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Feasibility Study of Assessing the Supply and Demand for Educators in Maine

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Policymaker Summary

Why was this study conducted?

Like most states, Maine is facing staffing shortages. Recent MEPRI studies have documented—both quantitatively and qualitatively—some of the challenges that schools face in filling teacher positions. In this report we focus on the supply of educators and assess the feasibility of using administrative data from the certification system to identify shortage areas. Specifically, we combine certification and staff data to quantify the number of certificate holders who are working in their endorsement area, working in education outside of their endorsement area, or not working in Maine's education sector (i.e. potentially available for hire) to get a rough sense of demand and supply. We give special attention to teacher shortage areas including math, science, special education, world languages and English language acquisition.

Findings & Conclusions

A key conclusion of this report is that the available administrative data have limited usefulness in accurately identifying shortage areas. The data are helpful for providing a rough estimate of differences in educator supply across different parts of the state, but are less helpful for making a determination about whether a given supply of credentialed educators in an area is adequate to meet the needs of that region.

Data limitations result primarily from the fact that a majority of Maine's potential educators (58%) hold multiple certifications. A simple count of the number of certified individuals in any given role provides an over-estimate of the number of potential educators available to work in that field, which complicates the depiction of "supply". The number of staff *positions* that exist is also an inexact estimate of the actual need for educators in a region. A substantial proportion of employed staff members (32%) hold more than one position. Since one person can fill more than one role in a school, the number of positions is an overestimate of the number of *people* needed on staff. On the other hand, there may be unfilled positions due to a shortage of qualified applicants, so that some counts underestimate the number of needed positions. Analysis of demand was further limited because the certification records used in this feasibility analysis lacked detailed information about whether individuals were employed in full- vs. part-time positions. Do educators wear multiple hats because there are shortages in supply of other personnel to fill positions, or because there is only demand for a part-time position? Conversely, do schools create full-time positions in order to attract job applicants when only a part-time position is needed?

Despite these data limitations, we are able to document that a substantial number of endorsed individuals are not working in Maine's education sector. For example, about 18% of individuals holding Maine teacher or administrator certifications were not employed in our public or private pK-12 schools. Paraprofessionals were even less likely to be using

their credentials; almost 41% of persons holding an educational technician endorsement were not working anywhere in Maine's public or private education sectors.

Analysis also revealed different patterns of "supply" and "demand" across teacher shortage areas. In all shortage areas there are more certified individuals statewide than are employed in the endorsement area. However, there can be local shortages; a county may have fewer eligible educators than positions in a given subject area. Mathematics has about a 1:1 relationship between the number of persons endorsed in secondary mathematics and the number of math teachers, but this is an inexact match because elementary (K-8) certificate holders are also eligible for some middle school math positions. The equal proportion is concerning given that the analyses also showed that many individuals holding a credential are not actively seeking employment in that field. For example, some of those holding math certification are working as administrators or curriculum coordinators or other roles. We conclude that a robust supply needs a substantial excess of eligible teachers for the number of needed positions.

In contrast, special education would appear to have a robust supply as judged by the near 2:1 ratios of credential holders to staff positions both statewide and within each county. However, it also has the highest proportion of conditionally certified teachers and is widely regarded as an area of severe shortage. Supplemental analysis revealed that a substantial proportion of individuals with special education credentials were employed but not in public school special education teaching positions. Some were present in the staff data in special purpose private schools, and 17% of eligible special education teachers were employed as mainstream classroom teachers. This is encouraging as it suggests they are employing inclusive education practices, but it complicates the depiction of demand for this important pool of educators.

The variability in data patterns across subject areas was somewhat unexpected, and suggests that there may be underlying differences in the nature of teacher shortages depending on the field. These distinctions are somewhat speculative given the limitations of the available data and merit further study as they may imply a need for different strategies to recruit and retain educators for specific fields.

How do the findings relate to other research that has been, or will be, conducted?

The current report can be deemed as a bridge between a 2018 study of teacher turnover and a 2020 study on educator recruitment and retention. It was an exploratory effort to understand how the readily available data can inform our understanding of supply and demand. The findings were used to shape the data collection and analysis used for the ongoing Educator Recruitment and Retention study that is scheduled to be finalized in early 2020.

Specific policy implications

Since it is common for school districts to employ a single individual to work in more than one type of role (or in the case of teachers, more than one subject area), it is desirable to encourage educators to develop expertise in more than one area. This affords more flexibility for both employers and educators. Cross-training may be especially useful in rural areas where there may not be adequate numbers of students to warrant full-time positions for some educational roles.

Staff shortages appear to have multiple contributing factors. Some subject areas (e.g. math) may have a dearth of individuals with the appropriate academic background and/or

teacher preparation. In contrast, special education teaching has a seemingly adequate supply of credential holders but still faces a shortage of job applicants—perhaps because their skills are sought for multiple settings. This variation implies that there may be a need to recognize nuanced differences between subject fields when developing strategies for enticing educators to enter and remain in the workforce. Additional study is warranted to better understand these differences, which may be informed by an ongoing study of educator recruitment and retention.

It would be useful to identify the types of ongoing or annual reports about educator supply and demand that would be helpful to the field (i.e. Maine Department of Education, policymakers, and K-12 practitioners). These reports would likely require additional data linkages in order to be feasible to produce on a regular basis. For example, conducting analyses of staffing needs across the state would be easier if information about the full-time equivalent status of each position were included in the data fields that are already directly linked within the certification system.

A centralized system for tracking job openings and applications, such as those used in other states, may enable the ability to identify shortage situations in real time and thus create new potential to be able to direct resources to struggling districts. The potential benefits to policymakers and practitioners would first need to be understood in more detail so they could be weighed against the cost of developing and implementing such a system.

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Background

As with most other states, Maine public schools are reporting increasing difficulty in finding well-qualified individuals to fill vacancies in certain areas. These challenges are worse for certain teaching subject areas (such as special education, mathematics, science, and world languages) and specialty fields (such as speech and language pathologists) than in others. Different regions of the state are also harder hit than others, and within regions, our smaller and more rural schools tend to have a harder time recruiting educators (MEPRI, 2018). Many of the factors that affect recruitment also affect retention, causing greater staff turnover in some districts than in others and exacerbating existing shortages. All of these trends are consistent with well-established patterns seen across the country (Ingersoll, 2001; National Public Radio, 2015; Sutcher, Darling-Hammond, Carver-Thomas, 2016; MEPRI, 2018).

The goal of the current study was to use existing administrative data to quantify the extent of the "supply" problem in Maine. The ideal measure of the availability of qualified educators for specific position openings would be based on actual job application data. Namely, the number (and percent) of openings in a given district is the best depiction of its demand for new educators, and the number of individuals who apply for a given position—and whether the applicants hold the necessary credentials for the position—is the best indicator of local supply. However, Maine does not have a centralized teaching job application system[1], so those types of administrative data are not available on a statewide level for assessing shortages. Thus this study was conducted using more readily-available data to investigate supply and demand across the state.

A prior MEPRI study (2018) investigated the teacher turnover rates in various settings in Maine using multiple years of staffing data. This study validated the

[1] For example, NH (www.edjobsnh.com); Ohio (education.ohio.gov/About/Education-Jobs); South Carolina (www.cerra.org/online-educator-employment-system.html); Texas (tea.texas.gov/Texas_Schools/Job_searches)

conventional wisdom that certain districts had higher turnover rates (and thus face a greater need to recruit and hire new teachers each year) than others. Districts that rely more heavily on brand-new beginning teachers, those that have higher rates of student poverty, and those with lower average salaries experienced more teacher turnover. However, turnover rates in Maine were lower than the national average. Because the prior study of turnover relied solely on staffing data, it did not have the ability to make robust distinctions between different subject areas. In addition, staffing data alone are insufficient to assess the extent to which newly-hired individuals possessed the expected knowledge and experience for the positions they filled. This additional level of detail requires certification data.

The current study seeks to gain additional perspective on staffing challenges by incorporating certification data into the analysis. Certification data can be used to quantify the number of educators in each region of the state that hold credentials for various types of positions, and thus provide a rough estimate of "supply" in each county. However, the fact that an individual holds valid certification does not guarantee that they are actively looking for jobs in that field. In addition, many educators hold certification for more than one type of position ("endorsement area") yet one person can only fill up to one full-time equivalent position.

With regard to "demand", this analysis uses staff data to quantify the need for educators of each position type across every region of the state. However, this is an imprecise measure of true demand, as it is possible that a given school is unable to fill a needed position and is forced to operate with reduced staff, so that the number of actual positions is an underestimate of need. Also, the number of positions is only one measure of staffing challenges. A teacher that returns to the same position from year to year is less of an administrative challenge than the teachers who move or leave a position that then has to be filled with a new hire. Using number of positions to measure of "demand" quantifies the size of the workforce but does not account for the heightened challenges in districts with high turnover.

Within these limitations, by comparing the available supply of credentialed educators to the number of positions in each part of the state the current study does provide a measure of relative shortage in different regions of the state and in different

endorsement areas. In addition, the process of conducting this study offered an opportunity to identify the capacity and limitations of available administrative data for investigating questions of educator shortage.

Study Questions and Methods

To respond to the questions and needs raised by policymakers in the development of this study, we developed the following study questions:

- What does the supply of educators look like in Maine (i.e. how many people hold current certification for teaching, administrative, educational specialist, paraprofessional and clinical positions)?
- What is the demand for educators in the fields that require state certification?
- What proportions of the eligible (certified) supply are working in their endorsement area, working in education outside of their endorsement area, and not working in the education field (i.e. potentially available for hiring)?
- What proportion of educators is working in positions that require certification without holding the appropriate endorsement?

The bulk of the study was comprised of quantitative analysis of data from two primary sources obtained from the Maine Department of Education's new certification system (implemented for the 2018-19 school year). First, certification (endorsement) data were used to describe the available pool of potential eligible applicants for Maine public school positions. Endorsement data included information on all certificates held during the 2018-19 school year, as of April 2019. These data capture the "supply" of persons who are currently certified by the Maine Department of Education to work in teaching, administrative, educational specialist, and/or paraprofessional positions. Staff employment data, as reported each December by school districts through the NEO data system and subsequently linked to certification records, were then used to describe the number of staff working in various types of positions that require state certification. NEO data includes information on all individuals employed in Maine's education sector during the fall of school year 2018-19; a subset of the full NEO data fields were available within the

certification system. Public education includes traditional public schools as well as public charter schools, Career and Technical Education schools, and state-run schools. The staff data also includes staff at certain private schools that receive public funds, such as town academies and special purpose private schools for students with special educational needs, and other private schools that report their data to the state.

Each of these data files was cleaned to remove duplicates, mapped to geographic locations, and aggregated to person-level data. Endorsement data and staff data were then linked using the Staff ID, a unique identifier assigned to all individuals who work in Maine's public education sector. This enabled us to determine which of the individuals holding valid Maine endorsements were working in public schools, private schools, or not employed in public education during the school year 2018-19.

Conceptually, the certified individuals that were not working in public schools represent excess supply (i.e., individuals eligible but not currently employed in Maine's education sector). These data were also used to identify individuals that were not working in positions for which they hold an endorsement because they were working under a different endorsement (e.g., a certified teacher working as an administrator, or as an ed tech). Lastly, the matching process also identified individuals working in public education who did not hold an appropriate endorsement for their position. These analyses were also broken out by county to depict regional differences in educator supply and demand. Special attention was given to known teacher shortage areas, which Maine identifies as mathematics, science, world language teachers, English as a Second Language, gifted and talented, and special education.

To facilitate analysis, endorsements and their corresponding positions were categorized into five subgroups:

1. Teachers
2. Administrators
3. Educational specialist roles
4. Clinical staff, and
5. Paraprofessionals

Table 1 summarizes the endorsements and NEO position labels that align to each group.

Table 1. Maine Certification Endorsements and Related Staff Position Titles

Certification Endorsements	NEO Position Titles
Teachers	
General Elementary, Early Elementary (K-3), Early Childhood (Pre-K), Gifted/Talented, English-Second Language, Teacher of Students with Disabilities, plus subject areas including English/Language Arts, Mathematics, Social Studies, Physical Ed, Music, Computer Technology, Visual Arts, Media Production, Business Education, Science, Science-Life, Science-Physical, Industrial Arts/Technology, Spanish, French, Italian, Latin, etc.	Classroom teacher, Title I teacher, SPED teacher, G&T teacher, ELL teacher, long-term substitute, and visiting teacher
School & District Administrators	
Superintendent of Schools, Assistant Superintendent, Building Administrator, Assistant Building Administrator, Administrator of Special Educ, Assistant Dir. Of Special Ed, Athletic Director, Director Adult and Community Educ, Assistant Director Adult and Community Educ, Teaching Principal, Vocational Education Evaluator	Principal, Assistant Principal, Superintendent, Assistant Superintendent, Teaching Principal, Special Educ Director, Special Educ Assistant Director, Dean, Assistant Dean, Adult Ed Director, Adult Ed Assistant Director, Athletic Director, CTE Director, CTE Assistant Director, CTE Evaluator
Educational Specialist	
Guidance Counselor, Literacy Specialist, Curriculum Coordinator, School Psychologist, Special Education Consultant, Library/Media Specialist	SPED Consultant, Curriculum Coordinator, Director of Guidance, Guidance Counselor, Library/Media Specialist, Literacy Specialist, School Psychologist or Examiner, Instructional Coach, Supervisor of Instruction, Teacher Support Team Member, Technology Integration Coordinator, Title I Coordinator, ELL Programs Director, Other SPED Services Provider, CDS Case Manager
Clinicians	
Nurse, Speech and Hearing Clinician	Nurse, Speech and Hearing Clinician
Paraprofessionals	
Ed Tech I, II, and III, Ed Tech II and III Up, Ed Tech II and II Voc, Ed Tech, NCLBA	Ed Tech I, II, and III, Ed Tech-Library Media I, II, and III, Student Monitor, Substitute Teacher, Substitute Ed Tech, Substitute Other

Four additional categories were created to capture staff in positions that do not require a specific *certification*. Many of the clinical positions, such as social workers or clinical counselors, require other types of professional licenses that are managed by the state Office of Professional and Financial Regulation rather than the MDOE Certification division. Thus such licenses were not within the scope of the study. Extra- and co-curricular positions are almost always part-time and are often filled by individuals who hold certification (such as teachers), but they do not require a particular credential. The same is true for many of the "other professional" positions, which often draw candidates from the pool of certified educators but do not require certification. The "other staff" positions require only a criminal history records check.

Table 2. Positions That Do Not Require Certification Through MDOE

Category	NEO Positions
Extra-curricular support	Coach (Athletic), Co-Curricular (non-Athletic)
Other Professional	Attendance Coordinator, Business Administrator/Manager, Computer Maintenance, Co-Op Director, Computer/Technical Coordinator, Director of Data Services, Director of Student Activities, Director of School Performance Management, Drop-Out Prevention Coordinator, Employment Coordinator, Interpreter, McKinney-Vento Liaison, Sign Language Interpreter, Talent Development Strategy Coordinator, Volunteer Coordinator, Certified Employment Specialist, Interpreter or Translator for the Deaf, Director of Technology, Data Specialist, School Resource Officer
Other Clinical	Athletic Trainer, Audiologist, Board Certified Behavior Analyst, Counselor or Rehab Counselor, Director of Health Services, Occupational Therapist, Recreation Therapist/Specialist, Physical Therapist, School Social Worker, Speech-Language Pathologist, Licensed Clinical Professional Counselor, OT Aide, PT Assistant, Speech-Language Therapy Aide/Assistant, Physician, Health Aide
Other Staff	Administrative assistant/secretary, bookkeeper, bus driver, facilities maintenance, food service

Limitations

Perhaps the most substantial limitation of the data used for this analysis is a lack of detail about the staff positions. To reduce the amount of person-level information that needed to be shared with researchers, the study relied on the staffing data that was uploaded to the certification data system and therefore available from a single source. This process also allowed researchers to envision the types of analyses that could be conducted

by staff who have access to the certification data, but who do not have direct access (or who do not have the necessary technical expertise) to link directly to NEO staff records. The subset of information available within the certification system and shared with researchers did not include detail about whether each position was full-time or part-time, nor a distinction between stipended vs. salaried positions. This reduced level of detail proved to be a barrier in certain analyses, as described in the report findings and conclusions.

Findings

Staffing Needs for Maine Schools (pseudo-demand)

The first task of the study was to compile basic information about the number of people employed in Maine schools. This initial description illustrates one key aspect about our education workforce: Maine educators often fulfill multiple distinct roles.

Table 3. Number of Separate Public or Private School System Positions Held by Individuals in 2018-19

# of Unique Positions	Individual Persons	% of Individuals
1	34,557	68%
2	9,456	19%
3	3,535	7%
4	1,513	3%
5	703	1%
6 or more	837	2%
Total	50,601	100%

A position is defined in the staffing data based on the school or district and position title, and in the case of teachers, the subject(s) taught. There are a few different ways that a single person could hold more than one position. First, one person can hold multiple positions of the same type, such a high school teacher with multiple subjects or a music teacher working in more than one school. Second, a person could switch jobs, so that they are associated with both the first position (ended) and the second position (active) within one year. Lastly, one person can be employed in more than one position type, such as a part-time teacher also serving as a part-time administrator. As described above in the

methods section, the data available in the certification system did not further describe the percent time (full-time equivalent, or FTE) of each position. While the StaffID field can be used to identify when one person holds more than one position, it is insufficient for determining whether each position is large or small. This inflates the perception of the size of the workforce when each position is counted equally.

Thus, to reduce some of the overlap in positions, the staffing data was next aggregated so that each person was only counted once for each position *type*. For example, the high school teacher with multiple subjects and the music teacher serving three elementary schools were each treated as one position of type=teacher. An individual working as both a teacher and an administrator was counted once as an administrator and once as a teacher. This provides a better estimate of the overall need for staff *of each type*. It is not an exact measure of demand because some of the positions being counted are only part-time; we were unable to adjust for this without any information on the full-time equivalent status of each position. (As described above, the full- or part-time status *is* available to the Department in the NEO system through annual staff reporting but was not included in the subset of data that are linked to the Certification data system.) This method also does not capture positions that are needed in schools but were unable to be filled at the time of data collection (i.e. unmet demand). However, all staff positions within each type are included, even if the employee did not appear to hold the appropriate endorsement for their position. Because the number of positions is not adjusted for full or part-time, we also include the number of individuals within each position type that also hold a second (or more) position of a different type. Presumably, these individuals are working part-time in each position. The results are displayed in Table 4.

Table 4: Employment During the 2018-19 School Year by Position Type

Position type	Public School System Employees*		Private School System Employees*	
	(1) Headcount of individuals holding position type	(2) Headcount (%) of individuals in (1) also holding another type of listed position	(3) Headcount of individuals holding position type	(4) Headcount (%) of individuals in (3) also holding another type of listed position
Teacher	16,051	2,002 (12.5%)	1,355	117 (8.6%)
Administrator	1,508	336 (22.3%)	206	36 (17.4%)
Educational specialist	2,783	1,278 (45.9%)	153	40 (26.1%)
Speech & nurses	577	57 (9.9%)	54	0 (0%)
Paraprofessional	15,503	915 (5.9%)	1,184	67 (5.7%)
Total position types	36,422		2,952	
Unduplicated Total (unique individuals)	34,187		2,826	

*Publics include regular public districts, public charters, state-run schools, Bureau of Indian Education schools, magnet schools and Career and Technical Education (CTE) schools. Privates include private schools, special purpose privates and town academies. Individuals who worked in both private and public school systems were categorized as public.

A total of 34,187 persons held a total of 36,422 teacher, administrative, specialist, clinical and paraprofessional positions during the 2018-19 school year. Notably, the number of positions *aggregated by type* is markedly lower than the total number of positions when multiple positions of the same type are counted separately, as was captured in Table 3 (50,601 unique positions). Many employees have jobs that span separate positions by including more than one subject, grade level, school, or district. Table 4 also illustrates that many staff still hold more than one *type* of position, especially in the public sector. For example, of the 16,051 teachers in the public sector, one in eight (n=2,002) hold at least one other type of credentialed position. Educational specialist positions are the most likely to be combined with another position type, with nearly half also serving in another type of job. The overlap between position types goes in both directions, so individuals are counted in both column 1 and column 2 for each position held. Table 5 provides a detailed breakdown to illustrate the overlap for the 16,051 public school teachers and 1,508 public school or district administrators.

Table 5. Public School Teachers and Administrators with Additional Positions Requiring Credentials

Position Type	Number of Teachers Also Employed in Position Type	Number of Admins also Employed in Position Type
Teacher	--	188
Administrator	188	--
Educational specialist	1,044	112
Clinical (Speech or Nurse)	8	8
Paraprofessional	762	28
Total (% of total)	2,002 (12.5%)	336 (22.3%)

Teachers serving multiple roles most often combined classroom instruction with educational specialist positions (e.g. literacy specialist, instructional coach, Supervisor of Instruction, Technology Integration or Computer/Technical Coordinator). Less commonly, teachers also served as paraprofessionals (mostly Ed Tech IIIs) or administrators (principal, assistant principal, teaching principal, or Director roles). Administrators with multiple position types were most likely to serve jointly as teachers, and also held specialist positions.

In addition to educational positions requiring certification, public school teachers and administrators also fulfilled other types of roles in the education system, as shown in Table 6.

Table 6. Public School Teachers and Administrators with Other Public School Positions

Position Type	Number of Teachers Also Employed in Position Type	Number of Admins Also Employed in Position Type
Coaches or co-curricular	4,327	164
Other professional	86	78
Other clinical	16	11
Other staff	647	62

Tables 4, 5, and 6 show that the K-12 education workforce is not cleanly segregated into categories. Staff fulfill positions at multiple levels of responsibility and requiring varied training and experience. Some teachers also serve as administrators, and some administrators also serve as administrative assistants, chemical hygiene officers, facility managers, and substitute teachers. **This overlap between position types complicates**

the depiction of "demand" of certain types of staff. This is further limited by the lack of detailed information about full- vs part-time positions that was available to researchers via certification records (although captured in other MDOE data sources).

Statewide number of eligible (credentialed) educators (pseudo-supply)

Endorsement data are one way to estimate the total supply of persons available to work in teaching, administrative, clinical, specialist, and paraprofessional roles in Maine public schools. In 2018-19, there were 93,792 endorsements held by a total of 40,788 individuals. As with staffing positions, many individuals held multiple endorsements as depicted in Table 7.

Table 7. Number of Separate Maine Dept. of Education Endorsements Held by Individuals in 2018-19

# of Unique Endorsements	Individual Persons		Number of Endorsements Held	
	#	%	#	%
1	17,086	42%	17,086	18%
2	9,201	23%	18,402	20%
3	4,136	10%	12,408	13%
4	7,741	19%	30,964	33%
5	1,327	3%	6,635	7%
6 or more	1,297	3%	8,297	9%
Total	40,788	100%	93,792	100%

There are a few key portraits of "multiple endorsement" holders. It is quite common for teachers and educational technicians to hold more than one type of endorsement. For example, secondary life science teachers (endorsement #395) are often also endorsed in physical science (#350), and those holding educational technician III (endorsement code #023) also meet the criteria for ed tech I and II and likely hold all three endorsements. It is also common for those with administrator or educational specialist preparation to have also worked as a teacher, and these individuals typically retain their teaching certification to have expanded career options. Lastly, an individual can hold more than one type of certification for the same endorsement during a given year – for example, a teacher could upgrade from conditional to a higher credential before it has expired, or from a professional to a master certificate.

Table 8 further displays the overlapping nature of the numbers of people holding endorsements both within and across the five job categories used in this study.

Table 8: Public Educator Certification in 2018-19 by Endorsement Field (pseudo-supply)

Job group	Number of Valid Endorsements	Headcount of individuals endorsed	Number (%) conditionally certified	Headcount (%) also endorsed for another job group
Teacher	35,681	23,357	1,490 (6%)	3,685 (16%)
Administrator	3,173	2,527	91 (4%)	1,766 (70%)
Education Specialist	2,217	2,141	76 (4%)	1,106 (52%)
Clinical (Speech, nursing)	724	724	11 (2%)	104 (14%)
Paraprofessional	51,997	16,119	N/A	1,282 (8%)
Total	93,792	44,868	1,668	4,080* (9%)
Unduplicated Total Number of Individuals:				**40,788**

* *Total number of individuals holding endorsements in more than one job group*

As of April 2019 there were 40,788 individuals holding at least one current endorsement. 97% had a Maine address and 3% had an address outside of Maine, most often in New Hampshire, Vermont, or New Brunswick, Canada.

Of the 23,357 individuals holding a teacher endorsement in Maine, 35% (n=8,113) hold more than one type of teaching endorsement, for example, in science and math or language and ESL, and 16% (n=3,685) hold a non-teaching endorsement (e.g. administration or educational specialist) in addition to their teaching endorsement(s). Specifically, of the 3,685 persons who held both a teaching and some other type of certificate, 1,656 held an administrator endorsement, 1,210 were endorsed as ed techs, 960 held an educational specialist credential, and 77 held a clinical certificate (speech and hearing clinician or school nurse). Other job categories had similar overlap, with administrators being the most likely to hold endorsements for multiple job categories. The key takeaway from Table 8 is that educators in Maine are prepared to serve in multiple different types of positions, with the average educator holding two or more distinct credentials. **This cross-trained workforce makes it difficult to accurately predict the true "supply" of educators for any given position**, as most educators fill only one type of role at a time.

The analyses thus far demonstrate that using administrative data to estimate supply and demand for educators is imprecise. The number of public school positions is an inexact measure of the number of *people* needed, because in many cases one person fulfills more than one type of position. In Table 9 we depict other ways to illustrate educator shortages. Here we combine the number of individuals available to serve in public school positions (based on endorsements) to the number of current staff within each job category. The goal of this comparison is to explore the proportion of the "supply" that is being captured into the workforce, and the excess "supply" available for open positions. The supply of individuals is measured as those who are fully endorsed or conditionally endorsed. In addition, the depiction is complicated by the presence of employed individuals who should be endorsed but are not (i.e., they are employed in Maine's public education sector but are not listed as holding an appropriate endorsement for the position).

Table 9: Number of 2019 Educator Endorsements and Employment by Job Group

	Headcount Endorsed (Table 8)	Endorsed & working in related public school position	Endorsed & working in other type of position	Endorsed & working in private school	% of Endorsed Available for Positions
Teacher	23,357	15,480	2,910	802	17.8%
Administrator	2,527	1,132	848	91	18.0%
Education specialist	2,141	1,387	460	86	20.6%
Clinical	724	460	95	20	20.5%
Paraprofessional	16,119	7,601	989	1,001	40.5%

Teachers: Of the 23,357 individuals endorsed to be a Maine teacher in 2018-19, 93% (21,723) were fully certified and 6% (1,490) were conditionally certified. Of all those certified, 66% (15,480) were employed as teachers in the public sector. 16% (3,712) were working in the public sector as something other than a teacher or in the private sector, mostly as educational technicians (1,444), specialists (754), or administrators (581). About 18% (4,165) were not employed in the public or private k-12 education sector in Maine.

Of the 16,048 people employed in teacher positions in the public sector, 97% (15,480) were endorsed as a teacher and 3% (568) were not endorsed as a teacher according to the available certification records. Of the 568 public school teachers who were not endorsed, 398 of them were not in the endorsement file (i.e., they held no endorsement) and 170 were in the endorsement file but held something other than a teacher certificate; most, 80%, had an ed tech certificate.

Administrators: Of the 2,527 people holding one or more administrator certification, 96% were fully endorsed and 4% were conditionally endorsed. Of the 848 working in the public sector in some other type of position, 479 were teaching, 347 were in education specialist positions, 49 were ed techs, and 2 were in clinical positions.

Looking from the other direction, there were 1,508 people in administrator positions in the public sector in 2018-19, 87% of whom were matched to an administrator endorsement. However, 13% (166) of the persons employed in public sector in an administrator position were not endorsed as an administrator (n=82 as teacher, n=94 were endorsed in something else, and n=72 did not appear at all in the endorsement file).

Education specialists: Of the 2,434 persons holding an education specialist endorsement, 2,320 (95%) were fully endorsed and 114 (5%) were conditionally endorsed. Of the 2,434 people with educational specialist endorsements, full or conditional, 57% (1,387) were working in a educational specialist position in the public school sector, 22% were working in the public sector in some other type of position (i.e., not educational specialist) or in the private sector and 20% (501) were not employed anywhere in the education sector in Maine.

Of the 546 persons holding educational specialist endorsements but not working in a specialist position in the public sector, 460 were working in the public sector in another type of position (279 as teacher, 90 as administrators, 86 as other professionals, 60 as ed techs, and 26 in other roles) and 86 worked in the private sector.

Of the 2,954 persons working in educational specialist positions in the public sector, 1,387 (47%) held one of the specialist endorsements listed in Table 1 and 1,372 (46%) held some other kind of certification (1,274 teacher, 76 as ed techs, 154 as administrators and 16 clinical). Unlike the other position categories, the "education specialist" grouping use in this study is indirectly aligned, as some of the position types (for example, Teacher

Support Team Member or Title I Coordinator) do not require one particular type of endorsement. However, about 7% (195) were not found in the certification records with any type of endorsement.

Paraprofessional: There were 16,119 persons holding an educational technician endorsement (Educational Technician I, Educational Technician II, or Educational Technician III, or Educational Technician, NCLBA). Of those endorsed, fully or conditionally, 47% (7,601) were employed in a paraprofessional position in the public sector, 12% (1,990) were employed in the public sector but not as a paraprofessional or in the private sector, and 40% (6,528) were not employed anywhere in the education sector in Maine.

Of the 1,990 persons holding one or more paraprofessional endorsements but not working in a paraprofessional position in the public sector, 989 were working in the public sector in another type of position: 711 as teachers, 68 were educational specialists, 5 administrators, and the remainder in other roles. The rest, 1,001, were working in the private sector.

Clinical: Of the 724 persons holding a clinical endorsement (school nurse or speech and hearing clinician), 97% held a full endorsement and 3% were conditionally endorsed. Of those endorsed fully or conditionally, 64% (460) were employed in a clinical position in the public sector, 16% (115) were employed in the private sector or in the public sector but not as a nurse or speech and hearing clinician, and 20% (149) were not employed anywhere in the education sector in Maine. There were 578 persons holding a clinical position in the public sector, 80% (460) of whom held an endorsement as a clinician and 20% (118) of whom did not.

Shortage areas

In the last series of analyses, we compiled the number of people in each county holding positions in critical educator shortage areas (secondary math, physical science, world languages, special education, English Language Learners, or speech and hearing/language pathology). These are depicted in the first column in each table. Because not all positions are full-time, we also captured the proportion of teachers in high-need fields that also hold a position in another category, and therefore are not full-time in the

shortage subject, in column 2. This information is relevant for assessing supply because it implies that individuals in teaching those multi-subject positions are expected to have content knowledge expertise in more than one subject; the higher the proportion, the more likely that the teachers are teaching out-of-field. In the third column we compiled the number of individuals living within each county that hold an endorsement for each position type. These numbers are from certification data, not staffing data, so the endorsed individuals living in each county are not necessarily the same individuals as those employed in each county. Nonetheless, column 3 can still be compared to column 1 to for a general sense of the number of eligible applicants and total teacher pool in each county. The fourth and final column in each table depicts the proportion of certificate holders in column 3 that have conditional rather than full certification.

Secondary Mathematics

Table 10. Secondary Mathematics (Endorsement 300)

County	# Teachers with Subject = Mathematics (any grade)	% Teaching additional subjects	# Holding Secondary* Mathematics Endorsement (300)	% Conditional Endorsements
Androscoggin	101	9.9%	94	6%
Aroostook	75	32.0%	86	8%
Cumberland	321	23.7%	282	5%
Franklin	33	15.2%	35	6%
Hancock	70	35.7%	64	9%
Kennebec	117	6.8%	132	6%
Knox	51	19.6%	44	5%
Lincoln	34	8.8%	29	0%
Oxford	55	9.1%	46	11%
Penobscot	162	29.0%	157	5%
Piscataquis	16	25.0%	17	24%
Sagadahoc	22	27.3%	33	0%
Somerset	35	14.3%	53	6%
Waldo	30	16.7%	25	0%
Washington	28	17.9%	36	6%
York	178	8.4%	165	3%
Out of State	--	--	75	8%
Total	1,328	19.1%	1,373	6%

*There are also math teachers who hold an elementary and middle school (K-8) endorsement (see Table 12). Because elementary teachers are not generally expected to apply for secondary math teaching positions, here we include only those who hold a Secondary level endorsement to depict the "supply" of math teachers.

Maine has about the same number of mathematics teacher positions as they have individuals certified to teach secondary (grades 7-12) math (1,373 compared to 1,328). This is not an exact alignment. An educator is reported as a "mathematics" teacher if he or she is a subject specialist, which can happen at any grade level. Nearly all positions labeled with a subject of mathematics can be assumed to be in middle and high schools, where teachers typically specialize in one or more subjects. However, math teachers in 6th grade or below are not covered by a secondary (grade 7-12) math endorsement, and must hold either a middle level (grade 5-8) or elementary (grade K-8) endorsement. Math teachers in grades 7 and 8 can hold any of those three endorsements (elementary, middle, or secondary), and high school teachers must hold a secondary math endorsement.

However, this ratio of positions to certificate holders—while inexact—still provides a rough means for comparison. The equal proportion remains concerning, as we know from the analyses above that many individuals holding a credential are not actively seeking employment in that field. For example, some of those holding math certification are working as administrators or curriculum coordinators or other roles, or in positions altogether outside of public schools; a robust supply needs a substantial excess of eligible teachers for the number of needed positions.

Overall, about 1 in 5 math teachers also teach another subject. Counties with the highest proportion of multi-subject teachers were Aroostook, Hancock, Penobscot, and Sagadahoc. There were 9 counties—Androscoggin, Cumberland, Hancock, Knox, Lincoln, Oxford, Penobscot, Waldo, and York—that had fewer endorsed residents than teaching positions (i.e. column 3 is less than column 1). The counties with the highest proportion of conditionally certified residents were Hancock, Oxford, and Piscataquis.

Secondary Science

For secondary science, life and physical science are combined as one subject; this requires combining the data on life and physical science endorsements. As with mathematics, there is an imprecise alignment between teachers identified with subject = science and those holding a secondary science credential, as individuals with an elementary (K-8) credential are eligible to be science subject specialists in those grades.

Table 11. Science: Secondary Life (#395) or Physical (# 350) Science

County	# Teachers with Subject = Science (any grade)	% Teaching additional (non-science) subjects	# Holding Secondary* Science Endorsement (350 or 395)	% Conditionally certified
Androscoggin	81	13.6%	123	6%
Aroostook	70	37.1%	137	6%
Cumberland	301	23.6%	588	6%
Franklin	38	21.1%	73	5%
Hancock	56	44.6%	117	7%
Kennebec	102	10.8%	173	8%
Knox	47	14.9%	82	12%
Lincoln	28	3.6%	79	4%
Oxford	42	9.5%	103	8%
Penobscot	137	25.6%	295	7%
Piscataquis	15	13.3%	22	5%
Sagadahoc	20	30.0%	49	4%
Somerset	27	18.5%	88	9%
Waldo	31	16.1%	93	3%
Washington	21	4.8%	53	4%
York	163	5.5%	268	4%
Out of State	--	--	108	5%
Total	1,179	19.3%	2,451	6%

*There are also science teachers who hold an elementary and middle school (K-8) endorsement (see Table 12). Because elementary teachers are not generally expected to apply for secondary science teaching positions, here we include only those who hold a Secondary level endorsement to depict the "supply."

Table 11 presents a cohesive depiction of all science subjects. If an individual teaches multiple science subjects, they are counted only once in column 1 and are not treated as teaching multiple subjects in column 2. If an individual holds both life and physical science certification, they are counted only once in column 3. Unlike mathematics, the number of individuals holding science teacher certification (2,451) is more than double the number of science teacher positions (1,179), and there were no counties with fewer endorsed residents than science teachers.

However, like mathematics, there were still about 1 in 5 science teachers also teaching a non-science subject. To further investigate, we explored the overlap between math and science teachers and found that there were 150 individuals teaching both mathematics and science, mostly at the middle school level. These represent about 11% of

math teachers and 13% of science teachers. They account for more than half of the 19% of math teachers in multiple subjects, and about two-thirds of the science teachers in multiple subjects. Of the 150 teaching both math and science, 130 (87%) were endorsed to teach both subjects, including 98 middle school teachers holding an Elementary (Grade K-8) endorsement. Of the remaining 20, two were certified for math but not science, eleven were certified for science but not math, and seven were not certified in either subject (but held other certifications).

Comparison Subjects: Secondary Social Studies & Secondary English

To provide context for the above findings for secondary mathematics and science, Table 12 depicts parallel information for secondary English Language Arts and Social Studies, two subjects that are not considered shortage areas.

Table 12. Secondary English (#100) and Secondary Social Studies (#200) Teachers

County	# English Teachers	# Endorsed (100)	% Conditional Cert	# Social Studies Teachers	# Endorsed (200)	% Conditional cert
Androscoggin	126	136	3.7%	78	167	3.6%
Aroostook	91	121	5.0%	66	113	1.8%
Cumberland	347	553	2.2%	269	572	2.1%
Franklin	36	46	6.5%	36	51	2.0%
Hancock	64	84	4.8%	53	90	2.2%
Kennebec	116	181	4.4%	110	203	3.9%
Knox	48	82	6.1%	39	64	6.3%
Lincoln	38	48	2.1%	23	48	4.2%
Oxford	71	86	2.3%	42	93	6.5%
Penobscot	184	216	4.6%	123	255	3.5%
Piscataquis	15	20	5.0%	11	33	0%
Sagadahoc	31	47	4.3%	24	59	5.1%
Somerset	38	79	2.5%	30	85	5.9%
Waldo	40	68	2.9%	28	72	4.2%
Washington	33	56	8.9%	24	56	3.6%
York	189	243	2.5%	148	264	3.4%
Total	1,467	2,066	3.8%	1,105	2,225	3.5%

It is noteworthy that the ratios of credential holders to teacher positions in these two subjects (1.4:1 for English and 2:1 for social studies) is not markedly different from secondary science. However, there proportion of conditionally certified math and science teachers is more than 50% higher than these two subjects.

World Languages

Table 13. World Languages

County	# World Language Teachers	% Teaching additional subjects	# Holding World Language Endorsement (4xx)	% Conditionally certified
Androscoggin	34	0%	49	2%
Aroostook	22	13.6%	33	0%
Cumberland	167	0.6%	300	10%
Franklin	11	0%	28	4%
Hancock	21	14.3%	28	0%
Kennebec	46	2.2%	75	11%
Knox	22	13.6%	31	3%
Lincoln	16	6.3%	22	0%
Oxford	15	6.7%	26	8%
Penobscot	51	7.8%	94	9%
Piscataquis	5	20.0%	2	0%
Sagadahoc	8	12.5%	21	5%
Somerset	5	0%	24	21%
Waldo	10	0%	23	17%
Washington	9	11.1%	15	20%
York	69	2.9%	96	7%
Out of State	--	--	49	6%
Total	511	4.3%	916	8%

Statewide, the total number of world language teachers is less than half of the number of science teachers. Two counties – Cumberland and York – account for almost half of all teachers (46%), yet have a smaller proportion of Maine's students (37%). In four counties (Piscataquis, Sagadahoc, Somerset, Washington) there are fewer than 10 world language teachers serving the entire region, while no county employed fewer than 15 science teachers. This is an indication that students in some different regions may have more limited opportunities to study other languages.

The number of individuals certified to teach a world language (916) is substantially higher than the total number of world language teachers (511), and only Piscataquis County has fewer endorsed residents than world language teachers. However, only a handful of counties (Cumberland, Kennebec, Penobscot, and York) had more than 50 individuals certified to teach a foreign language; regardless of the relative size of the demand in the other 12 counties, fewer than 50 is still a small supply. Only 4% of world language teachers are also assigned to teach in another subject area. The proportion of individuals holding conditional certification (8%) is modestly higher than the 6% in math and science.

Special Education

Table 14. Special education

County	# Special Education Teachers	% Holding additional types of positions	# Holding Special Education Endorsement (282, 286, 291, 292)	% Conditionally certified
Androscoggin	211	16%	385	9%
Aroostook	116	21%	232	6%
Cumberland	516	11%	1112	9%
Franklin	57	7%	145	7%
Hancock	99	17%	205	10%
Kennebec	191	7%	452	11%
Knox	88	25%	130	14%
Lincoln	60	7%	131	9%
Oxford	124	23%	193	13%
Penobscot	267	14%	424	9%
Piscataquis	24	8%	51	18%
Sagadahoc	63	13%	135	9%
Somerset	71	11%	165	10%
Waldo	59	19%	167	13%
Washington	60	18%	110	13%
York	299	15%	658	8%
Out of State	--	--	161	9%
Total	2,305	14%	4,856	9%

Special Education is a large category of teachers, comprising 15% of the total 15,480 teachers in 2018-19. There were twice as many individuals holding endorsements as there are special education teachers, and this approximate ratio was present across all counties. However, it is widely known that districts report ongoing shortages and challenges in hiring special education teachers. This suggests that there may not be a shortage of individuals available to fill special education teacher positions and leads to deeper questions about the availability of the individuals holding certification in special education to work as special education teachers.

To further explore this seeming "surplus" of special education credential holders, additional analysis was conducted on all of the 4,856 individuals holding a special education endorsement in 2018-19. Of those credential holders, four out of five were employed in education last year; only 18.5% were not found in the staff data. Half of those credential holders (49.9%) were employed as a special education teacher in either a public *or private* school, while 17.2% were employed as a classroom (or other) teacher in a public or private school. A small proportion of 3.9% were working as administrators, and the remaining 10.4% were working in other positions including educational technicians. These findings substantially change the understanding of the ratio of special education credential holders to public school special education teachers. Namely, many of the individuals holding a special education teaching credential are employed in the education sector but not as special education teachers. In particular, there is a need for special education teachers in special purpose private schools, and also an emphasis on employing dually-certified teachers as mainstream inclusive classroom teachers. Thus the demand for individuals with special education training is not captured solely by the number of special education teachers in public schools. In other words, the seemingly large ratio of special education endorsement holders to public school special education teachers does not mean that there are substantial numbers of eligible job applicants available to apply for special ed teaching job opening, as many of them are already employed in other roles.

English Language Learner Teachers

Table 15. Bilingual or English Language Learner Teacher (Endorsement 650 or 660)

County	# EL Teachers	% Holding additional types of positions	# Holding Bilingual or ELL Endorsement (650 or 660)	% Conditionally certified
Androscoggin	54	17%	55	11%
Aroostook	4	75%	10	10%
Cumberland	90	12%	250	4%
Franklin	1	100%	7	0%
Hancock	4	75%	16	0%
Kennebec	13	15%	22	5%
Knox	4	50%	12	0%
Lincoln	3	100%	11	9%
Oxford	4	25%	9	0%
Penobscot	4	50%	35	0%
Piscataquis	0	--	1	0%
Sagadahoc	3	67%	16	0%
Somerset	2	0%	8	0%
Waldo	1	100%	19	11%
Washington	2	0%	4	0%
York	18	50%	51	2%
Out of State	--	--	23	0%
Total	207	24%	549	4%

In contrast to special education teachers, the number of ELL teachers is quite small. ELL teachers in counties with large ELL populations (Androscoggin and Cumberland) were typically dedicated solely to that role, while those in counties with small ELL student populations were likely to hold part-time ELL positions in conjunction with other subjects or roles.

Speech and Hearing/Language Clinicians

Speech and hearing educators are specialist positions and not teaching roles. These clinical positions were initially identified for more detailed analysis as a high-need field due to reports of chronic shortages of these educators. However, in exploring the data it became apparent that these specialists are unlike other roles in more ways than one. As noted in the Department of Education's Rule chapter 115, Part II, Section 2.6.A, "NOTE: Certification is not required for a person who holds a valid license as a speech-language pathologist under Title 32, Section 17301 and who has received approval by the Maine Department of Education." This means that a school district can hire an individual to provide speech services as long as that person is either licensed by the state as a Speech-Language Pathologist or certified through the Maine Department of Education as a Speech and Hearing Clinician. The title of the position reported in the NEO staff data system is an indicator of which type of credential the person holds, but the nature of the work is similar, if not identical, in the two position titles. Table 17 summarizes the number of positions of each type by county, and also the number of residents in each county holding the state endorsement. Less than 1% of those holding state endorsements were conditionally certified. Districts are more likely to hire licensed speech pathologists than certified speech and hearing clinicians.

Table 16. Speech and Hearing Clinician (Endorsement 293)

County	Speech - Language Pathologists (Licensed)	Speech & Hearing Clinicians (Certified)	# Holding Speech and Hearing (Endorsement 293)
Androscoggin	20	13	18
Aroostook	12	6	7
Cumberland	62	28	44
Franklin	11	0	1
Hancock	17	12	13
Kennebec	17	22	23
Knox	12	5	3
Lincoln	4	4	4
Oxford	10	4	2
Penobscot	49	19	36
Piscataquis	4	0	0
Sagadahoc	7	9	6
Somerset	12	3	4
Waldo	5	4	4
Washington	8	3	4
York	58	16	28
County Not Specified	47	2	--
Total	355	150	198

Summary & Conclusions

In general, these analyses reveal that the readily available administrative data are most helpful for illustrating the differences in educator supply across different parts of the state. They are less helpful for making a determination about whether a given supply of credentialed educators in an area is adequate to meet the needs of that region. The following summarizes the key points of the findings.

It is common for educators to hold more than one type of position. Thus, using staffing data to estimate the need for different types of educators across the state is only approximate without information on whether the positions are part-time or full-time. Moreover, the number of positions that exist is an inexact estimate of actual need for educators, because there may be unfilled positions that are not captured in staff counts.

Using certification data as an estimate of the supply of educators is also inaccurate. A substantial proportion of credential holders (e.g. about 18% of eligible teachers and administrators) are not working anywhere in Maine's K-12 education sector. Some individuals retain their credentials "just in case" even when they have no immediate intentions of seeking related employment in public schools. Others may have have left the education field but hold multi-year credentials that have not yet expired. Still others have multiple types of credentials but only use one at a time, while some hold multiple positions but are only credentialed for some of them. All of these issues introduce imprecision when trying to use the number of credential holders as an indicator of workforce supply.

More surprisingly, there were different patterns of supply and demand across the shortage areas we investigated. For example, there are proportionally fewer mathematics teacher certificate holders than credentialed science teachers, but both subjects have about the same proportion of conditionally-certified educators. The ratios of science teachers to eligible credential holders were not markedly different from secondary English, an area that is not considered to be in shortage. In contrast, special education would appear to have a robust supply as judged by the 2:1 ratio of credential holders to staff positions both statewide and within each county, but has the highest proportion of conditionally certified teachers and is widely regarded as an area of severe shortage. A substantial proportion of individuals with special education credentials were employed in special purpose private

schools or as mainstream classroom teachers, which complicates the depiction of demand for this important pool of educators. This variability across subject areas was somewhat unexpected, and suggests that there may be underlying differences in the nature of teacher shortages depending on the field. These distinctions are speculative and merit further study as they may imply a need for different strategies to recruit and retain educators for specific fields.

Policy Implications

Since it is common for school districts to employ a single individual to work in more than one type of role (or in the case of teachers, more than one subject area), it is desirable to encourage educators to develop expertise in more than one area. This affords more flexibility for both employers and educators. Cross-training may be especially useful in rural areas where there may not be adequate numbers of students to warrant full-time positions for some educational roles.

Staff shortages appear to have multiple contributing factors. Some subject areas (e.g. math) may have a dearth of individuals with the appropriate academic background and/or teacher preparation. In contrast, special education teaching has a seemingly adequate supply of credential holders but still faces a shortage of job applicants—perhaps because their skills are sought for multiple settings. This variation implies that there may be a need to recognize nuanced differences between subject fields when developing strategies for enticing educators to enter and remain in the workforce. Additional study is warranted to better understand these differences, which may be informed by an ongoing study of educator recruitment and retention.

It would be useful to identify the types of ongoing / annual reports about educator supply and demand that would be helpful to the field (Maine Department of Education, policymakers, and K-12 practitioners). These reports would likely require additional data linkages in order to be feasible to produce on a regular basis. For example, conducting analyses of staffing needs across the state would be easier if information about the full-time equivalent status of each position were included in the data fields that are already directly linked within the certification system.

A centralized system for tracking job openings and applications, such as those used in other states, may enable the ability to identify shortage situations in real time and thus create new potential to be able to direct resources to struggling districts. The potential benefits to policymakers and practitioners would first need to be understood in more detail so they could be weighed against the cost of developing and implementing such a system.

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