Introduction

The Next Generation Science Standards put forth an ambitious vision for K–12 science instruction. Developing the knowledge and skills needed to implement the NGSS poses unique challenges for novice science teachers, who comprise about a quarter of all teachers of science in the nation. This work outlines the current status of novice science teachers in the United States—defined as teachers in their first five years of teaching science—using data from the 2012 National Survey of Science and Mathematics Education (NSSME).

The 2012 NSSME, funded by the National Science Foundation, surveyed over 3,700 teachers of science. Although the focus of the 2012 NSSME was not on novice teachers, the dataset includes 857 teachers who reported being in their first five years of teaching science, including 226 elementary grades teachers (defined as teaching any grade K–5 or teaching a self-contained 6th grade class), 232 middle grades teachers (non-self-contained, teaching any grade 6–8), and 399 high school teachers (grades 9–12). However, because of the sample design and the use of design weights in analysis, results of the 2012 NSSME are nationally representative. Consequently, the results should be interpreted as indicative of all novice science teachers, not just those who participated in the study.

More About the 2012 NSSME

For additional information, please visit the 2012 NSSME website:

http://www.horizon-research.com/2012nssme

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The First Five Years:

What the 2012 National Survey of Science and Mathematics Education Reveals about Novice Science Teachers and their Teaching

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Key Findings about Novice Science Teachers

School Contexts

- **Novice science teachers are more likely than other teachers to work in challenging schools and classrooms.**
  - More likely to work in urban schools
  - More likely to teach in schools with higher proportions of students eligible for free/reduced-price lunch
  - In high-poverty schools, more likely to be assigned to classes of students with low prior achievement

College Coursework and Professional Development

- **Many novice teachers of science do not have a strong background in the science they are expected to teach.**
  - Especially true at the elementary and middle grade levels
  - At all levels, very few have any preparation to teach engineering
- **Most novice science teachers have not had substantive opportunities to attend science-specific professional development (PD).**
  - At the elementary level, 40% have had no science-specific PD in the preceding three years
  - At the middle and high school levels, only a third have had more than 35 hours of PD in the last three years; roughly half have had less than 16 hours of PD
  - Elementary science teachers are much less likely to receive feedback about their science teaching than secondary science teachers

Perceptions of Preparedness and Beliefs about Teaching and Learning

- **Many novice science teachers report that they do not feel very well prepared to teach science.**
  - At the elementary level, only a third indicate feeling very well prepared to teach science; a large majority to do not feel prepared to teach engineering
  - Less than 25% feel very well prepared to teach science to students with learning or physical disabilities, or English-Language Learners
  - Most novices do not feel very well prepared to monitor and address student understanding during instruction
- **Many novice science teachers have beliefs about teaching and learning that are inconsistent with research about how people learn.**
  - Many agree that:
    - Teachers should explain concepts to students before having them consider evidence
    - Hands-on activities should primarily be used for reinforcement of already learned ideas
    - Definitions for new vocabulary should be given at the beginning of instruction on a science idea

Nature of Instruction

- **A majority of classes give a heavy emphasis to understanding science concepts and increasing student interest in science.**
- **However, instruction is still dominated by lecture.**
  - The most commonly noted in-class activities were the teacher explaining science ideas to the whole class and whole class discussions
  - Less than two-thirds of classes engage in hands-on/laboratory activities on a weekly basis
- **Many teachers are pulling together their own instructional materials.**
  - One-third to one-half of classes, depending on grade level, primarily use non-commercially published materials or a mix of commercial and non-commercial materials most of the time
  - Of those using commercially published materials, more than two-thirds of classes taught by novice science teachers supplement, and nearly half skip parts of their material

Implications

1. Preservice programs may need to reconsider course requirements to allow prospective teachers greater opportunity both to learn science and how to teach science effectively.
2. Preservice programs may want to shift their emphasis to having teacher candidates analyze, implement, and reflect on extant curriculum materials rather than encouraging them to develop their own.
3. Schools, districts, and states may want to consider using departmentalized teachers at the elementary level as very few teachers have the time and training to become expert practitioners in every core academic subject.
4. At the elementary level, induction programs may be able to help novices see cross-curricular connections, helping them find time to teach science more frequently than they would have otherwise.
5. Induction programs can help novices reshape their beliefs about effective science teaching and learning.
6. Induction programs can provide supportive environments for teachers to discuss and practice modifying instruction to meet the needs of all students.
7. Induction programs can support novice science teachers in selecting and purposefully implementing high-quality instructional materials.

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