Literature Search

*STEM Teacher Recruitment*

Berry’s (1986) case study of 80 non-education college seniors in 1985 considered how academically able students might be attracted and retained in public school teaching. Those students classified as academically able had SAT scores over 500 out of 800 and a grade point average of 3.0. Math and science college students preferred “a pure and logical focus and indicated that conversely teachers worked with intangible outcomes and too much uncertainty” (p. 274). Those in math and science felt that they did not have the “teaching-type personality” and would rather “do something” with their knowledge than try to “sell” (p. 274) it to students. Science students could not envision explaining the content and advanced concepts of their subject area at a high school level.

Berry’s findings indicated that the students’ own experience in public schools was the most influential factor in their decision not to teach. Based on their own high school experience students deduced that teaching was a bureaucratic and unstimulating job. University laboratory classes for students of science, technology, engineering and mathematics are conducted in a more open ended and creative way than laboratory classes taught in kindergarten through twelfth grade schools (Moreno, 2007). Novice STEM teachers must learn to balance lecture and hands-on learning in their own secondary school classrooms, although this can be in conflict to the intent of the school district (Cooney, Shealy, & Arvold, 1998; Tomanek, 1996).

*National STEM Teacher Attrition Statistics*

Studies of teacher retention have consistently found that the highest rates of turnover and attrition occur in teachers’ first five years of teaching, that middle and high school teachers are more likely to leave teaching than those in elementary grades, that teachers of math and science have higher rates of attrition than other content areas, and that teachers with higher academic ability measured by Scholastic Aptitude Tests (SATs) or American College Test are more likely

Ingersoll (2001) claimed that school staffing difficulties are a result of “a revolving door” (p. 29), due to high rates of early-career teacher attrition. The number of math and science teachers nationally certified each year is more than enough to compensate for turnover due to retirement but insufficient to cover losses due to turnover before retirement. Each year approximately 120% of the number of teachers newly hired in math or science positions, leave teaching (Ingersoll, 2007). Podgursky et al.’s (2004) analysis of teacher retention between 1992 and 2000 found that regardless of gender, teachers with high ACT ability in math and science left the classroom at higher rates than those with lower scores “indicating that sorting by ability is even more potent for this group” (p. 515).

Teacher Preparation Affects on STEM Teacher Attrition

Ingersoll et al. (2011) find that pedagogy preparation is strongly related to attrition among science and math teachers. Using data from the National Center for Education Statistics’ 2003-04 Schools and Staffing Survey and the 2004-05 Teacher Follow-up Survey, researchers evaluated attrition data of STEM teachers prepared by both traditional college programs and through alternative route programs. They found that first-year teachers who took 3 or 4 methods courses had a 36 percent lower odds of leaving the classroom as those who had not taken similar courses. In addition, learning how to select and adapt instructional materials; coursework in learning theory or child psychology; observation of other’s classroom teaching; and formal feedback on their own teaching were significantly and strongly related to STEM attrition rates. Ingersoll et al. caution that the findings could be more related to teachers’ pre-existing commitments to the profession or other career options, rather than their preparation. Controlling for these variables they report that findings regarding pedagogical preparation on attrition are still robust.
Inservice Causes of STEM Attrition

Ingersoll (2000, 2002, 2003, 2006) indicated that over half of all teacher attrition is due to job dissatisfaction, the pursuit of a better job or career in or out of education, and/or a lack of public respect. Ingersoll (2000) summarized the following reasons for STEM teacher dissatisfaction: 66%, poor salary; 32%, poor student motivation; 22%, poor administrative support; 21%, student discipline problems; 15%, lack of faculty influence and autonomy; 11%, intrusion on teaching time; 9%, class sizes too large; 6%, inadequate time to prepare; 1%, poor opportunity for professional advancement.

Henke, Zahn and Carroll’s 2001 study of more than 700 college graduates indicated that first-time teachers who major in engineering, math or natural science were less likely to be teaching five years after graduation than teachers who major in education, with a STEM attrition rate of 30% rather than 14% of others (as cited in Guarino et al., 2004). Of those who reported job dissatisfaction, the explanations included low salaries, lack of support from administration, student discipline, and lack of influence over school decision making (Kiepper & Barufaldi, 1998).

Dawson (2002) reported that teachers in math and science may have problems not experienced by teachers in other curriculum areas, such as obtaining and preparing laboratory materials or helping students understand particularly difficult content and skills. Early career science teachers reported that post-certification support of maximum value to them included graduate classes, written materials that they could refer to over time, an electronic network of teachers as mentors, and support via the internet or interactive communication.

Data reported by 1970-2008 alumni of Barnard College, Bryn Mawr/Haverford Colleges, Princeton University, Swarthmore College and Vassar College in 2009 Research

Secondary certification in grades sixth through twelfth was pursued by 62% of the CETE total population who participated in a survey (N=924). Science and mathematics certification represented 5.6 and 8.9 %, respectively of the all survey participants. The majority of mathematics teachers were men, and the science teachers were not gender dependent.
The percent of teacher certified in STEM areas who chose to teach after graduation/certification, 75%, was similar to the percent of teachers in other certification areas who also chose to teach.

The length of time teaching among CETE teachers certified in mathematics or science was not significantly different (p= 0.64) than the length of time taught by teachers in the other secondary certification areas. In fact, CETE secondary certified STEM teachers are 1.2 times as likely as CETE secondary certified teachers in art, English, foreign language and social studies to teach five or more years. STEM teachers are 1.9 times more likely to teach five or more years than not to teach five years.

Percent of Teachers who Graduated 1970-2001 disaggregated by Certification Area regarding the number of years taught in K-12 Public and Private Schools.

<table>
<thead>
<tr>
<th>Certification Area</th>
<th>Teaching less than five years</th>
<th>Teaching five or more years</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary (N=158)</td>
<td>40.5%</td>
<td>59.5%</td>
<td>100%</td>
</tr>
<tr>
<td>Secondary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Art (N=1)</td>
<td>100%</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>English (N=84)</td>
<td>39.3%</td>
<td>60.7%</td>
<td>100%</td>
</tr>
<tr>
<td>Foreign Language (N=12)</td>
<td>25.0%</td>
<td>75.0%</td>
<td>100%</td>
</tr>
<tr>
<td>Mathematics (N=40)</td>
<td>35.0%</td>
<td>65.0%</td>
<td>100%</td>
</tr>
<tr>
<td>All Sciences</td>
<td>34.6%</td>
<td>65.4%</td>
<td>100%</td>
</tr>
<tr>
<td>Biology, Physics &amp; General (N=26)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Studies (N=87)</td>
<td>40.2%</td>
<td>59.8%</td>
<td>100%</td>
</tr>
<tr>
<td>Secondary Sub-total (N=250)</td>
<td>38.0%</td>
<td>62.0%</td>
<td>100%</td>
</tr>
<tr>
<td>Elementary and Secondary Combined (N=408)</td>
<td>39.0%</td>
<td>61.0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Very few STEM teachers offered subject specific comments in their survey replies concerning the length of time they taught. Some former teachers mentioned that STEM teaching was “draining” (Survey, April, 2008), and a few alumni commented that “I was not intellectually
challenged teaching addition and subtraction, and I was not prepared for the emotional challenge of teaching poor Indian students remedial math” (Survey, April, 2008).

Only one former STEM teacher specifically mentioned in his/her survey comments that the lure of more lucrative career options influenced his/her decision to leave teaching, “I like money (at least I’m honest ;). I wanted to combine my science and education interests in a different way” (Survey, April, 2008).

Other STEM teachers who were teaching at the time of the survey commented from their students’ perspective. Some indicated that they chose to continue in teaching because “I know that I’m better at my job than some other random math teacher would be in the same position, so to leave would be to make life harder for my students” (Survey, April, 2008). While other STEM teachers who had left the classroom felt that they had not served their students well,

I chose to be licensed as a math teacher because I was good at math. Being good at something, however, does not necessarily make one a good teacher. I think to be a good math teacher (particularly for middle school students); one needs to love the subject. I like math, but I don’t think I love the subject in a way that I can impart to my students. (Survey, April, 2008)

References


