood out during our content analysis. We also provide exemplars of professional statements that best represent each type. The terms that typify each type and the phrases that emerged from our content analysis are summarized in Table 1.

Table 1: Top Terms and Phrases that Identify Each Type

Type	Defining Terms (Top 20 words)	Notable Words and Phrases
# 1 Inclusivist	languag*, cultur*, Spanish, english, social, studi*, counselor, counsel*, program, servic*, famili*, speak, travel, abroad, serv*, divers*, histori*, group, colleg*, esl	Responsible citizens, building rapport, variety of backgrounds, helping students who struggle, ALL students have worth and deserve respect, become better informed citizens, global perspective
# 2 Idealist	want, music, love, get, alway*, thing, see, like, day, just, someth*, come, give, peopl*, tri*, much, job, find, think, enjoy	Passion, I believe, love, inspiration, greatest thing about being a teacher, no greater experience
# 3 Nurturer	children, potenti*, reach, safe, strive, love, confid*, respect, given, achiev*, contribut*, within, child, uniqu*, lifelong, self*, desir*, come, prepar*, inspir*	Impact the lives, education with love, get involved and invested, tremendous love for children, understanding of children's needs
# 4 Generalist	grade, taught, coach, program, district, elementary, wisconsin, middl*, children, colleg*, univers*, volunt*, graduat*, degre*, substitut*, two, summer, special, current, past	Coaching/coach, completed, have taught, volunteer, assistant, substitute/long-term substitute
# 5 Classroom Expert	read, team, staff, instruct, district, special, support, implement, behavior, assess, administr*, leadership, train, intervent*, literaci*, leader, program, member, base, grade	Intervention, collaborating/collaboration, training, facilitate, experience
# 6 Guide	must, engag*, think, respect, instruct*, social, encourag*, order, critic, expect, inform, idea, philosophi*, process, content, role, safe, style, relationship, effect	Believe, evolve together, guide, caring, secure and safe environment, atmosphere, positive relationships, building relationships, support
# 7 External Expert	art, technolog*, scienc*, busi*, speech, project, comput*, cours*, languag*, design, communic*, librari*, therapi*, integr*, program, area, media, current, base, research	Technology, extensive experience, enhanced my content knowledge, computers, computer related technology, technology education, library media, background, speech/language, business

1. Inclusivist

“I have worked tirelessly to differentiate my lessons, activities, and assessments based on the learning needs and interests of my students while offering them a more global perspective of the world and their place in it.” —Inclusivist Teacher Applicant

Inclusivists believe that part of their role is to prepare all students, regardless of background or socioeconomic status to be well-informed citizens and to be aware of a global perspective. Two primary themes are central to the definition of the Inclusivist. First, applicants emphasized their instruction supported all students. For example, one applicant wrote “[a]s an aspiring teacher, I am committed and passionate about helping students who struggle academically and socially.” Other Inclusivists focused on minoritized and marginalized students, demonstrating an emphasis on social justice: “As a professional school counselor I believe that ALL students: have worth and deserve respect, will have ethnic, cultural, racial, sexual differences, and special needs valued in planning and implementing services deserve to grow in a safe environment that

promotes lifelong learning.” As part of their drive to support all students, Inclusivists are interested in teaching students to be aware of their abilities to make a difference in the world and to look beyond their own local experiences. For example, one applicant explained, “[m]y teaching philosophy is that with the appropriate support, guidance and instructional programs[,] all students can learn and enjoy the process of discovery and knowledge constructio[n], to become better informed citizens and more creative human beings.” Many of the applicants who aligned with this type professed their own love of travel and highlighted their experience as a qualification for the job. One applicant stated, “I have traveled extensively and have taught for three summers in China.” The Inclusivist considers all students are able to learn and believes that a central purpose of education is to prepare them for their place in the world as active and well-informed members of the community.

2. Idealist

“I love seeing those ahh moments from students. To me those are the best parts of teaching. I love knowing that I helped someone understand a concept that they were once struggling with....You can see my passion and love for teaching come thru in my work and teaching.” —Idealist Teacher Applicant

Idealists express great passion for teaching, for the craft of the profession, and for students. Idealists focus on their love of teaching and why they want to be in the classroom. “‘Happy is the man whose work is his play’ describes my heartfelt feeling about teaching,” one applicant wrote. “There is no greater experience for me than to work with kids.” For many Idealists, their passion results from daily interactions with students. As one applicant stated, “Every time a troubled and at-risk student has a good day...[e]very time that one student’s joke or smile helps me keep positive through a tough day, I know why I became a teacher. The greatest thing about being a teacher is the randomness of where a day’s inspiration comes from.” Others tied their idealism about teaching to their content area and their passion about sharing a subject with students. For example:

“I wanted to show my students that reading can be fun, that you can read anytime and anywhere, and that it doesn’t have to be just for school....I want to show my students that when you read you develop lifelong skills....I believe there is no greater joy than seeing a student finally understand a concept, seeing their eyes light up and the light bulb go off in their heads. Reading does not have to be tedious work and I hope to instill a love of reading in each of my students.”

Idealists demonstrate passion for teaching, the students, and the subject matter that drives their desire to be in the classroom.

3. Nurturer

“To insure [sic] development of self-confidence, I provide a warm and nurturing environment, thereby facilitating feelings of security. I set clear behavioral expectations and follow through on disciplinary procedures in a consistent and fair manner. I have a strong set of classroom skills coupled with twenty two years of experience as an elementary teacher[,] which has helped me develop a wide range of abilities.”

—Nurturer Teacher Applicant

Nurturers believe that part of being an educator is to take care of and support their students. The main philosophy is that teachers must nurture the whole child in addition to providing academic instruction. One Nurturer wrote that, “teachers impact the lives of those they teach, not only because young childhood intervention is so important and children look up to their teachers for guidance, but also because teachers have chosen to commit themselves to the shaping of their students’ characters, our future community.” Often Nurturers cast themselves and their skills as an educator as an integral part of the child’s development as a whole. “With these tools I have cultured, I will be able to support and educate children in many areas of life,” one applicant wrote. “Most of all, I really care about the lives of children and will strive for their excellence. I want to see children succeed, and it is important that as a school counselor I educate children by giving them the guidance and education they require to be self-sufficient, healthy, and happy human beings.” The passion for children holistically and a desire to care for and foster their development defines a Nurturer.

4. Generalist

“I also have volunteered numerous hours of time at both communities helping with the youth in various sports and activities. I spend much of my time on weekends coaching youth sports or refereeing basketball and baseball.” —Generalist Teacher Applicant

Generalists took two approaches in their professional statements. The first emphasized career trajectory and expertise gained from volunteering, coaching, or participating in other organizations. These Generalists often used these terms: coaching/coach, completed, have taught, volunteer, assistant, substitute, or long-term substitute. One applicant said, “I have accomp[li]shed many long-term sub positions in Phy-ed and other areas of studies.” Another applicant wrote, “I have coached Freshman Girls Basketball for two years, and have coached and refereed both boys and girls basketball at almost all elementary and high school levels.”

The second Generalist approach was a personal narrative that reported a life journey. For example, one applicants stated “After graduation from college, I moved to Virginia where I taught for 2 years in a 3rd-5th grade cross-categorical class in the...Public Schools. ...After moving back to Wisconsin, I taught for 3 years in the...School District teaching 8th & 9th grade students with Learning Disabilities.” These applicants highlighted their work experience in one school district and their moves to other school districts or states. Generalists highlighted the different experiences they acquired as they transitioned to new schools or states.

5. Classroom Expert

“I have thirty years of experience as a school psychologist, twenty-five of them in the [Name] school district. I have extensive experience in psycho-educational evaluation, Individual Education Plan (IEP) development, and case management of special education evaluation/placement processes.” —Classroom Expert Teacher Applicant

Classroom Experts often open their professional statements with phrases such as: “I have [blank] years of experience,” “I have been in education for [blank] years,” “I have substantial experience.” Classroom Experts not only started their statements by listing their years of experience, they also thoroughly described their skills, licenses, and certifications. For example, one applicant stated, “My experience as a school psychologist in the...School District has allowed me to refine my skills as an educator, child advocate, collaborator, and psychometrician.” Other statements demonstrated expertise by immediately emphasizing positions held and tasks completed: “As a literacy coach, I provided staff development and training to the staff in the following areas,” an applicant wrote. “As a dedicated and skilled professional learning leader with versatile teaching and learning expertise[,] I have excelled in providing standards-based instructional leadership and effective actions in support of developing the school[']s professional learning community for high levels of student achievement,” another applicant wrote. Classroom Experts illustrated their expertise by relying on established professional norms (advanced degrees, awards and accolades, years in the field, etc.) to document their status in their statements.

6. Guide

“I am able to create positive relationships with these students and assist them in becoming learners who realize that their education belongs to them, that they need to make their learning active, not passive. Building such relationships is central to helping students understand their true potential. Students need to feel safe, but challenged; that is when they learn the most.” —Guide Teacher Applicant

Guides focus on facilitating learning rather than acting as “the sage on the stage.” These educators acknowledge the importance of utilizing their students’ natural skills and curiosity, and harvesting that interest to guide them through school. As one Guide wrote, “[it] is my desire as an educator to help students meet their fullest potential in these areas by providing an environment that is safe, supports growth beyond comfort zones, and invites the sharing of ideas.” Guides value students’ experiences and opinions as a method of teaching rather than the teacher telling students what they need to know. “The purpose of school is to educate the whole child, preparing them for the rest of their lives, supporting their social, emotional, physical and cognitive development through a curriculum fostering practical knowledge and skills as well as courses related to students interests and goals,” an applicant wrote. Guides support students’ whole development, not just their intellectual development, and recognize the power of tapping into students’ goals and interests. One applicant further emphasized these concepts and noted the importance of the classroom environment: “There are three elements that I believe are conducive to establishing such an environment: the teacher acting as a guide, allowing the student’s natural curiosity to direct his/her learning, and promoting respect for all things and all people.” Overall,

Guides are teachers who value working with, rather than directing, students to provide learning experiences that encourage and supports student development of knowledge and as persons.

7. External Expert

“Having worked in the public and private sector in various marketing and sales capacities for fifteen years prior to becoming a marketing, business, and management educator, I bring real world experience to the classroom.” —External Expert Teacher Applicant

External Experts bring experience in education and other industries to their role as a teacher. For example, one teacher promoted the list of experiences he or she had: “More than fifteen years of college or secondary mathematics teaching experience. Over 25 years of experience in facility management, computer operations, network operations, procurement, specifications, computer science instruction, technology training, new school technology design, and supervising the development of complex computer and communications systems.” External Experts come into teaching with a developed expertise in a specific industry, often outside of education. They identify their strengths through their experience and vast knowledge of their subject, rather than emphasizing a particular teaching philosophy. One applicant explains, “I worked for 12 years in San Luis Potosi as Electronic Engineer. My experience in Mexico has been related with several fields including Broadcasting, Manufacturing and Consumer Electronics.” Many External Experts come from fields outside of education, but some also bring education-related expertise. For example, one applicant wrote, “I am an experienced speech/language pathologist who has worked with children in the schools and Birth-to-Three... left Speech Therapy to fulfill a dream of owning my own business....Throughout my self-employment years, I never stopped working with children. I had a side job working in the public school as a para-professional.” Overall, External Experts emphasize and value their years of service in fields outside of the traditional educational route.

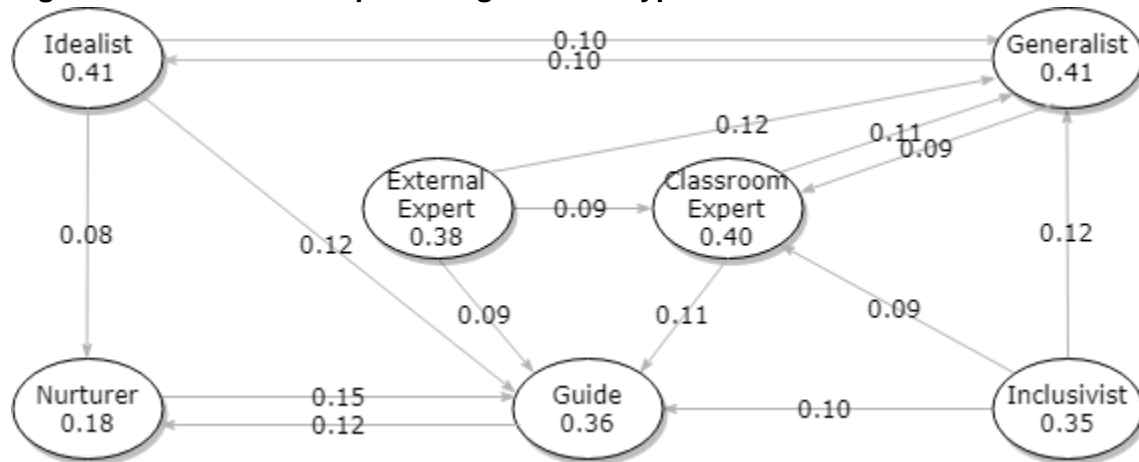
Interrelationships among the Types

The relationships among the seven types of teacher applicants can be seen in Figure 2. The number within each oval represents the average probability of an individual’s statement being classified into a given type, among those for whom the given type was the most probable. Because our model started with 10 latent topics or teacher types, the average probability of someone being randomly classified into a type was one out of 10. Therefore 0.10, the baseline against which the probabilities in Figure 2 can be assessed. For example, among applicants classified as Guides, the average probability of being classified as a Guide was 0.36, which is 3.6 times greater than the probability of being classified into a type at random and thus provides evidence favoring the validity of our typology. The mean probabilities are quite similar across the types, except for Nurturer (0.18), whose mean probability value is only half or less of the values of the others, but still roughly two times greater than we would expect from a random process.

In Figure 2, for each type, the arrows represent the probabilities of applicants’ second or third most likely type. For example, the arrow leading from Nurturer to Guide in the lower left shows

that if Nurturers hadn't been classified as Nurturers, they had a 15% chance of being classified as Guides. If there was not a clear choice for the second most likely type, we presented the other types of similar likelihood. Generalists, for example, have two arrows exiting their area, one leading to Idealist and one to Classroom Expert.

Figure 2: Interrelationships among Teacher Types



Using these secondary and tertiary probabilities, we can observe some interesting aspects of our typology. We can see that the Guide is the next most likely classification for five of our teacher types (External Expert, Classroom Expert, Inclusivist, and Nurturer) and the Generalist was the runner-up among Idealists, External Experts, Classroom Experts, and Inclusivists. This suggests that there may be something universal, or perhaps generic, about the qualities espoused by Guides and Generalists, an idea that is further supported by the observation that Guides and Generalists are the most common types of teachers found on the market.

Another interpretation that may be drawn from the Figure 2 is that the values and ideas espoused by Guides and Generalists are foundational values and ideas for most teachers. Some teachers (Guides and Generalists) maintain these core values and ideas. Other teachers (e.g., External Experts, Inclusivists) start from this foundation and then differentiate themselves by extending their values and ideas into other domains.

A corollary to this perspective would suggest that the External Expert and Inclusivist, neither of which are secondary or even tertiary runners-up among the other types, are somehow unique and perhaps rare on the labor market. This would be consistent with their proportional representation on the labor market at 7% and 6% respectively. It is beyond the scope of model diagnostics to determine if the unique nature of these teachers is valued on the job market.

Relationships with Personal Characteristics

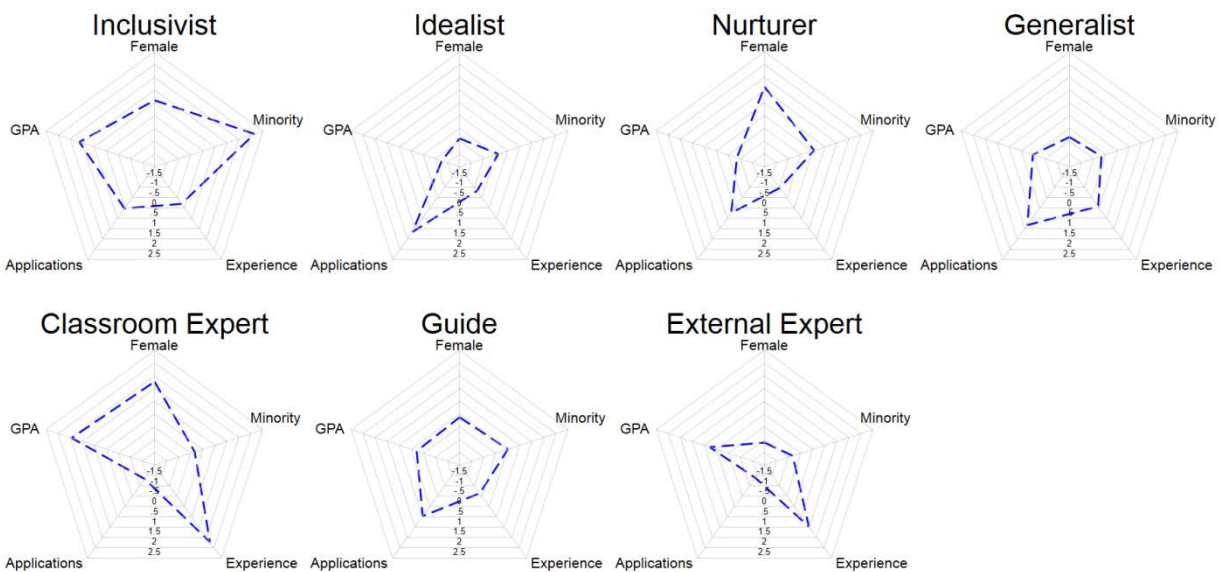
One concern with the construction of emergent typologies is that the groupings may not actually reflect distinct latent groups but rather represent statistical anomalies. Our content analysis provides evidence of construct validity as do the assignment probabilities and topic correlations. Another source of evidence to support the validity of our typology can be found in

the types' relationships to personal characteristics of the teacher applicants. That is, dominance of certain characteristics within a teacher type helps establish the legitimacy of the types.

We examined relationships among our teacher types and five key personal factors: gender, ethnicity, experience, number of applications submitted, and college GPA. Computing marginal values following regression models of each factor on the teacher types and other factors (as controls), we standardized the marginal values across the types and then created radar plots to better facilitate comparisons among the seven teacher types. Thus, the value of 0 indicates the mean estimate of the seven types.

As the dotted lines show in Figure 3, we found a distinct shape for each type. The Idealist and the Classroom Expert showed contrasting patterns in terms of nearly all personal characteristics. Idealists submitted a far higher average number of applications per person, and the proportion of female applicants, years of experience, and GPA were much lower than average. Classroom Experts were more likely than average to be female and have significantly higher GPAs and more years of experience. They submitted fewer applications than the average. Inclusivists included a higher proportion of minority teachers and higher than average GPA. External Experts, on the other hand, reported lower than average proportions of minority teachers and female teachers. They submitted significantly fewer applications per person and had more years of experience than the average.

Figure 3. Relationships among Teacher Types and Personal Characteristics



The other three types, Nurturer, Generalist, and Guide differed in terms of the proportion of females, number of applications submitted, and years of experience. Generalists tended to submit significantly more applications than average were more likely than the average to be male and majority. Although the overall sample of 17,207 was disproportionately female, the percentage was even higher than average for the Nurturer. The Nurturer also reported less experience and

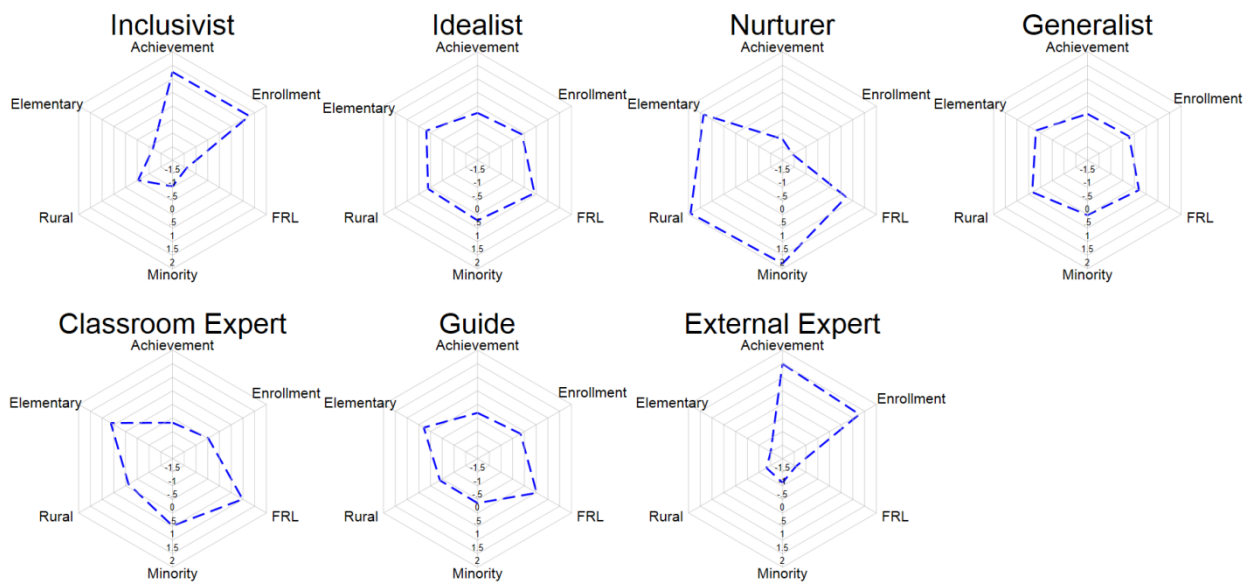
lower GPA. The Guide showed average values in many respects, with slightly fewer years of experience and more applications submitted than average.

Relationships with Vacancy Characteristics

We also drew radar plots to compare relationships among the teacher types and the characteristics of the open positions to which the teachers applied. We chose six vacancy features: achievement, enrollment, proportions of free and reduced-price lunch students and minority students, and proportions of rural and elementary schools, which are related to job application preference of teachers. The analytic process was same with that of personal characteristics.

As Figure 4 shows, Inclusivists and External Experts were more likely to apply to schools with larger enrollments and higher academic achievement. In the same vein, they were far less likely to apply to schools in rural areas or with higher portions of poor or minority students. We also found that the Inclusivist and the External Expert did not apply for elementary schools as much as other types of teachers. Nurturers sharply contrasted with Inclusivists and External Experts. Nurturers were far more likely to apply to hard-to-work schools in rural areas or with higher portions of poor or minority students. They were less likely to apply to high achievement and large size schools, and more likely to apply for elementary school positions.

Figure 4. Relationships among teacher types and job vacancy characteristics



Idealists, Generalists, and Guides were similar in that most of their six vacancy characteristics were close to the average, suggesting that the vacancy characteristics might not be important to those teachers. Inclusivists and External Experts both show similar tastes for the types of vacancies to which they apply, namely those that are low-poverty, low-minority, non-rural, high-achieving, and located in larger districts.

Discussion

By using correlated topic modeling to analyze professional statements Wisconsin teacher applicants included in their job applications, this paper creates a teacher typology consisting of seven types of teachers: Inclusivist, Idealist, Nurturer, Generalist, Classroom Expert, Guide, and External Expert. Once the statements were typed into one of the seven groups, thorough content analysis of the statements provided promising evidence of construct validity. Differential relationships among teacher types and applicants' personal characteristics further support the validity of our typology. The findings show that this new method of blending correlated topic modeling and content analysis provides a robust and transparent strategy to construct and validate text-based typologies. The characteristics and patterns identified among teacher types yield promising opportunities and directions for further research.

Compared with previous typology studies, our research has made four significant contributions. This study is the first of its kind to analyze a nearly statewide dataset of teacher application and administrative data. With scarce exceptions (e.g., Urick & Bowers, 2014), few teacher typologies have been constructed on a sample that can be used to generalize findings to a policy relevant population. Second, this study is the first to apply a quantitative analysis method on the supercomputing level to analyze qualitative data in the development of a typology of teachers. Our typology adds nuance to prior conceptions of teacher types, while identifying teacher characteristics that were previously poorly substantiated or all together unknown. Third, our union of correlated topic modeling and targeted content analysis creates a methodological template where this strategy can be implemented in the broader field of education. Lastly, we have provided valuable insights about how types of teacher labor market preferences are linked. While the teacher typology and corresponding labor market preferences we identify are salient in their own right, our work lays a foundation for subsequent research that can apply our typology to explore phenomena such as differential attrition, hiring outcomes, links to measures of teacher effectiveness, the composition of teacher types within highly effective schools, and teacher-principal fit.

This study has limitations. While its scale is unprecedented, our findings are only generalizable to teachers active on the job market and may differ in notable ways from the overall teaching force. There is room for additional ways to examine the validity of this new teacher typology, such as examining different types of teacher applicants' behavior in the labor market to check consequential validity. Other characteristics of applicants and vacancies besides the ones selected for this study can potentially lead to interesting findings and further validity check, such as applicants' educational backgrounds, work experience, and the fit between them and the vacancies they apply to.

In light of the limitations of the current study, future research pursuing this teacher typology can continue to examine its validity with a growing dataset and study whether it can generalize to other geographical contexts, such as a different U.S. state or another country. The consequential validity would be another meaningful direction worthy of further investigation, as the potentially different job market behaviors by different types of teacher applicants or school districts can lead to a better understanding of fit between applicants and schools, which can likely optimize the

teacher labor market through increasing the efficiency of hiring and decreasing new teacher mobility.

References

- Arlot, S., & Celisse, A. (2010). A survey of cross-validation procedures for model selection. *Statistics surveys*, 4, 40-79.
- Bidwell, C. E., Frank, K. A., & Quiroz, P. A. (1997) Teacher types, workplace controls, and the organization of schools. *Sociology of Education*, 70, 285–307.
- Blei, D. M., & Lafferty, J. D. (2007). A correlated topic model of science. *The Annals of Applied Statistics*, 1(1), 17–35.
- Blei, D. M., Ng, A. Y., & Jordan, M. I. (2002). Latent Dirichlet allocation. In *Advances in neural information processing systems* (pp. 601–608).
- Boyd, D., Lankford, H., Loeb, S., Ronfeldt, M., & Wyckoff, J. (2010). The role of teacher quality in retention and hiring: Using applications to transfer to uncover preferences of teachers and schools. *Journal of Policy Analysis and Management*, 30(1), 88–110.
- Cannata, M. (2010). Understanding the teacher job search process: Espoused preferences and preferences in use. *Teachers College Record*, 112(12), 2889–2934.
- Capecchi, V. (1968). On the definition of typology and classification in sociology. *Quality and Quantity*, 2(1–2), 9–30.
- Chang, J., Gerrish, S., Wang, C., Boyd-Graber, J. L., & Blei, D. M. (2009). Reading tea leaves: How humans interpret topic models. In Y. Bengio, D. Schuurmans, J. D. Lafferty, C. K. I. Williams, & A. Culotta (Eds.), *Advances in neural information processing systems 22* (pp. 288–296). Retrieved from <https://papers.nips.cc/paper/3700-reading-tea-leaves-how-humans-interpret-topic-models.pdf>
- Clark, W. A., Huang, Y., & Withers, S. (2003). Does commuting distance matter?: Commuting tolerance and residential change. *Regional Science and Urban Economics*, 33(2), 199–221.
- Corcoran, S. P., Jennings, J. L., & Beveridge, A. A. (2011). *Teacher effectiveness on high- and low-stakes tests*. Paper presented at the Society for Research on Educational Effectiveness, Washington, D.C.
- Cowan, J., Goldhaber, D., Hayes, K., & Theobald, R. (2016). Missing elements in the discussion of teacher shortages. *Educational Researcher*, 45(8), 460–462.
- Darling-Hammond, L. (2000). Teacher quality and student achievement. *Education Policy Analysis Archives*, 8, 1–42.
- Duncan-Andrade, J. (2007). Gangstas, Wankstas, and Ridas: Defining, developing, and supporting effective teachers in urban schools. *International Journal of Qualitative Studies in Education*, 20(6), 617–638. DOI: 10.1080/09518390701630767
- Engel, M., Jacob, B. A., & Curran, F. C. (2014). New evidence on teacher labor supply. *American Educational Research Journal*, 51(1), 36–72.
- Farley-Ripple, E. N., Raffel, J. A., & Welch, J. C. (2012). Administrator career paths and decision processes. *Journal of Educational Administration*, 50(6), 788–816.
- Goff, P. T., & Bowers, A. J. (2016). *Leaders on the job market: An analysis of application patterns & preferences*. Paper presented at the American Education Research Association annual meeting, Washington, D.C.

- Goldring, E., Huff, J., May, H., & Camburn, E. (2008). School context and individual characteristics: What influences principal practice? *Journal of Educational Administration*, 46(3), 332–352.
- Hornik, K., & Grün, B. (2011). Topicmodels: An R package for fitting topic models. *Journal of Statistical Software*, 40(13), 1-30.
- Hanushek, E., & Rivkin, S. (2007). Pay, working conditions, and teacher quality. *The Future of Children*, 17(1), 69–86.
- Hurley, A. E., Scandura, T. A., Schriesheim, C. A., Brannick, M. T., Seers, A., Vandenberg, R. J., & Williams, L. J. (1997). Exploratory and confirmatory factor analysis: Guidelines, issues, and alternatives. *Journal of Organizational Behavior*, 18(6), 667–683.
- Jackson, C. K. (2013). Match quality, worker productivity, and worker mobility: Direct evidence from teachers. *Review of Economics and Statistics*, 95(4), 1096–1116.
- James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). *An introduction to statistical learning* (Vol. 112). New York: Springer.
- Johnson, S. M., & Birkeland, S. E. (2003). Pursuing a “sense of success”: New teachers explain their career decisions. *American Educational Research Journal*, 40(3), 581–617.
- Krieg, J. M. (2006). Teacher quality and attrition. *Economics of Education Review*, 25(1), 13–27.
- Kukla-Acevedo, S. (2009). Leavers, movers, and stayers: The role of workplace conditions in teacher mobility decisions. *The Journal of Educational Research*, 102(6), 443–452.
- Lee, S., Song, J., & Kim, Y. (2010). An empirical comparison of four text mining methods. *Journal of Computer Information Systems*, 51(1), 1–10.
- Liu, E., & Johnson, S. M. (2006). New teachers’ experiences of hiring: Late, rushed, and information-poor. *Educational Administration Quarterly*, 42(3): 324–360.
- Loeb, S., Kalogrides, D., & Beteille, T. (2012). Effective schools: Teacher hiring, assignment, development, and retention. *Education Finance and Policy*, 7(3), 269–304.
- Loeb, S., Kalogrides, D., & Hornig, E. L. (2010). Principal preferences and the uneven distribution of principals across schools. *Educational Evaluation and Policy Analysis*, 32(2), 205–229.
- Myers & Briggs Foundation. (2018). MBTI basics [Webpage]. Retrieved from <https://www.myersbriggs.org/my-mbti-personality-type/mbti-basics/>
- Ni, Y., Sun, M., & Rorrer, A. (2015). Principal turnover: Upheaval and uncertainty in charter schools? *Educational Administration Quarterly*, 51(3), 409–437.
- Patrick, P. K. S., & Yick, A. G. (2005). Standardizing the interview process and developing a faculty interview rubric: An effective method to recruit and retain online instructors. *The Internet and Higher Education*, 8(3), 199–212. doi:10.1016/j.iheduc.2005.06.002
- Pierson, A. (2014). *What makes a successful principal? Incorporating school principal background in state and district policy*. Santa Monica, CA: RAND Corporation. Retrieved from https://www.rand.org/pubs/rgs_dissertations/RGSD336.html.
- Quinn, K. M., Monroe, B. L., Colaresi, M., Crespín, M. H., & Radev, D. R. (2010). How to analyze political attention with minimal assumptions and costs. *American Journal of Political Science*, 54(1), 209–228.

- Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, schools, and academic achievement. *Econometrica*, 73(2), 417–458.
- Ronfeldt, M., Loeb, S., & Wyckoff, J. (2012). How teacher turnover harms student achievement. *American Educational Research Journal*, 50(1), 4–36.
- Rushton, S, Morgan, J., & Richard, M. (2007). Teacher’s Myers-Briggs personality profiles: Identifying effective teacher personality traits. *Teaching and Teacher Education*, 23(4), 432–441.
- Rutledge, S., Harris, D., Thompson, C., & Ingle, K. (2008). Certify, blink, hire: An examination of the process and tools of teacher screening and selection. *Leadership and Policy in Schools*, 7(3), 237–263.
- Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative health research*, 15(9), 1277-1288.
- Smith, T. M., & Ingersoll, R. M. (2004). What are the effects of induction and mentoring on beginning teacher turnover? *American Educational Research Journal*, 41(3), 681–714.
- Spence, M. (1973). Job market signaling. *The Quarterly Journal of Economics*, 87(3), 355–374. Retrieved from <http://www.jstor.org/stable/1882010>
- Thomson, M. M., Turner, J. E., & Nietfeld, J. (2012). A typological approach to investigate the teaching career decision: Motivations and beliefs about teaching of prospective teacher candidates. *Teaching and Teacher Education*, 28(3), 324–335.
- Urick, A. M. (2012). To what extent do typologies of school leaders across the U.S. predict teacher attrition? A multilevel latent class analysis of principals and teachers (Ed.D. dissertation). Retrieved from ProQuest Dissertations and Theses Global. (Order No. 3508631).
- Urick, A., & Bowers, A. J. (2014). What are the different types of principals across the United States? A latent class analysis of principal perception of leadership. *Educational Administration Quarterly*, 50(1), 96–134.
- Wang, C., & Blei, D. M. (2011). Collaborative topic modeling for recommending scientific articles. In *Proceedings of the 17th ACM SIGKDD international conference on knowledge discovery and data mining* (pp. 448–456). Association for Computing Machinery.
- Wang, Y., Bowers, A. J., & Fikis, D. J. (2017). Automated text data mining analysis of five decades of educational leadership research literature: Probabilistic topic modeling of EAQ articles from 1965 to 2014. *Educational Administration Quarterly*, 53(2), 289–323.
- Watt, H. M. G., & Richardson, P. W. (2008). Motivations, perceptions, and aspirations concerning teaching as a career for different types of beginning teachers. *Learning and Instruction*, 18(5), 408–428.
- Winter, P. A., Ronau, R. N., & Muñoz, M. A. (2004). Evaluating urban teacher recruitment programs: An application of private sector recruitment theories. *Journal of School Leadership*, 14(1), 85–104.
- Wisconsin Department of Public Instruction. (2017). Archived school staff: Salary, position, & demographic reports [Webpage]. Retrieved from <https://dpi.wi.gov/cst/data-collections/staff/published-data>

Yang, T. I., Torget, A. J., & Mihalcea, R. (2011). Topic modeling on historical newspapers. In *Proceedings of the 5th ACL-HLT Workshop on Language Technology for Cultural Heritage, Social Sciences, and Humanities* (pp. 96–104). Association for Computational Linguistics.