

**Report from the New Science Teachers' Support Network:  
What School Leaders Can Do To Support New Science Teachers**

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## **Supporting New Science Teachers: What School Leaders Can Do**

### **The Challenge of New Science Teacher Attrition**

Nationally, there is a growing shortage of science teachers. The science teacher turnover rate is approximately 15% annually (United States Department of Education-USDOE, 2004b) with a shortage of teachers prepared for these positions. For example, in 2003-2004 over half of secondary schools reported science teacher vacancies with 31% finding it very difficult or impossible to fill positions in the physical sciences and 21% reporting similar difficulties for the life sciences. As a result, 26% of secondary schools hire teachers that do not meet their state requirements for licensure and 34% use substitute teachers to fill vacancies (USDOE, 2006). Usually new underqualified science teachers have a bachelor's degree in science, but lack teaching experience or professional training in how to teach. These ill-prepared, new science teachers face the extra challenge of discovering how to teach on their own.

### ***Why New Science Teachers Leave***

Science teachers experience greater job dissatisfaction and are more likely to leave the profession compared to other subject area teachers (Ingersoll, 2000). NSTA (2000) found that the main reason teachers' leave teaching is job dissatisfaction, with "poor administrative support" cited as a major reason for dissatisfaction.

### ***The Consequences of Science Teacher Attrition***

Well-prepared teachers have the largest positive impact on high student achievement (Darling-Hammond, 2000, 2003). We know that science education in the

United States is falling short. For example, The Report by the National Commission on Mathematics and Science Teaching for the 21<sup>st</sup> Century (NCMSTTC, 2000) documents our need to improve science teaching and learning. Furthermore, results of the Trends in International Mathematics and Science Study indicated that United States' graduating high school students ranked well below the international average and 8<sup>th</sup> grade students performed below students from many developed countries (USDOE, 1998, 2004a). The Commission identified the lack of qualified secondary mathematics and science teachers as a major reason for these poor findings.

Teacher preparation and on-going development play a strong role in students' science performance. The Educational Testing Service found in its study, *How Teaching Matters* (Wenglinsky, 2000), that student achievement increases over 40 percent of a grade level when teachers are skilled at implementing hands-on experiences in class, by over 40 percent of a grade level when students have teachers who are trained in laboratory skills, and by 92 percent when teachers effectively use research-based assessment strategies. For new science teachers to have the potential to produce high-achieving science students, they need to know their science content and also be skilled in how to effectively plan, teach, and assess hands-on, laboratory-based science instruction. There are high costs associated with continually hiring, training, and losing new teachers, not only in dollars but also in staff moral and student achievement.

### **Ways to Reduce New Science Teacher Attrition**

The greatest resources are committed administrators and senior teachers who establish a collegial atmosphere where all teachers support those new to the profession.

This means setting up policies and procedures to provide positive working conditions and support for new teachers to succeed. It also means minimizing the seniority system where senior teachers get easy working conditions at new teachers' expense.

### ***Improving Working Conditions***

Teacher attrition can be reduced through attention to improving new science teachers' working conditions. Through improved working conditions, new science teachers are provided the time they need to learn how to teach well.

While it is tempting to hold off until the last possible day to hire an underprepared teacher in hopes of finding one who is more prepared, valuable training and planning time is lost. Administrators must weigh the potential benefit of hiring underprepared teachers early so that they can participate in summer professional development opportunities or prepare for teaching by reviewing school curriculum guidelines, surveying science equipment and materials, planning initial lessons, and setting up the lab. New teachers hired late start off teaching with a distinct disadvantage.

Careful thought needs to be given when developing teaching assignments for new science teachers. Science teachers have additional preparation time compared to teachers in other disciplines since science teachers must provision for regular classroom instruction plus laboratory-based instruction. New science teachers need to be assigned fewer different types of classes to teach so that the teacher can adequately prepare for inquiry-based, hands-on science instruction. By teaching only one type of science class (e.g. regular education chemistry), new science teachers have time during the teaching day to reflect on their teaching effectiveness. This in turn allows them to adjust their

teaching during the day to increase student learning. Instead, if the teacher is getting ready to teach another type of class (e.g. conceptual chemistry or, worse yet, a different science such as biology), they do not have time to reflect and revise their plans between classes. This also increases chances for compromising students' laboratory safety.

Room assignment is important to science teachers. New science teachers need to be assigned rooms that are purposely designed for science instruction. They need to be able to teach in one room so that they are not spending their time provisioning for the same science activity in different rooms. Consider having veteran teachers take on the extra burden of changing rooms instead of new teachers.

Since new teachers need extensive time to plan for effective teaching, it is especially important that new teachers not be asked to do additional duties such as coaching sports or coordinating the science fair. Administrators and senior teachers must be cognizant of the extra time it takes new teachers to plan for regular instruction plus laboratory-based instruction, and extra duties beyond those related to science teaching should not be assigned.

### ***Providing Adequate Support***

In addition to setting up favorable working conditions for new teachers, there are three general forms of support: first week information, resource support, and teaching support. Most school divisions do a good job of providing information teachers need the first week, but this is often where support ends. Establishing a plan and identifying a person responsible for providing this information will help new teachers with tasks such

as taking attendance using the school system's protocols, knowing procedures for making photocopies, and meeting resource personnel.

Another form of support is providing resources to enable teachers to teach. This goes way beyond informing teachers how to obtain textbooks, paper, and pencils. Depending on the technology available, resources range from overhead projectors, transparency pens, and transparencies to computers with projection systems. In addition to having the equipment, new teachers need someone to model effective use of equipment. Additionally, science supplies are needed to conduct science experiments. In order for students and teachers to conduct experiments, teachers need to know what science supplies and equipment should be found in all science classrooms, and the location of shared science supplies. Having easy access to supplies needed for teaching will enhance new teachers' effectiveness and likelihood of actually having students conduct laboratory experiments.

The most crucial form of support for new science teachers is providing them with coaching and mentoring in order for them to perfect their teaching and enhance student learning. Retired master science teachers are one group not to overlook as a source of support because many have skills, knowledge, and time to work with new teachers. Retirees can observe classroom teaching and provide support throughout the school day (Dunne & Newton, 2003; Heller, 2004) to ensure that science instruction is safe and effective. Additional possibilities are teachers on extended maternity leave or teachers who are fully released from their own teaching to help new teachers. From this group, retirees are often the most abundant, cost effective, and knowledgeable resources with time to focus on mentoring new teachers.

### *In-Class Support*

From our work with teachers in the New Science Teachers' Support Network (NSTSN) (NSF DUE 0302050), there is not a generic model for supporting new science teachers. However, data from the NSTSN reveals that the following supports positively impact teaching efficacy and performance as well as student achievement.

In-class support for new science teachers makes a difference in teaching and student learning. For new science teachers to become effective quickly, they need in-class guidance while they are learning to teach and help in planning. This is especially important as many new teachers are entering teaching without education coursework or student teaching. Retired science teachers can serve as a resource for training new teachers in this manner.

Free of the constraints of teaching their own students, retirees are able to help new science teachers plan effective lessons before, during, and after school as the new teacher's schedule permits. At the beginning of the year, retirees help teachers establish effective classroom management routines. Experienced with the curriculum, retirees help new teachers with both long range and short range planning. In terms of long range planning, retirees help new teachers develop their understanding of the conceptual flow and pacing of curriculum. In terms of daily planning, retirees have experienced the ways in which student misconceptions occur and can help new science teachers address and prevent students' misconceptions.

Retirees can help new teachers identify strategies for teaching and organizational ideas for laboratory activities. Sometimes retirees help new teachers find needed science

equipment that already exists in their school. Other times, retirees may perform an experiment with new teachers before they use it with students to ensure that the teachers are familiar with laboratory protocol. In terms of students' safety and access to quality instruction, new teachers must physically perform laboratory procedures themselves before using the equipment with students. Busy new teachers may skip this step, but a retiree can ensure that this occurs.

Planning can also include the development of opportunities for the retiree to model particular techniques during a lesson. If new teachers are hesitant to give up their role temporarily in the classroom for a retiree to model effective teaching, new teachers usually feel more comfortable if they have shared in the development of the parameters for when and how the retiree will teach. For example, retirees can model how to effectively ask questions or raise students' level of awareness of safety by teaching a short segment of class. Since science teachers utilize tools and hands-on materials, they need to be especially vigilant and effective managers of the classroom.

### ***Teacher Efficacy and Student Achievement***

Overall in our research with middle and high school science teachers, students enrolled in the classes of teachers who received the support of in-class mentors who were retirees performed significantly better on standardized tests and had better science grades than students enrolled in the classes of a comparable set of new science teachers who did not receive the in-class support from retirees. In contrast we found a slight drop in teaching-efficacy of teachers who had the retirees' in-class support. Reflective teachers may have reduced self-efficacy as they become more aware of the needs of their students

and their teaching deficiencies. New science teachers should be reminded that teaching is an ongoing growth experience, and learning to teach well takes time.

### **Recommendations for School Leaders**

Effective school leaders create school environments that nurture new teachers to succeed at teaching and reach their potential. Our research suggests the following policies and practices:

#### ***Pay Attention to Working Conditions***

- Hire early and assign classes so that the new teacher can start planning to teaching before they have to start school.
- Assign new teachers only one class preparation so they have time to reflect and revise lessons between class periods to perfect their teaching skills.
- Provide new science teachers their own room in which to teach instead of having them float between classrooms with a cart.
- Protect new teachers from additional school duties beyond those directly related to teaching their own classes.

#### ***Provide Support***

- Establish a plan and identify a person or team to provide new teachers with an orientation to the school, policies, and procedures.
- Provide teaching resources including teaching supplies, computer equipment, and science equipment, along with a person to demonstrate effective equipment use.

- Provide an in-class coach/mentor to support the new teachers while learning to teach, such a retired science teacher who has time to observe the new teachers teaching over an extended period of time and suggest how to more effectively impact student learning.

### *In-Class Support*

To encourage effective teaching and learning, coaches/mentors who spend extended time in and out of the classroom with the new teacher can:

- Observe new science teachers teaching and provide constructive feedback,
- Assist in establishing classroom routines,
- Problem solve classroom management challenges,
- Share about the school's culture,
- Participate in long and short-term planning with emphasis on sequence and pace,
- Identify students' common misconceptions and assist with planning to mitigate them,
- Provide lesson ideas, materials, and equipment or help locate equipment,
- Perform experiments with new science teachers prior to use with students,
- Model effective, safe instruction for large and small groups, and
- Focus on increasing student learning.

Through our work with new science teachers in the NSTSN, we have found this set of parameters makes new science teachers more aware of what they must do to be effective, supports an increase in their instructional competency, and results in better

student achievement as compared to new science teachers without the support of an in-class coach/mentor.

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