# *An Analysis of Secondary Science Teacher Retirement in Kansas*

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EDUCATION INFORMATION

 The University of Kansas Center for Science Education (CSE) was established in Fall 2000 based on a recommendation from the Task Force on Science Education appointed by Chancellor Robert Hemenway. The CSE is an interdisciplinary collaborative venture intended to improve science education at KU and throughout the state of Kansas while contributing to scholarship in science education on a national and international level. CSE activities involve scientists, science educators and education specialists from many units on the Lawrence campus including the College of Liberal Arts and Sciences, the School of Education, the School of Engineering, the Center for Teaching Excellence, the Center for Research on Learning, and the Natural History Museum & Biodiversity Research Center. KU CSE produces data-based reports including giving direction to the Center's research and mission.

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Americans seem to love their teachers, while seemingly hating the teaching profession. Science education is of particular concern. Each year brings a new blue-ribbon commission issuing a white paper examining America's schools, frequently emphasizing the need for science and technology literacy while also decrying the declining quality of the teaching force. The concern about scientific literacy is a serious societal issue if the United States is to remain competitive in the 21st century. While addressing this issue, many of the reports stress a growing need for highly qualified teachers, particularly in mathematics and sciences, to develop a citizenry able to fully participate in an increasingly complex, technology-driven society. Science in schools has been a part of this discussion since the publication of *A Nation at Risk* (1983). The United States has focused national attention on American students' dismal performance in science, where the statistics are certainly alarming: American school children continue to perform so poorly on standardized tests of science achievement that they often come in near the bottom when compared with students from other industrialized countries (PISA 2009, TIMSS, 2007). With this science literacy focus now spanning almost three decades, it is clear that the roots of the problem are deep and complex.

There is a growing consensus among researchers and educators that classroom teachers are a critical factor in improving student academic achievement. School districts report that they have a difficult time recruiting and retaining sufficient numbers of highly skilled teachers trained in science, technology, engineering and mathematics (STEM) content and teaching pedagogy. There is a need for these highly qualified STEM teachers at the same time that layoffs within the teaching workforce are occurring across the country.

The dichotomy of teacher layoffs occurring at the same time as a great need for highly qualified teachers is very confusing to those engaged in STEM teacher preparation. Teacher preparation programs are left with very basic questions: How many new teachers should be produced each year to meet the needs of the school districts? During these layoffs, is there really a shortage of highly qualified secondary science teachers? Will there be jobs available for graduates that are prepared to start their teaching career? The operational definition of a shortage must include the notion that a shortage exists when too few persons with the required qualifications offer their services for the available

openings (Rumberger, 1985). Determining an absolute value of teacher shortages as a function of unfilled positions is very difficult. Differently sized school districts have a variety of adjustments to schedules, class sizes, and hiring standards to allow them to meet their staffing requirements (Haggstrom et al., 1988). However, there is evidence that indicates that shortages of math and science teachers have existed for most of the last 30 to 40 years (Kershaw & McKean, 1962; Levin, 1985; Collins & Gillespie, 2009).

Where a teacher shortage occurs is an equally important component of the problem. Shortages may be a local issue in districts that do not have access to a pool of highly qualified applicants. This is particularly true in states with a high number of rural school districts that are far from urban centers and far from the teacher preparation programs (U.S. Department of Education, National Center for Education Statistics, 2009). These districts have low numbers of students and limited numbers of teachers. The loss of a single teacher may create a shortage in these districts. Critical shortages can occur when a highly qualified science teacher cannot be recruited to fill a local teaching position.

Beyond shortages, the perceived growing need for these STEM teachers was addressed by President Obama in his 2011 State of the Union address when he set a national goal saying, "… over the next 10 years, with so many baby boomers retiring from our classrooms, we want to prepare 100,000 new teachers in the fields of science and technology and engineering and math." The President is expressing a concern about a graying science and math teacher workforce. Leaving behind the question of the training necessary to produce high quality STEM teachers who have a deep and rich disciplinary understanding, it is important to note that in the next 10 years, over half of the nation's nearly 3.2 million public school teachers will become eligible for retirement. It is difficult to extrapolate the discipline-specific need for secondary science teachers from this overall number of retirement-eligible teachers.

Further complications arise in determining how many science teachers are needed, based on the work of Ingersoll and Perda (2009). They argue that retirement is not a significant variable in perceived teacher shortages when they state:

> The data show that there are indeed widespread school staffing problems—that is, many schools experience difficulties filling their classrooms with qualified candidates, especially in the fields of math and science. But, contrary to conventional wisdom, the data also show that these school staffing problems are not solely, or even primarily, due to shortages in the sense that too few new mathematics and science teachers are produced each year. The data document that the new supply of mathematics and science teachers is more than sufficient to cover the losses of teachers due to retirement.

In their view, the revolving door of secondary science teaching is created by working conditions and the pay gap between science teaching and other opportunities for those trained in the sciences. Math and science have long been among the disciplines that are typically found to be the fields with the highest turnover rate (Murnane et al., 1991).

Given idiosyncratic difficulties in determining actual shortages and the need for secondary science teachers, teacher retirement could serve as a baseline for teacher preparation programs' production of new science teachers. This work uses Kansas as a case study to understand the extent and location of science teacher retirement across the school districts of Kansas.

**Kansas Secondary Science Teacher Data (2009-2010)**

The total student enrollment for the state of Kansas is 473, 772. Of these, 258,531 are secondary students (grades 6-12). These students are in 290 Kansas school districts; each of which offers all of the secondary grade levels. The number of secondary science teachers in the districts range from 1 to 206 (mean: 7.3, median: 4, mode: 3) for a total Kansas science teaching force of 2435. This includes all teachers who taught at least one section of science during the school day during the 2009-2010 school year. The statewide average age of secondary science teachers is 44 years with 14 years of teaching experience, establishing a median combined age and experience of 56.

In Kansas, teachers are eligible for retirement at a combined age and years of experience that total 85. An alarming statistic that quickly emerges from the data is that currently, 320 secondary science teachers are teaching over the retirement threshold of 85. 13% of the secondary science teachers are in this situation. Of these secondary science teachers 91 are over age of 65. Current data also indicates that half of the secondary science teachers will reach the threshold for retirement in less than 15 years. State-wide science teacher data further indicates:

- An average of 70 secondary science teachers will be eligible to retire each year through 2030 (Figure 1).
- 573 secondary science teachers (24%) will be eligible to retire over the next five years.

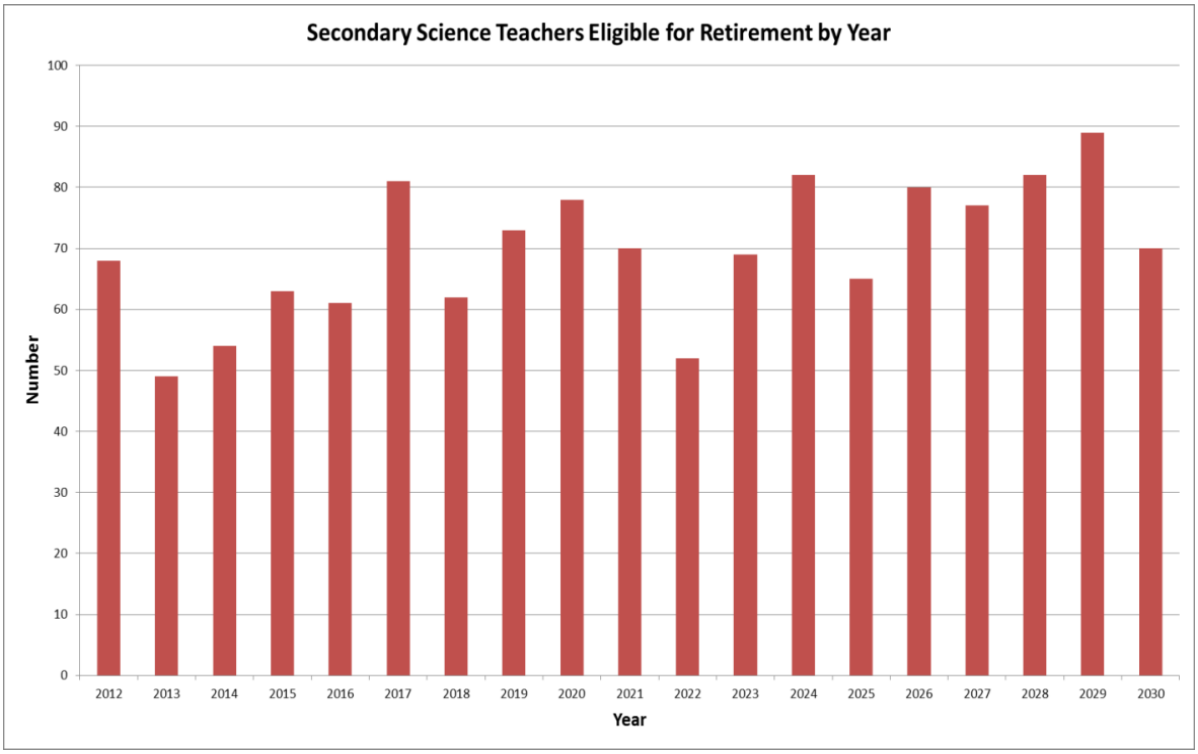


**Figure 1: Secondary Science teachers who will become eligible for retirement by year.**

In determining a shortage of secondary science teachers in a large and predominantly rural state, it is just as important to determine where these shortages occur. Since teacher preparation most commonly consists of completing a four year program before the teacher is prepared to begin teaching, it is equally important to predict where future shortages will

occur. Using geographic analysis to look statewide at school districts, a risk for retirements scale was applied to the science teaching workforce of each school district (Figure 2). The index established 40% of the science teachers retiring in a district places that district in high risk category (red), 21% – 40% of science teachers retiring classifies a district at being at moderate risk. 21% or below of a districts science teachers eligible for retirement places the school district in the minimal risk category.

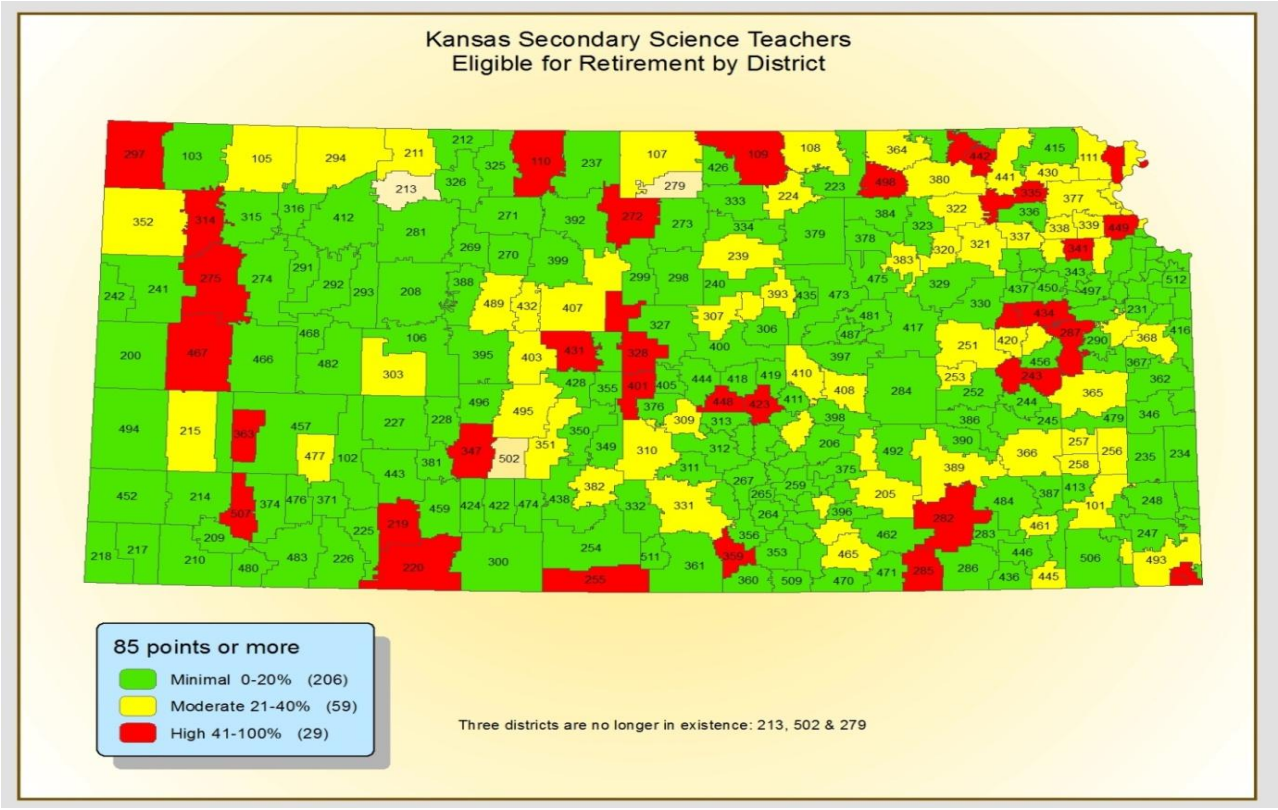


**Figure 2: Current eligibility for retirement for secondary science teachers**

While no clear geographic patterns emerge from the map, it is clear that potential retirements are widespread. The 29 red districts that have more than 40% of their science teachers immediately eligible to retire (Figure 2) are dispersed across the state. One in ten districts are currently at high risk of losing a large portion of their science-teacher workforce; while an additional two in ten could lose a significant part of their science teachers in the near future. Even for those districts which don't face the risk of imminent science teacher retirements, there are still emerging issues. The two maps, represented in Figures 3 & 4, show the five and ten-year progression of potential science teacher

shortages resulting from retirement for Kansas school districts. Applying a slightly higher threshold of risk (i.e. 50% or more teacher loss due to retirement) to account for the wide variation in the number of science teachers in a district; projecting the data out over the next five years indicates that 39 districts could lose half of their science teachers or more (Figure 3). Most of these are smaller, somewhat rural school districts, although the state's larger districts are at moderate risk for losing 31% to 50% of their science teachers over the next five years. These projections show that most districts in Kansas will find themselves needing to replace a significant number of their science teachers destined to permanently leave the workforce due to retirement.

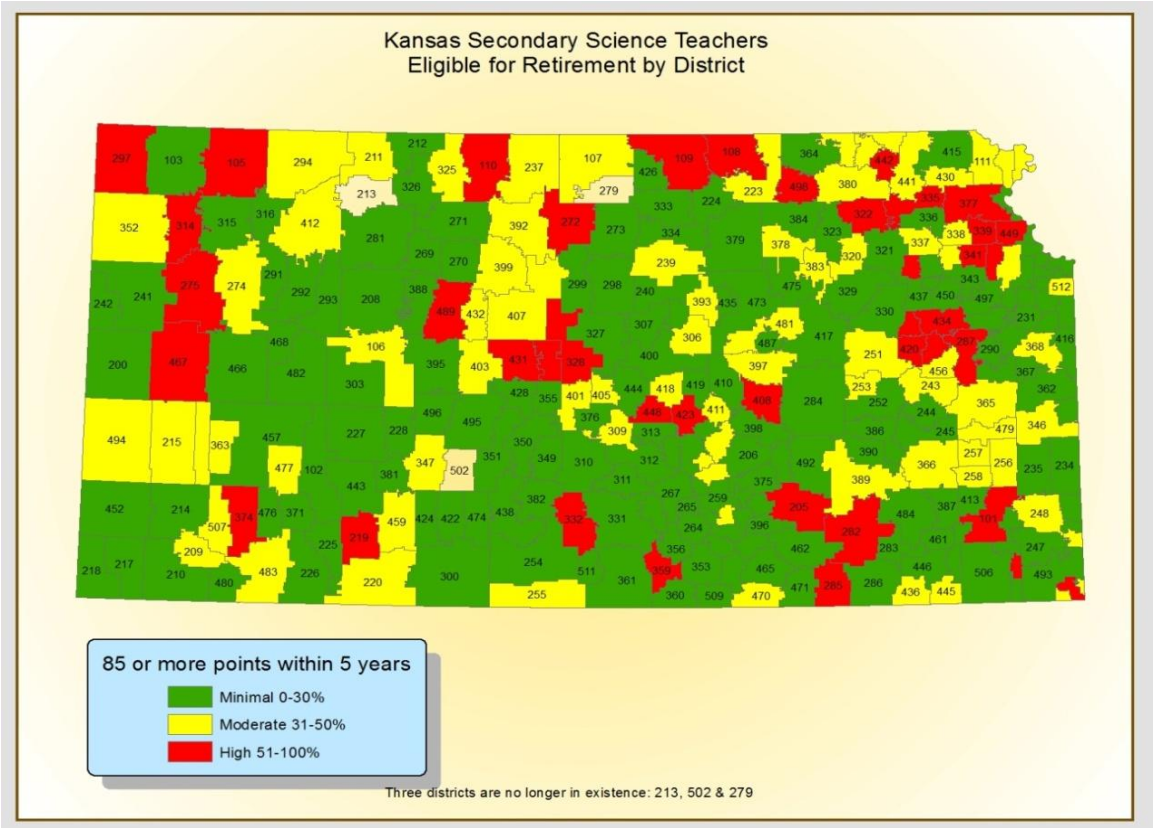


**Figure 3: Eligibility for retirement of secondary science teachers over the next five years.**

The response of Kansas teacher preparation programs in creating new science teachers in response to this retirement data cannot be immediate. Undergraduate teacher preparation programs in the state are four year programs. The need for highly qualified science teachers will continue to grow during the four years needed to prepare the new teachers. The retirement data, however, can establish a target for the level necessary for new science

teacher production. Figure 4 shows the statewide distribution of secondary science teachers that will become eligible for retirement over the next ten years. Looking five and ten years down the road (Figures 3 & 4) the increasing number of red districts shows the likelihood that many of the state's districts will need to replace over half their science teachers within the coming decade. In fact, these 89 red districts represent about a third of the total 290 school districts in Kansas.

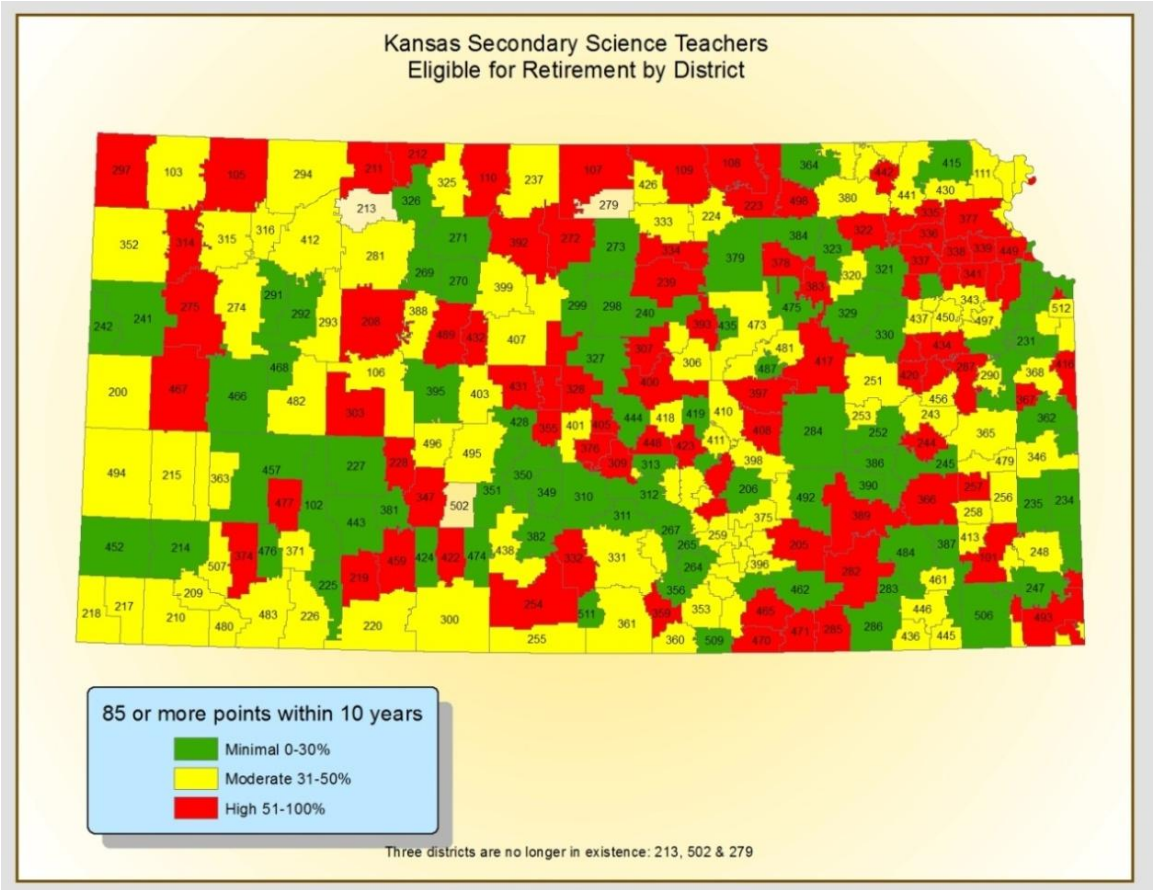


**Figure 4: Eligibility for retirement of secondary science teachers over the next ten years.**

While potential shortages are widespread, similarities among these districts emerge when the relative population densities of each district are taken into account. The U.S. Department of Education divides all school districts in the country into one of four broad categories: city, suburban, town or rural. According to this classification, Kansas has 7 city districts, 9 suburban districts, 65 town districts and 210 rural school districts. Table 1 shows the number of science teachers according to the type of district in which they work. The first column is the number of teachers who are eligible to retire now at the previously discussed 85 threshold. Rural districts have the highest preportion of their science

teacher workforce currently eligible to retire (17.5%) followed closely by town districts (17.1%.) This means the vast majority of Kansas school districts (275 out of 291) face the prospect of replacing more than 1 out of every 6 of their science teachers due to retirement.

| | Mid and Early Career | Eligible to Retire | Percent Eligible |
|---|---|---|---|
| City Districts | 447 | 34 | 7.6% |
| Suburban Districts | 289 | 42 | 14.5% |
| Town Districts | 563 | 96 | 17.1% |
| Rural Districts | 718 | 126 | 17.5% |

**Table 1: Science teachers by district classification**

In this analysis, we chose to use secondary science teacher data (2009-2010) so that we could understand a specific component of the teaching workforce. General teacher workforce statistics are not very helpful in predicting changes within specific subgroups of teachers. In this case study, the specific subgroup of teachers is those teachers who teach at least one class section of secondary science. Separating teachers by discipline allows for analysis of workforce variables specific to that particular subgroup. For example, it is important to understand that retirement is not the primary reason that secondary science teachers leave teaching. However, based on this data, it is clear that not all of the teachers will retire when they become eligible however.

Retirement numbers can provide useful guidance for the necessary production of new science teachers. Teacher retirements in Kansas provide a relatively consistent target for new teacher production, since the individuals who do retire will leave the workforce and not return. It is also important to understand the geography of the teacher workforce; in this case, retirement. Teacher shortages are often a local issue. In responding to the loss of a secondary science teacher, a small and rural district has special challenges in both attracting and retaining a replacement science teacher. The Kansas secondary science teacher data reflects the potential for geographically widespread teacher shortages over the next ten years as a result of retirement. Specific policies and programs need to be

developed that address a variety of specific local needs. This will ensure that all students continue to have availability to high-quality teaching and discipline-prepared science teachers across the State. It is hoped that the insights emerging from this state level case study will inform all stakeholders on actual needs of their local communities.

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