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Where Have All the Teachers Gone?

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Abstract

A rising need for teachers is projected for California and the nation during the next decade. Sound policy for teacher preparation should not only foster a capable workforce, it should also assure that the supply of qualified teachers balances with employment demand. A conceptual model is proposed to describe the flow of individuals through teacher preparation programs and the workplace. In California the workforce is projected to grow by thirty percent over the next ten years, stimulating the demand for teachers. At present the number of newly credentialed teachers exceeds the number hired. However, the apparent abundance masks an oversupply of teachers in some curricular and geographic areas and shortages elsewhere. Evidence for a lack of balance between supply and demand is found in an upward trend of emergency hiring of teachers who do not meet all requirements for a credential and low employment rates for first-time college and university prepared teachers. The asymmetry between supply and demand could be redressed partly through better retention of working teachers and closer coordination of preparation programs with the needs of schools in their service areas.

A basic concern for state and federal policymakers who fund and regulate public school systems is determining how many teachers are needed to provide a desired level of service to a given student population. The number of students assigned to a teacher, a measure of workload, presumably influences the way in which a teacher prepares, delivers instruction, manages the classroom, etc. Conventional wisdom suggests that lower teacher workloads should result in more attention to individual students, and stronger student outcomes. The Tennessee studies of class size found that teachers in smaller classes have more time to give to individual children. (Mosteller, Light, and Sachs, 1996) In Tennessee a reduction in class size from 23 to 15 in grades K 3 speeded up learning and continued to confer lasting benefits to students when they attended

larger classes in later grades. Even so, there is ongoing debate among researchers about the relationship between class size and student achievement. (Glass, 1979; Greenwald, Hedges, and Laine, 1996; and Hanushek, 1996)

Such debate is understandable given the increased costs of smaller classes. For example, California policymakers in 1996 allocated $771 million for a statewide reduction in class sizes for grades K-3. According to Kirst, Hayward, and Koppich (1995) California appropriations for K-12 education consume 35% of the state's general fund, with teacher salaries accounting for 80 percent. The average annual teacher salary in California is about $40,000. In 1995-96 there were about 5.4 million students enrolled in California's public schools, along with 232,000 teachers, yielding a student-teacher ratio of 23:1. In order to reduce this ratio by one point to 22:1, it would be necessary to increase the pool of working teachers by 10,000 at a projected cost of $400 million. Of course, actual costs could be more or less depending on how the increase is achieved. The pool of working teachers could be enlarged by slowing the transition of teachers out of school employment, by recruiting more formerly employed teachers back into service, or by recruiting more first time teachers from traditional or non-traditional preparation programs. Whatever the methods, employing more teachers, means drawing money away from competing policy goals, a decision which is attended by debate.

Teacher Supply and Demand

An evaluation of the supply of teachers in relation to demand provides relevant background for such policy choices. There are at least two significant dimensions to an analysis of supply and demand. One dimension relates to the skills and abilities expected of teachers. For example, California has a linguistically and culturally diverse student population. Many of California's teacher preparation programs have added training to facilitate adapting instruction in culturally appropriate ways and language acquisition. While more extensive teacher preparation is intended to improve instruction, it usually consumes additional time and resources. Darling-Hammond and Hudson (1990) and the report from the National Commission on Teaching and America's Future (1996) discuss teacher preparation issues in detail. Reynolds (1991) comments that teacher licensure is intended to protect the public from harm. Ashton (1996) notes that teachers with regular state certification receive higher supervisor ratings and student achievement than teachers who do not meet standards. If teachers are not adequately prepared for their jobs and cannot teach effectively, they place their students at risk. The requirements for a teaching credential are designed to provide assurance that teachers are adequately prepared. Ideally, such requirements reflect a consensus of expert practitioners, teacher educators, and researchers. The substance of teacher preparation is not the main focus of this paper.

The second dimension of an analysis of teacher supply and demand describes the flow of people into and out of public school employment. Primary components of this dimension are the hiring needs of public schools and the capacity of various sources to meet those needs. Major sources of credentialed teachers include college and university preparation programs and re-entrants from the reserve pool of previously employed teachers. Other numerically less prominent sources are school district and university programs to facilitate the mid-career transition of people into teaching from jobs in other industries or the military.

The relationship between the two dimensions of preparation and flow is complex. One hypothesis is that certification and licensure requirements restrict access to the teaching profession. Other conditions remaining equal, higher standards will depress the numbers of teachers who are prepared. Under this hypothesis there are two ways to meet increased demand. One way is to lower the requirements, reducing the time and cost required to become a teacher. A risk of this strategy is that less well prepared teachers may tend to be be less effective in their

jobs and more prone to attrition. A second way is to provide additional incentives to prospective teachers, for example, higher salaries or better working conditions.

When there are insufficient numbers of suitably credentialed applicants, California school districts can hire individuals on emergency permits who lack some requirements for a credential, usually proof of competence in their subject(s) of instruction or pedagogy. (Hart and Burr, 1996) Approximately one-third of emergency permits in 1994-95 were issued to individuals without the training to teach or work with children. Emergency permits are most often granted in the areas of special education, bilingual education, mathematics, and science. Emergency permit hiring is more prevalent in California's large urban districts than elsewhere. Where the need is ongoing, emergency permits are renewed annually. About sixty percent of California's emergency teachers are teaching on renewals of old permits, with no limit on the number of possible renewals. Overall the percentage of teachers on emergency permits has grown steadily since 1989, with much but not all of the increase related to more stringent credentialing requirements in special education.

School district demand for teachers is influenced by the willingness of prospects to apply for jobs. Tierney (1993) surveyed employment decisions of recent graduates of teacher preparation programs and school district personnel offices in California. Most graduates intended to teach at public schools within California and began searching for employment during or immediately following the completion of their programs. Over half preferred to teach within 25 miles of their current home. The most important reasons for applying to their chosen districts included: closeness to their current home, availability of assignment, and reputation of the district. The school district priorities for evaluating candidates included: job interview, performance in student teaching, candidate enthusiasm, and reference letters. Although school districts generally require transcripts, the reputation of the credential program, the candidate's academic record, and the reputation of the undergraduate institution were less heavily weighted.

An additional factor influencing the demand for qualified teachers is the rate at which teachers leave public school employment. One challenge in estimating teacher attrition is that few research studies continue long enough to observe the departure of all participants. Willet and Singer (1991, p. 411) comment that "the clearest signals about teachers' careers will come from studying cohorts of teachers whose professional lives were tracked from a common reference point - their entry into teaching." They recommend survival analysis as a statistical method for coping with such "censored" data. Longitudinal tracking of individuals permits the calculation of various statistics, including survival probabilities, or the proportion of an initial cohort surviving through successive years. Median career length is computed as the elapsed time until half the cohort has left. Hazard probabilities are the conditional probabilities that a teacher will leave, given that he or she survived through the end of the previous year.

Not all teachers who quit permanently sever their ties with public schools. A significant part of the demand for teachers can be met by rehiring individuals who have previously taught. Beaudin's (1993, 1995) studies describe factors influencing the reentrance of previously employed Michigan teachers into public school service. Teachers were more likely to return if their instructional specialties provided limited opportunities for higher paid jobs outside of education. They were more likely to return if they had more than two years of teaching experience coupled with a masters degree, or if they were older when they interrupted their career. About 55 percent of reentering teachers returned to their original school districts. The probabilities of returning to the original district were higher for those districts with higher salaries and higher levels of funding. Individuals with more years of teaching experience and who only interrupted their careers for one year were more likely to return to their original districts.

Nationally, between 1988 and 1994, schools hired increasingly larger proportions of first-time teachers and smaller proportions of reentrants. (NCES, 1996a) In 1994 about 57

percent of first-time teachers came fully prepared from college or university programs, a decrease of about 10 percentage points since 1988. Possibly a consequence of this decrease, many students are being taught core academic subjects by teachers without adequate educational qualifications in their assigned fields. (NCES, 1996b) For example, in grades 7-12 during 1990-91 about one fifth of students received instruction from underqualified teachers in English, one-quarter of students in mathematics, thirty-nine percent in life science or biology, fifty-six percent in physical science, and over half in history or world civilization.

NCES (1996c) estimates that total K-12 enrollment will increase from 49.8 million in 1994 to 54.6 million by 2006, an increase of about 10 percent. During the same period the number of high school graduates is estimated to increase by 21 percent. Perhaps reflecting uncertain prospects for growth in higher education, NCES projects the number of bachelor's degrees to increase, either by 0.5 percent under a low alternative, or by 22 percent under a high alternative. Under a middle alternative, the number of classroom teachers is expected to increase from 2.96 million in 1994 to 3.43 million by 2006, a rise of 16 percent.

Supply and Demand Model and Indicators

An evaluation of teacher supply and demand should include estimates of the numbers of teachers needed, along with the capacity of primary sources to meet that demand. Ideally, a flow analysis would track individuals as they make their way through postsecondary education or the workplace into and out of public school teaching. Given that such tracking systems do not exist in California or many other states, other sources of data are used to construct indicators which can be used inferentially. Using indicators to make inferences may less satisfactory than using tracking systems. However an indicator based analysis is superior to uninformed guesswork.

A rational method for constructing indicators of the flow of individuals through institutions involves a conceptual model. One simple model includes four main components: the K-12 school system, the college/university preparation programs, the pool of re-entrants, and the pool of less than fully qualified individuals who are willing and permitted to work on an emergency basis. Increased K-12 student enrollment for example, requires hiring more teachers in order to sustain a given student-teacher ratio. The number of teachers available depends in part on enrollments in college and university preparation programs, and the capacity of colleges and universities to serve undergraduates. The pool of K-12 graduates is a source of prospective college students, and colleges/universities need enrollment to sustain degree and credential programs. Additionally, there is a continually replenished pool of former teachers, some of whom are interested in re-entering the profession. Where school districts cannot recruit and hire a sufficient number of fully qualified teachers, they turn to emergency permit hiring. While this particular model can be refined, it provides a starting point for discussion.

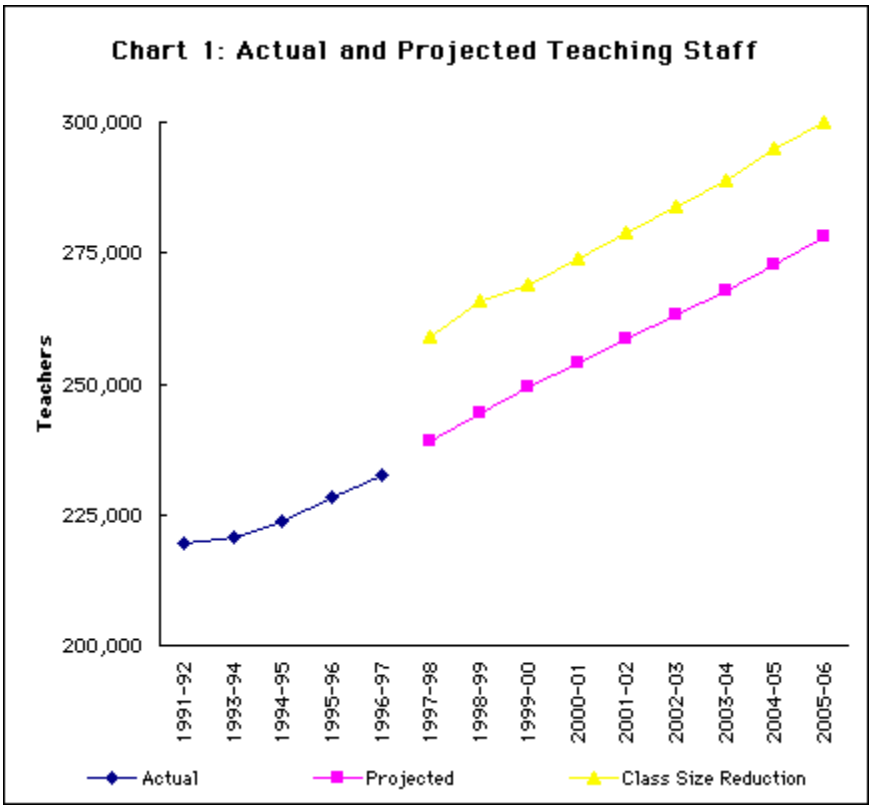
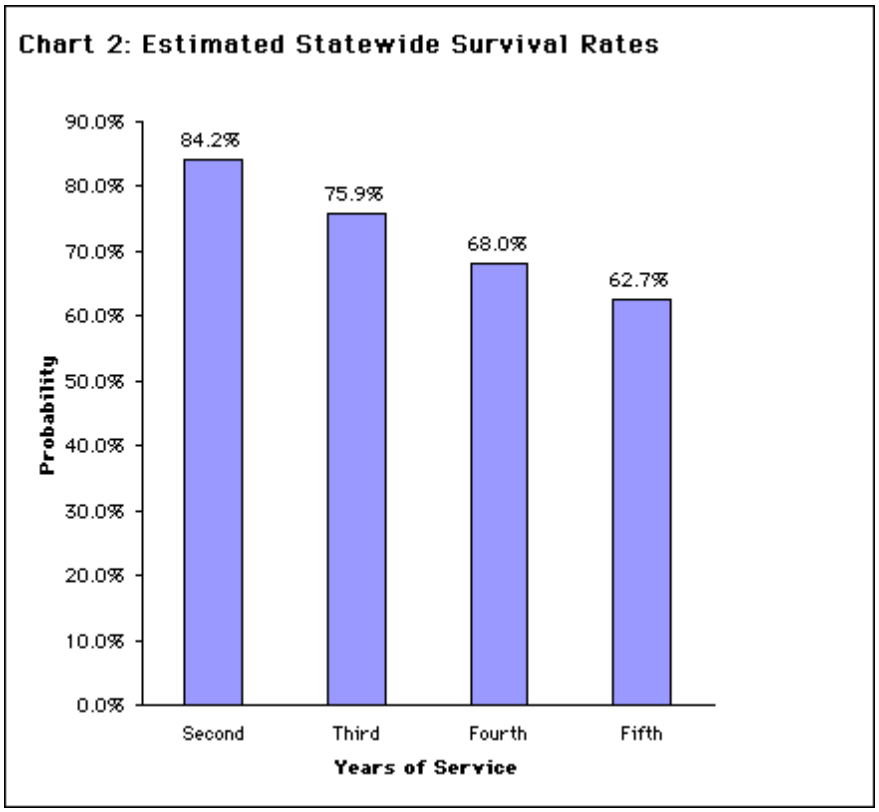


Chart 1 displays California's actual and projected graded K-12 enrollment and numbers of classroom teachers. (See Note 1.) The actual average ratio of K-12 pupils to classroom teachers from 1991-92 through 1995-96 is 23 to 1. This ratio is not a measure of class size, given that it does not take account of physical classrooms. As an overall measure, it encompasses situations with typically low student teacher ratios, such as special education, and situations with high ratios, such as some physical education classes. The projected numbers of teachers from 1996-97 onward assume continuation of the 23 to 1 student teacher ratio. During the fall of 1996 the California Legislature enacted a program, which gives incentives to school districts to reduce class size in three elementary grades. Under this program there is a limit of twenty students in a "class." An estimated 20,000 additional teachers are needed to fully implement this program, which represents about an eight percent increase in the size of the workforce. The projected number of teachers under the Class Size Reduction Program is calculated by applying an eight percent increase to the original projections. Over the next ten years, with class size reduction, the teaching workforce should increase in size by 68,000, which is about 30 percent growth.

The total number of teachers employed at any given time depends on the flows of individuals in and out of the workforce. These flows include hires of first-time or previously employed teachers, retirements, and attrition of experienced teachers. Information about retirements is available from The California State Teachers Retirement System. (See Note 2.) Between 1990 and 1995 and average of 5,150 K-12 public school teachers retired each year, typically with 28 years of service at an age of 61. The percent of staff retiring varied from a low of 1.8 percent in 1990 to a high of 2.3 percent in 1993. On average about 2 percent of teachers retired each year.

Estimates of teacher attrition can be made using data from the California Department of Education annual staff surveys of professional assignments. (See Note 3.) School districts provide the number of years of service for each teacher. A cohort of new first-time teachers is operationally defined as those who are beginning their first year of service. The size of this cohort in its second year and following years is estimated by counting the number of teachers in the district who are beginning their second year in the district and overall. The available data

neither identify nor permit the longitudinal tracking of individuals, precluding a traditional application of survival analysis techniques. Even so, it is possible to develop estimates of the relevant survival statistics.



Cohorts of new first-time teachers were estimated from the surveys of professional staff for 1986-87 through 1995-96. Overall estimates of survival probabilities for this period can be made by calculating the percent of the original cohort which appears to be present in succeeding years and averaging across cohorts. By definition 100 percent of such teachers are present the first year. As displayed in Chart 2, an average of 84 percent were present at the beginning of the second year, 76 percent the third year, 68 percent the fourth year, and 63 percent the fifth year. An estimated half of all new first-time teachers remain at the beginning of a seventh year. Annual attrition of the total population of teachers is estimated at six percent. (See Note 4.) The risk or hazard that a teacher will quit in a particular year, given that he or she survived through the end of the previous year was 16 percent after the first year, 10 percent after the second, 10 percent after the third, and 9 percent after the fourth.

The estimated eight percent of teachers who leave the workforce annually due to retirement and attrition influences the annual number that must be recruited and hired. For example, in round numbers:

228,000 teachers employed in 1994-95 year
(minus) 18,000 eight percent attrition and retirement

210,000 teachers remain available for 1995-96

However, about 232,000 teachers were actually employed in 1995-96, so that 22,000 teachers were needed to fill the gap. More arithmetic indicates that about forty percent of those hired in 1995-96 were re entrants, compared to 60 percent first-time teachers.

22,000 teachers actually hired in 1995-96
(minus)13,500 actual first time teachers hired in 1995-96

8,500 re-entrants in 1995-96

Among other requirements, California teachers must possess a four-year undergraduate degree from a regionally accredited college or university, and a major in their subject area of instruction. A "fifth-year" teacher preparation program traditionally supplements the undergraduate degree. For this reason, the capacity of colleges and universities to serve undergraduates and produce undergraduate degrees influences teacher preparation. Table 1 displays annual counts of undergraduate degrees produced by the state's accredited public and independent colleges and universities along with counts of students from public high schools graduating five years earlier. (See Note 5.)

Table 1

Undergraduate Degrees and High School Graduates

Year of Degree	Number of Degrees	Graduation Year	High School Graduates
1989-90	96,270	1984-85	225,448
1990-91	99,553	1985-86	229,026
1991-92	105,446	1986-87	237,414
1992-93	108,103	1987-88	249,518
1993-94	109,850	1988-89	244,629
1994-95	107,661	1989-90	236,291
1995-96	*103,179*	1990-91	234,164
1996-97	*107,775*	1991-92	244,594
1997-98	*109,857*	1992-93	249,320
1998-99	*111,515*	1993-94	253,083
1999-00	*112,448*	1994-95	255,200
2000-01	*114,730*	1995-96	*260,378*
2001-02	*116,461*	1996-97	*264,307*
2002-03	*123,178*	1997-98	*279,552*
2003-04	*125,640*	1998-99	*285,138*

The average number of years spent pursuing an undergraduate degree is disputed, but likely depends on the type of institution (public versus private) and selectivity. Although the undergraduate degree conventionally takes four years, many students require five years or longer. Table 2 compares the number of degrees in a given year with the size of the public school graduating class five years previously. The ratio of graduates (lagged by five years) to undergraduate degrees is 0.44. Assuming that this ratio of graduates to degrees remains constant, the projections of high school graduates can be used to estimate the future supply of undergraduate degrees. Under this assumption, over the next ten years there will be an average annual net increase of 2,807 undergraduate degrees per year. The assumption of a constant ratio

is probably optimistic, given a recent analysis of funding for public higher education and student aid in California showing that the state's colleges and universities probably will not receive additional resources needed to increase their capacity to serve future potential undergraduates. (Breneman, 1995)

Decreases in the number of college graduates in the late 1980s are correlated with a leveling off and actual decrease in the number of undergraduate degrees granted in recent years. The projections suggest that there will be continued decline in the number of undergraduate degrees for one more year, potentially followed by increases through 2003-04. The short term trend suggests that there will be decreasing numbers of students completing teacher preparation programs. Over the longer term, assuming that programs continue to attract and serve students at the same level as in the past, there should be increasing numbers of college and university prepared candidates. On the other hand, given the prospect of limited growth for higher education generally, it may be unrealistic to expect significantly greater numbers individuals completing teacher preparation programs.

Table 2 displays the number of newly prepared teacher candidates and the number of new teachers actually hired. (See Note 6.) New or first credentials exclude renewals, a process which California requires every five years. The number of college/university credentials includes prospective teachers who completed a college or university program. The number of emergency permits or waivers reflects people who have not met all the requirements for a credential. Out of state candidates, who are certified elsewhere, can be authorized to teach while they complete California requirements. The "Other" category includes interns and individuals who are converting types of credentials no longer in use to current ones.

Table 2

Actual New or First Time Credentials and New Hires of First Time Teachers

Year	Total	College/ University	Emergency/ Waiver	Out of State	Other	New Hires
1992-93	22,341	13,022	4,055	3,649	1,615	9,436
1993-94	22,808	13,332	5,235	3,083	1,158	12,530
1994-95	22,485	12,746	5,628	2,938	1,173	14,090
1995-96	22,767	13,432	5,408	2,700	1,226	13,535

Overall, about 58 percent of candidates were from colleges/universities, 22 percent received emergency permits or waivers, 14 percent came from out of state, and 6 percent from other sources. Emergency permits are issued only when a job offer is pending, so virtually all such recipients are employed. It is likely that teachers from out of state who seek a California credential have job offers. Candidates in the "Other" category who are converting outdated credentials may or may not be currently employed as teachers. School district interns have pending offers.

Dividing the number of new hires by the total number of credentials produces a rate which ranges from .42 to .62, averaging .55. This suggests that at most about fifty percent of all new or first time credential holders are actually hired. However, the probability of employment appears to be more remote for the college/university group, which must compete against emergency permit holders, out of state candidates and others. As stated earlier, virtually all emergency permit holders have job offers. It is not known how many out of state candidates or "other" candidates gain employment. Plausible estimates are that at least three fourths of out of state

candidates and half of "others" have jobs. If true, the four year average hiring rate for college/university credential holders is .33.

The four year trends for production of college/university credentials appears to be flat. This relatively flat trend is consistent with the recent leveling off and decline in the numbers of undergraduate degrees produced. It may also be a response to the apparently rigorous competition for a limited number of jobs and the prevalence of emergency permit hiring. During the same period the number of emergency permits and waivers increased by about one third, and new hires increased by about 43 percent. The number of credentials granted to candidates from out of state has declined by about 25 percent, possibly in response to California's weak economic conditions during the first half of the decade.

Discussion

Perhaps the most basic finding is the projected increase in the size of the teaching workforce. Driven by increasing student enrollment, the number of teachers needed will grow by about thirty percent during the next ten years. Given California's compulsory school attendance laws and the virtual entitlement of the opportunity to earn an high school diploma, schools must fill these teaching slots.

Does the increased demand for teachers prophesy a shortage by the year 2005? Assuming that current rates of attrition, retirement, and hiring of re-entrants remain constant, it is difficult to make a case for shortages. At the beginning of the school year in 2005 there will be an estimated need to hire about 29,000 teachers, of whom 17,400 will be first-time credential recipients. There were over 17,000 first-time or new credentials issued in 1995-96, exclusive of emergency permits. California's improving economy in coming years will probably lure more teachers from other states, further mitigating any prospect of a shortage. On the other hand, misalignment in the supply and demand of teachers is suggested by the increasing number of emergency permits issued and the apparently low employment rates for first-time college and university prepared teachers.

An estimated 22 percent of new teachers are currently hired on an emergency basis. Reynolds (1991), the National Commission on Teaching and America's Future (1996), and Hart and Burr (1996) suggest that this practice raises concerns about protection of the public interest. One concern is whether teachers on emergency permits are as effective with students as regularly credentialed teachers. Given that teachers on emergency permit lack proof of competence in their instructional area or in teaching techniques, they may well not be as effective. A second concern is how long emergency permit teachers remain in service. A lack of preparation on top of the stress of adapting to the pressures of a school environment could result in a higher attrition rate, compared to regularly credentialed teachers. If true, then the increased numbers of emergency permits should be associated with higher levels of attrition. To the extent that higher attrition rates and lower levels of preparation impede the development of a stable and experienced workforce, they probably contribute to low student achievement, poor discipline, and other undesirable student outcomes. There are administrative costs associated with teacher attrition for example, the resources expended for recruitment, hiring, and one or more years of induction. There will probably be negative consequences for the teaching staff, including lower morale, poorer attendance, and increased disciplinary problems.

While the need for teachers is growing, a corresponding increase in the capacity of teacher training programs seems unlikely. The decreasing numbers of high school graduates and degrees produced five years previously indicate that in the near term undergraduate degrees will continue to decrease, possibly depressing the enrollments in college and university teacher preparation programs. Over the next ten years, assuming optimistically that colleges and universities will be able to serve more students, there will be an estimated 15 to 20 percent increase in the production

of undergraduate degrees, corresponding to a thirty percent increase in the need for teachers. The expansion of teacher preparation program budgets at public universities would likely be difficult, particularly given present difficulties in competing for funds. In the unlikely event that more resources for teacher preparation programs are forthcoming, several years will probably be required to expand the programs. To the extent that such expansion encompasses better coordination with local school district needs, it may help to remedy emergency permit hiring.

An alternative to expanding preparation programs is to improve the survival rate of teachers on the job. Currently it appears that about half the cohort of first-time teachers survives past seven years, with greater numbers of teachers leaving the profession after the first or second year. Programs to retain more teachers for more years in the profession could reduce the need for hiring. Although such programs would be helpful statewide, they would be most useful in geographical and curricular areas that experience high rates of attrition.

An estimated one third of individuals who complete college and university preparation programs actually seek and gain regular teaching employment in public schools. The results are consistent with Tierney's (1993) finding that prospective teachers heavily weigh the closeness of jobs their current home and availability of assignment. School districts may find that the skills and abilities of the available candidates do not match the positions to be filled. On one level, the function of teacher training programs is to prepare teachers, not to guarantee employment. On the other hand, the room for improvement in the employment rate suggests a mismatch between labor market needs and the preparation programs.

Another alternative to college and university programs is the reserve pool of teachers who were previously employed in public schools and now wish to re-enter service. Over half of the teachers hired in 1995-96 had previous experience. Beaudin's (1993, 1995) findings suggest that the decision to re-enter may depend heavily on financial issues. A previously employed teacher is more likely to re-enter if the teaching job is geographically convenient and is higher paying than private sector alternatives. The hiring of re-entering teachers provides a context for interpreting the attrition of first-time teachers. While many first-timers leave after one or two years, it appears that many of them eventually return to teaching.

Conclusion

It was earlier noted that the quality of teacher preparation and the quantity of available teachers are not independent. A traditional interpretation of this statement is that higher preparation standards by limiting access threaten the supply of teachers and the staffing of schools. It would be unfortunate if the projected need for more teachers were to cause an erosion of standards for teacher preparation. This scenario leads towards lower student performance, less job satisfaction, higher teacher attrition, increased public discontent, and further erosion of standards. Easier teacher preparation programs and emergency permit hiring are expedient solutions to short term employment needs. However, such expediency may bring about greater long term problems.

Given the findings of this study a different interpretation and policy seems plausible. Teachers who are more thoroughly prepared to meet the specific needs of schools may persist longer in their jobs. If this is true, higher retention rates of qualified teachers would result in the establishment of a more stable, satisfied, and highly competent workforce, slowing the revolving employment door at school district offices, and reducing the need for emergency permit hiring. An additional, perhaps more important benefit is that better prepared teachers should be more effective in their jobs and assist more students to higher levels of attainment. A policy of higher standards and more support may be difficult to achieve in the near term. Public schools will have to be weaned from expedient employment practices, and preparation programs will need to become more rigorous and attentive to local needs. In the longer term this policy will benefit

students and the teaching profession.

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Notes

1. The actual graded K-12 enrollment and numbers of teachers shown in Table 3 are from the California Basic Educational Data System (CBEDS) of the California Department of Education. The enrollment figures are published annually in a document entitled "California Public Schools Enrollment." The numbers of teachers are published annually in a document entitled "Count of Certificated and Classified Staff in California Public School Districts." The teacher counts reflect certificated staff with classroom assignments, and exclude administrators and pupil services staff.

Table 3

Actual and Projected Enrollment and Teaching Staff

School Year	Graded K-12 Enrollment	Teachers	Class Size Reduction Program
1991-92	5,001,670	219,353	
1992-93	5,089,808	220,871	
1993-94	5,166,261	223,932	
1994-95	5,242,078	228,204	
1995-96	5,367,926	232,488	
1996-97	*5,495,075*	*238,951*	*259,000*
1997-98	*5,623,422*	*244,532*	*266,000*
1998-99	*5,737,874*	*249,509*	*269,000*
1999-00	*5,841,535*	*254,017*	*274,000*
2000-01	*5,945,067*	*258,519*	*279,000*
2001-02	*6,052,242*	*263,179*	*284,000*
2002-03	*6,160,231*	*267,875*	*289,000*
2003-04	*6,271,881*	*272,730*	*295,000*
2004-05	*6,392,367*	*277,969*	*300,000*

The projections of graded public school enrollment are published by the California Department of Finance Demographic Research Unit in a document entitled "K-12 Graded Public School Enrollment by Ethnicity, History, and Projection - 1995 Series." The projections are based on a grade-progression ratio (or cohort survival) projection method and the most recent ten years of historical enrollment data from CBEDS.

2. Counts of new retirants from K-12 districts from 1990 through 1995 were obtained by special request in February, 1996 from the California State Teachers Retirement System (CSTRS). The counts are cumulated over fiscal years ending June 30. Unlike the counts regularly published in the CSTRS annual report which include community college district staff, these data reflect certificated staff in K-12 districts only. Teachers make up 92 percent of all employed certificated staff according to published California Department of Education statistics. Therefore the number of retired teachers is estimated as 92 percent of all K-12 retired certificated staff counted by CSTRS.

3. Counts of teachers were obtained from a direct tabulation of the results of the annual Professional Assignment Information Form (PAIF), an annual survey conducted as a part of CBEDS. The information requested on the PAIF is required of each certificated staff, and includes demographics, assignments, and position/credentials. A "first-time" teacher is operationally defined as someone whose primary assignment is teaching and who reports being both new to the teaching profession and new to the district.

The CBEDS PAIF file does not include individual identifiers so that teachers cannot be tracked from year to year. It is possible to estimate cohort attrition by counting the number of teachers who report being their second year both at the district and in the profession, in their third year, fourth year, and so on. Unfortunately, this method does not account for those teachers who transfer from one school district to another, re entrants, or those who accept administrative jobs. The method of estimating attrition therefore undercounts the number of teachers who remain in the profession. On the other hand, when a teacher accepts a promotion or leaves for another district, a school district must recruit, select, and induct another teacher in order to fill the vacancy. Cross district mobility within the teaching profession has costs which are similar to those caused by attrition.

4. Table 4 contains actual counts of the number of teachers who reported that they were new to service and new to a district, who reported two years of service in a district and overall, and so on, up through five years. The counts are arranged so that the size of an hypothetical cohort can be followed across a row. The Professional Assignment Information Survey was not conducted in 1992, so data from that year are not available. The consequence is that survival and hazard rates for the 1992 cohort cannot be estimated.

Table 4

Actual Counts of Teachers by Years of Service

Cohort Year	First Year	Second Year	Third Year	Fourth Year	Fifth Year
1987	9,025	7,317	6,450	5,729	5,235
1988	8,301	7,242	6,433	5,865	n/a
1989	9,446	8,151	7,212	n/a	6,208
1990	11,523	10,076	n/a	8,002	7,471
1991	12,153	n/a	8,930	8,275	7,505
1992	n/a	7,658	7,235	6,482	5,792
1993	9,436	8,459	7,331	6,444	

1994	12,530	10,439	9,916
1995	14,090	10,504	
1996	13,528		

An exponential regression procedure was used to estimate the number of years the average teacher remains in the classroom. The independent variable was the number of years survived, ranging from 2 to 5. The dependent variable was the probability of survival associated with that particular number of years. Each cohort furnished up to four pairs of such numbers, depending on the starting year, which ranged from 1986-87 through 1995-96. The Excel logest function estimated the parameters for the model Y = B*M^X, with B = 1.026, and M = 0.904. The regression model estimates retention at 83.9 percent at the beginning of the second year, 75.9 at the beginning of the third, 68.6 for the fourth, 62.0 for the fifth, 50.7 for the fifth, and 45.9 for the sixth. It appears that about half of the cohort remains at the beginning of the seventh year.

Similar techniques can be used to estimate the annual rate of teacher attrition. Empirical hazard probabilities (the conditional probability that a teacher will leave, given that he or she survived through the end of the previous year) are calculated and used to fit an exponential regression model similar to the one used above to estimate survival rates. The parameter estimates for this model were B = 0.145, and M = 0.892. The fitted regression models are used to estimate survival and hazard probabilities for years 2 through 30. A weighted average of the hazard probabilities is calculated, using the survival probabilities as weights. The survival probability is interpreted as an estimate of the percentage contribution of an historical cohort to the current population of teachers. The associated hazard probability is the likelihood of attrition from that cohort. The weighted average was 6.0 percent, estimating the annual rate of teacher attrition. One caution is that this estimate relies on extrapolation of statistics beyond the range of available data. On the other hand, the result is identical to the annual attrition rate cited by Willett and Singer (1991, p. 410) for the United States as a whole and in various individual states.

5. The numbers of undergraduate degrees from 1989-90 through 1994-95 are taken from a report, "The Performance of California Higher Education," produced annually by the California Postsecondary Education Commission. The counts include degrees produced by the University of California, the California State University, and by accredited California independent colleges and universities.

The actual counts of high school graduates are taken from CBEDS K-12 enrollment reports, as described in Note 1. The projections of high school graduates are published by the California Department of Finance Demographic Research Unit in a document entitled "K-12 Public High School Graduates by Ethnicity, History, and Projection - 1995 Series." The projections are based on a grade-progression ratio (or cohort survival) projection method and the most recent ten years of historical enrollment data from CBEDS.

An unknown number of students who enroll at California colleges and universities and earn undergraduate degrees come from private schools in California, or from schools out of state. Equally unknown is the number of people who complete an undergraduate degree in California and leave the state, or who complete a degree elsewhere and move to California. Even so, it appears that the bulk of teachers employed in California also received their undergraduate education in-state. Table 3, which includes counts of out-of-state applicants appears to support this assumption.

The ratio of graduates to degrees, while providing a basis for making projections, simplifies a complex situation. Production of undergraduate degrees depends not only the number of potential degree seekers, but also on the level of resources that colleges and universities have to serve students, and on the goals of high school graduates. The ratio appears to be quite stable over the years covered in Table 3, and the correlation between graduates and degrees is quite stable.

6. The counts of first time and new credentials were obtained directly from the Credential Automation System, a database which is maintained by the California Commission on Teacher Credentialing. Although records are kept of credential and permit issuances, no records are kept of actual public school employment. The number of new or first-time credentials is an approximate count of the number of people receiving credentials. A few individuals may receive more than one new or first-time credential. It is possible that a person could receive a credential to work in one area, but then receive an emergency permit to teach in another subject. Although most people with emergency permits have pending job offers, it is also possible that some may not actually report for work.

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Employment Experience

- Consultant. California Commission on Teacher Credentialing. 1995 - present. Plan, organize and conduct research on teacher credential examinations, including the California Basic Education Skills Test. Contract management for the Multiple Subjects Assessment for Teachers. Develop and track indicators of teacher supply and demand.
- Director. Planning, Effectiveness and Accountability Unit, Chancellor's Office, California Community Colleges. 1990 - 1995. Manage accountability task force. Develop federal and state accountability programs.
- Administrator. Educational Planning and Information Center, California Department of Education. 1984 - 1990. Manage and develop K-12 accountability policies and programs.
- Consultant. California Assessment Program, California Department of Education. 1980 - 1984. Conduct research and assessment projects.
- Evaluation Specialist. Northwest Regional Educational Laboratory, Portland, Oregon. 1979 - 1980. Deliver evaluation technical assistance and training to state education agencies.
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