The National Congress on Science Education
2004 Focus Group Proceedings

Enclosed is a series of proceedings from the NCSE Focus Groups conducted during the 2004 Congress. The proceedings provide a summary of the discussions, rationale for the resolutions, and the outcome as voted upon by the 2004 Congress. For a complete outline of resolutions as they proceeded through the NSTA Council and Board of Directors, see the NSTA Congress Resolution Matrix.

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The Highly Qualified Teacher and Professional Development
Leader: Shelley Lee
Facilitator: Joyce Tugel

Background Information:
The teacher quality and professional development (PD) requirements of the No Child Left Behind (NCLB) Act of 2001 are having a profound effect on state and national science teacher organizations. The professional development definition in No Child Left Behind (NCLB) says that professional development programs must advance teacher understanding of effective instructional strategies that are research-based and include strategies for improving student academic achievement or substantially increase the knowledge and teaching skills of teachers.

State and national science teacher organizations must meet the professional development needs of teachers in this changing environment. Although the law stipulates that professional development funds can no longer be used for one-time, short-term experiences, guidance issued by the U.S. Department of Education states that Title II, Part A, funds may be used to pay the costs associated with having teachers attend one-day workshops or conferences if they are part of, and integral to, professional development activities that meet the other elements of Section 9101(34). The non-regulatory guidance also outlines the flexibility states have in High Objective Uniform State Standard of Evaluation (HOUSSE) procedures, determining which types of professional development activities can be used to support highly qualified teachers.

In light of available research and the requirements and definitions set forth in NCLB, state and national science teacher organizations must carefully select and plan professional development experiences and use available research and data to drive these offerings. Organizations also must carefully position and structure professional development opportunities by taking such steps as offering institutes instead of conferences or sponsoring year-long professional development experiences.

Focus Group Questions and Discussion:
<u>What is a highly qualified teacher of science?</u> A highly qualified teacher:

- Is licensed by his/her state
- Is professionally engaged
- Interacts with other teachers
- Has content knowledge
- May be National Board Certified
- Knows how to teach science content to engage his/her students
- Loves/is passionate about science
- Is a lifelong learner
- Routinely provides inquiry science experiences
- Uses/engages with technology
- Bases teaching success on student learning
- Knows student learning styles
- Is aware of achievement in other disciplines/can integrate other concepts from other disciplines

- Brings the outside world into the classroom
- Is a motivator/inspires the students/a good communicator
- Shares with his/her community, other teachers, and others
- Uses resources, informal science connections
- Maintains a classroom atmosphere for learning

An extremely important question is whether we are defining minimum or maximum criteria. It becomes important to distinguish whether we are thinking about our vision of science education or proficiency. Proficiency of teaching could have levels; for example, in WI, stages of proficiency are defined. In some cases, the teacher is eligible for funds.

What is "quality" PD for teachers of Science? Quality professional development

- Is job embedded
- Is realistically based/enhanced
- Has a built-in support structure (mentor/mentee)
- Is "cutting edge"
- Supports and increases student learning
- Is an ongoing experience (follow-up)
- Is research based/shows that it improves student learning (valued resources)
- Incorporates an assessment of the PD experience; demonstrates it is value-added
- Should model good teaching practices
- Should lead to the outcomes of quality science teaching
- Treats teachers as professionals
- Contains an inclusion perspective
- Is standards based
- Has a pedagogy content knowledge component as well as science content knowledge
- Bridges between background knowledge and the classroom techniques
- Aligns with national and state frameworks
- Includes vertical articulation

Every district in every state now has to submit a district professional development plan. The first area of influence is the school, and the plan should articulate individual goals of the teacher and activities that are designed to meet the goals. It should include specific science goals.

Should associations play a role in the professional development plan for the district/state?

- Can professional development be individual if it is district driven? How can it be district wide and still meet the needs of individuals? States are being given lots of leeway. In KS, there is great science but no funds. In WI, the Attorney General is saying that NCLB is underfunded.
- You have to keep working on it. You have to be on alert all the time.
- The national challenges are intense.
- The Department of Education is asking questions.
- The National Research Council has convened a committee.

What should your sphere of influence (local, regional, national) look like in the area of professional development?

- We need to counteract the problem of the lack of science in the state HOUSSE rubric. How do we influence this?
- How can you be specific to the needs of science if all the subjects are included?
- It is imperative that science be included. If the state has a rubric, science should be mentioned. It might be interesting to look at State Chapters' influence.
- State conference should align with NCLB. The issue is informing administrators that conferences **can** be a component of a teacher's Professional Development Plan (PDP).
- How can you get states involved with the legislative departments? Perhaps influence can be in an advisory capacity.
- NCLB—money, funding for PD is a real question. Is NCLB focused on content? You could do a one-day session on how to use CBL, and it will make a difference.
- Title II A Funds; WI used class-size reduction in the first year of Title II.
- Sphere of influence—start putting pressure on district, then state, then the legislature. Working through the state organizations. The sphere starts with us and then on to the others.
- Working with legislatures is important. Some states have a strong union. If your state has a union, work through it. Legislatures make things happen.

How can state organizations and affiliate groups help one another build strong professional development opportunities in science education?

- Publicity for PD opportunities (sites listed on NSTA website)
- Way to gather information for NSTA Web site—best practices. Gather models
- Position Statement to increase the awareness that good instruction will help achievement in math and language arts
- Identify strands in PD—folks will choose what they would like to participate in. Upon completion, the teachers would submit the ones they have attended and the organization would send a certificate
- An understanding of X number of hours that constitutes a legitimacy. (quality issue)
- In building a professional learning community, TN has looked at other organizations. They approached the TN Academy of Science. They plan to partner with other organizations.
- Provide organizations with quality PD presenters.
- Importance of having good speakers.
- What can we do besides conferences—e.g., 2-day conferences?
- Getting teachers together is most important. Conferences are vital.
- Networking is critical. We are falling short in addressing true professional development.
- Every person has a different goal and plan. There are many ways that we can meet the professional development requirement.
- Concerned because for many years, they have tried to have one-day conferences. They cannot get their teachers out of the classroom. It is a big problem. They cannot provide that in a state conference. They have their conference in a classroom. The follow-up meeting is not widely attended.
- The use of technology between state lines.

- The various science disciplines have their own conferences. Chemistry has developed its own online pre-conference.
- Elementary teachers need help in understanding "The Big Ideas of Science." Maybe online study groups.
- It is strong to say we are networking with other groups.
- Combining several science groups.
- Allowing college students to get college credit for going to conferences
- Ideas may be needed to get the reluctant teacher involved
- How do teachers find time to search things out and know how to put what they find into a plan? In Arizona, they have a Listserv to help teachers know when and where PD is being given.
- NSTA's Building a Presence for Science (BaP) is devoted to helping provide resources to meet teachers' needs.

Resolutions That Arose from the Professional Development Focus Group:

1. Whereas Improving Teacher Quality State Grants, Title II, Part A, states that funds may be used to pay the costs associated with having teachers and other LEA staff attend one-day or short-term workshops or conferences and whereas teachers are having a difficult time gaining approval for use of these funds, be it resolved that NCSE affirms that professional conferences are integral and valid parts of a PDP of a highly qualified teacher.

2. Whereas science educators are having difficulty securing funds and release time to attend professional conferences, be it resolved that NSTA develop a resource packet that provides guidance for CAGs in structuring and promoting conferences as an integral part of a professional development plan for the development and sustainability of a highly qualified science educator.

3. Be it resolved that in order for teachers to fulfill their professional development plans with valid and high quality PD opportunities, the NCSE requests that CAGs gather information about all relevant professional development opportunities in their state/region and disseminate this information to all science educators in their state.

4. Whereas science provides a context for the application of mathematics and language arts skills, be it resolved that NSTA will develop a position statement addressing the interrelationships between science, mathematics, and language arts and its implications for PreK–16 science instruction and professional development.

The Highly Qualified Teacher and Science Content
Leader: Melody Orban
Facilitator: Jean May-Brett

Participants in Focus Group: Glyn Burton (TN), Sandy Pace (VA), Carli Yeager-Hall (PA), Mark Farrand (SD), Mitch Batoff (NJ), John Staver (KS), Donna Daly (TN), Claude Toback (NY), Larry Lebofsky (AZ), and Alex Azima (MI)

Background/Issues
NCLB requires that any public elementary school or secondary school teacher who teaches core academic subjects (English, reading or language arts, math, science, foreign language, civics and government, economics, arts, history, and geography) must obtain full state teacher certification (including alternative certification), or pass the state teacher licensing exam; hold a license to teach in the state; and not have a certification or licensure requirement waived on an emergency, temporary, or provisional basis.

NCLB makes teacher quality a priority by requiring that all teachers be "highly qualified" in the subjects they teach by the end of the 2005–06 school year (all teachers hired and supported by Title I funds must have met this qualification by 2002–2003.) This means that teachers who are not new to the profession must 1) hold at least a bachelor's degree; 2) demonstrate a high level of competency in each of the academic subjects in which he or she teaches by passing a subject-matter test; 3) successfully complete an academic major, graduate degree, coursework equivalent to an undergraduate major, or advanced certification or credentialing; or 4) demonstrate competency in all the academic subjects the teacher instructs based on a high, objective, uniform, state standard of evaluation (HOUSSE).

The state HOUSSE may consist of a combination of teaching experience, professional development, and knowledge in the subject garnered over time in the profession.

New flexibility guidelines for NCLB highly qualified provisions were announced in March 2004. The flexibility changes affect teachers in rural districts, science teachers who instruct in more than one discipline, and middle and high school teachers who teach multiple subjects.

Teachers in rural schools who are considered "highly qualified" in one core academic subject but teach in another now have three years to become highly qualified in the subject they teach, as long as they receive professional development, supervision, or mentoring.

Newly hired teachers in rural schools also have three additional years to demonstrate they are highly qualified to teach other subjects. States may decide, based on their certification requirements, to allow science teachers to demonstrate they are highly qualified either in a broad science field or in specific individual fields, such as physics, biology, or chemistry.

The latest round of changes to NCLB also allow current middle and high school teachers who teach multiple subjects to demonstrate their subject-matter competency one time with their state's HOUSSE process.

Discussion Questions

1. Given the NCLB definition of a highly qualified teacher, what should be the *characteristics* of a highly qualified science teacher?
2. What is the situation in your home state with regard to determining whether your science teachers are highly qualified?
3. What should be the role of state and national science education associations in helping the state to determine the working definition of a Highly Qualified Science Teacher?
4. What has been the impact of the Highly Qualified Teacher (HQT) requirements on science teachers nationally?

Summary of Discussion/Resolutions

Concerns of the group

1. NCLB is not friendly to rural schools.
2. The term "middle level teachers" is not clearly defined…requirements in content background for K–5 or 6–8; some teachers working in grade 6 under the umbrella of a K–6 certificate.
3. Also…some states consider middle school teachers to be 5–8, while others consider them to be 6–8. Some states also make divisions by districts.
4. Certification in K–6; 6–12; K–8; 9–12 varies state to state.
5. In some states, elementary certified teachers who are assigned to teach middle level students must pass a test in the content area they are assigned to teach. If they do not pass, they are swapped with another teacher who has passed the test.
6. State processes for identifying HQT's include tests, scoring rubrics, NBCT's, etc..
7. Suggested that the K–10 teachers include the importance of mathematical content with the science content…the two are interrelated and interdependent.
8. The elementary level teachers often feel unprepared for teaching science due to a lack of training in science content. Suggestions made included partnerships for professional development with science departments and universities.
9. NCLB is a large school model, and it is assumed that it can fit every school. This is too complex an issue. It negatively affects some schools in determining who is a highly qualified teacher in each area of science.
10. Science is unique in that it has many different areas that require specific content knowledge for determining the HQT, especially at the middle and high school levels.
11. The elementary teachers also require a vast amount of training in subject matter so that they can teach all areas of science effectively and establish the proper foundation students will need at the higher levels.
12. Distance learning may be an answer to some of the HQT issues arising in rural schools. In addition, student-to-student teaching is proving extremely helpful in promoting effective learning in science.
13. Funding is a real problem with the NCLB legislation.
14. Coursework required to help current teachers attain HQT accreditation is not being provided by many universities.
15. Elementary level subject knowledge in science should be looked at as a means of preparing students for middle and high school levels. A closer look at professional

development for classroom teachers to gain science content knowledge and also preservice requirements at the university level are needed.

Discussion Questions

1. Given the NCLB definition of a highly qualified teacher, what should be the characteristics (in relationship to science content) of a highly qualified teacher of science?

   We need to focus on this from several points of view.

   Suggestion: Certification of teachers based on exams. What science content is tested on certification exams throughout the nation? Second, we would like to establish a minimum requirement for science courses that preservice teachers should take prior to enrolling in their methods courses.

   Suggestion: Universities do not necessarily provide adequate science instruction for elementary majors. The requirement for elementary preservice teachers should be three science courses that are inquiry-based in nature, with a lab component. These courses should cover the Earth/space, life, and physical sciences. They should also be standards based.

2. What is the situation in your home state with regard to determining whether your science teachers are highly qualified?

   Answers are extremely varied. Many stories had several common threads. Certification issues, NBCT, exams, and so on, are seen throughout the states. In some states, the teacher organizations were involved in the process; while in others, they were ignored.

3. What should be the role of state and national science education associations in helping the state to determine the working definition of a Highly Qualified Science Teacher?

   Resolutions, that address the requirements that preservice teachers need to be effective science teachers in the classroom need to be written in this Congress.

   We need to create a message that each state chapter can adopt and then direct toward the state and university level associations so that some change can take place.

4. What has been the impact of the HQT requirements on science teachers nationally?

   Flight to retirement. Lots of teachers leaving middle and secondary levels to teach at elementary or other levels. Anger and resentment among the teachers. Middle level may be hurt the most. Reorganization of K–8 in some states. Some of the annual yearly progress may be affected by reorganization, but HQT requirements will not change. Many losses of education graduates.

Discussed the Value Added Assessment program in Tennessee. Suggested that having the Department of Education person on our state organization boards would help avoid the problems that arise.

5. What role are supervisors of science in districts playing?

   NCLB tends to place 100% of the blame on teachers and provides them little power to change it.

   Group read over the Congress Resolution Matrix to determine previous resolutions that may have validity to what we are addressing. Made a list of applicable resolutions.

Resolution Suggestions

1. Whereas subject-matter knowledge is a necessary prerequisite to considering a teacher highly qualified, be it resolved that the National Congress on Science Education advocates that all elementary preservice teachers should successfully complete *at least* one physical science, one life science, and one Earth/space science course that are inquiry-based and include a lab component and that address the content as articulated in the *National Science Education Standards* (NSES) for the elementary level.

2. Whereas subject-matter knowledge is a necessary prerequisite to considering a teacher highly qualified, be it resolved that the National Congress on Science Education advocates that all middle level preservice science teachers should be required to successfully complete a *minimum* of 30 semester credit hours of science content courses to include at least one physical science, one life science, and one Earth/space science course that are inquiry-based and include a lab component and that address the content as articulated in the NSES for the middle level.

3. Whereas subject-matter knowledge is a necessary prerequisite to consider a teacher highly qualified, subject-matter knowledge alone is insufficient. Be it resolved, therefore, that the Chapters and Associated Groups of NSTA consider as highly qualified those teachers who possess an integrated knowledge of four areas: 1) subject matter; 2) teachers and teaching; 3) learners and learning; and 4) the context or setting in which they work.

4. Whereas subject-matter knowledge is a necessary prerequisite to consider a teacher highly qualified, be it resolved that the National Congress on Science Education advocates that all elementary inservice teachers should successfully complete *at least* one physical science, one life science, and one Earth/space science course that are inquiry based and include a lab component that addresses the content as articulated in the NSES for the elementary level.

5. Whereas subject-matter knowledge is a necessary prerequisite to consider a teacher highly qualified, be it resolved that the National Congress on Science Education advocates that all middle level inservice science teachers should be required to successfully complete a *minimum* of 30 semester credit hours of science content courses to include at least one physical science, one life science, and one Earth/space science course that are inquiry based

and include a lab component that addresses the content as articulated in the NSES for the middle level.

Action Steps

Communication about NCLB HQT Content and Pedagogical Content Knowledge (PCK)

1. Science summits: unions, college, teachers, professional development institute
2. Science Network
3. Newsletter articles
4. BaP
5. State organization sessions at conferences
6. Professional goal to increase pedagogical skills
7. Lesson study (i.e., book groups)

Pedagogical Content Knowledge Focus Group
Leader: Dee Goldston
Facilitator: Linda Crow

Participants in Focus Group: Nancy Evans Bennett (NJ); Ralph Peterson(ID); Monica Ellis (IN); Larry Madden (UT); Tom Archer (WA); Doug Scribrer (WY); Burnette Hamil (MS); Aleta Sullivan (MS); Lois Mayo (NE); Carolyn Hayes (IN); Renee Carson (AR); Mary Pat Coburn (CT); Richard Porter (SC); Bob Boone (WI); Becky Litherland (MO); Chris Purkiss (CO);

Resolution chair: Don Kline (PA)
Minutes Recorder: Christine Royce (PA)

Outline of Focus Group Proceedings

- Review of Resolution Writing and the three different types of resolutions
    - Message from Congress to CAGs
    - Request for action—needs action from the Board and Council
    - Requests for input from CAGs

- Introduction to the topic of the Focus Group
- Address each question one at a time.
- Afternoon breakout groups

The Issue

National policy demands that all teachers meet the standards to be considered highly qualified with emphasis on demonstrating subject-matter competency in science, but de-emphasizes the importance of other domains of teacher knowledge, such as pedagogical content knowledge critical to successful teaching of K–20 science.

Discussion Questions

1. **What are the essential elements of high quality instruction in science?**
    - Essential Characteristics
    - Content knowledge
    - Variety of approaches for instruction in the teacher tool kit
    - Limitations of various methodologies
    - Assessment—*formative/summative*
        i. *Focus on student learning*
    - Questioning techniques
    - Administrative support
    - Problem-solving skills
        i. Critical-thinking skills
    - Student motivation
        i. Family/parent impact
        ii. Knowledge of students (learning to learn)
    - Classroom climate/environment

- Ability to be an effective facilitator
- Recharging through professional meetings
- Effective classroom management
- Flexibility (teacher)
    i. Reflective practioner
    ii. Passion of the teacher
- Planning time
    i. Collaboration with other teachers
- Mentorship

Other questions related to PCK and elements of high quality teaching:

i. **Q:** What essentially drives my motivation?
ii. **Q:** Can I still be a highly qualified teacher without the administrative/parental support?
iii. Collaboration and reflection should go together. Work with new teachers in terms of mentorship.
iv. **Q.** What is content knowledge? Inquiry and process, as well as a working knowledge of the content of the subject itself. Is it process knowledge? Or is it "content knowledge"? NCLB states that content knowledge is the "content." Although the *National Science Education Standards* (NSES) identify Science as Inquiry, the other reports from NCLB, NSF, and others do not identify process as content.

- What is PCK? Pick three items from this list that define PCK. Variety of approaches; knowledge of students; and content knowledge (first two things most selected)
- IT becomes a Venn Diagram—Content and Pedagogy and PCK is the intersection.

2. Do we (or should we) consider PCK an essential part of instruction in science teacher education?

- By the length of the list…yes!

<u>Focus group discussion emphasized</u>

- Need to focus on issues of specificity of PCK for preservice/novice teachers
- Loss of content teachers in the field is high when they don't have pedagogical background and experiences.
- Problematic that content is the main emphasis in Washington, D.C. Reports.
- Strategies to formulate questions—and uses the questions to develop the lesson.
- Issues for licensure
- Readiness for PCK—connect it to an induction and mentoring
- Make explicit versus implicit strategies.
- What is PCK, PK, CK and how do we recognize them when we see them?
- Use of information processing model for students to begin to metacognitively think about their own learning (all students)

3. **How does PCK align (or not align) with the NCLB/HQT policy?**
    - As NCLB is written it does not and should.

    Focus group discussion highlights
    - The question itself is a problem….a big issue is not disqualifying a teacher who is good and HQ but doesn't have PCK (i.e., a new teacher).
    - Professionals in the field need to recognize the intricate way content knowledge and knowledge of teaching meld is an evolving process that begins with pre-service and continues throughout one's career.
    - PCK is too much theoretical and hard to conceptualize in a practical way. One can know the theoretical side, but the practical application side of PCK and its role in the standards is MUCH different.
    - Need for good quality fellowships and mentors cooperating teachers who know how to help new teachers understand their ongoing development of PCK

4. Is it sufficient to be highly qualified in a science content area to be a highly qualified teacher?
    - No—as discussed earlier, without content knowledge, the teacher is blind, and without pedagogical knowledge, the teacher is lame. Both are needed for high quality science teaching.

Afternoon focus group

High quality instruction requires both subject content and pedagogical expertise, which includes, but is not limited to the following:

Knowledge about students
- Motivation
- Focus on student learning

Teaching methods
- Variety of approaches to meet the needs of all students
- Understanding limitations of these approaches
- Critical thinking
- Problem solving
- Questioning
- Assessment

Classroom Climate
- Management
- Safe environment
- Enthusiasm and passion for teaching

Professional Growth

- Planning time
- Collaboration
- Reflection
- Mentoring and Support
- Administrative support

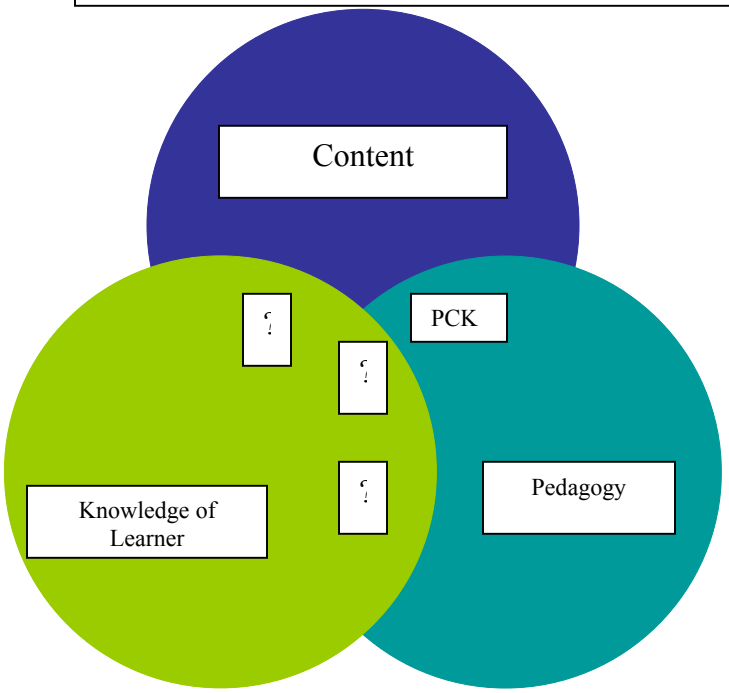
Recent publications describe PCK as a unique intersection of subject content and pedagogical knowledge. However, it has been described in various other ways leading to confusion among educators.

Resolution

1. High quality instruction requires both subject content knowledge and pedagogical expertise, which includes but is not limited to knowledge of students, teaching methods, classroom climate, and professional growth. Recent publications describe pedagogical content knowledge as a unique intersection of subject content and pedagogical knowledge. However, it has been described in various other ways, leading to confusion. Therefore

   Be it resolved that NSTA develop a clear and concise definition of pedagogical content knowledge to help guide professional development programs at local, state, and national levels.

The section overlapping Knowledge of the Learner and the other two circles is implied in the discussion of PCK, but the def. of PCK in general focuses only on the intersection of content and pedagogy. Discussion focused on the point that PCK is unique for each learning situation and the learners.



PCK is the unique blending of content and pedagogy that is influenced by the teacher's knowledge of the students.

The Highly Qualified Teacher—Recruiting, Retaining, and Recognizing
Leader: Jack Cooper
Facilitator: Jack Rhoton

Participants in Focus Group: Lloyd Barrow (MO), Joan Wagner (NY), Toni Velure (WI), Wayne Mangold (MT), Ella Jay Parfitt (MD), Jack Casper Olson (MN), Vince Lunetta (PA), and Steve Rich (GA)

Recorder: Mary Lightbody (OH)

Background
For the discussion focus, an analogy was presented of science teaching as a vertical tube with holes in the side. A teacher enters at the bottom, and ideally, emerges 30 years later as a retiree. Getting teachers into the profession was equivalent to putting teachers into the tube, and this included all factors that enhanced recruitment. All the factors that allow a teacher to exit holes in the tube were related to retention. At the same time, factors that kept teachers in the tube were considered recognition factors. For recruitment, consideration was to be given to everything from standard four-year programs to the new alternative certifications. Also coverage to programs that introduce people into the tube from industry, other disciplines, paraprofessionals, and various sources to replace those exiting was open. Recruitment could be at the bottom or into the holes at any year. Retention was to deal with any process that would keep a teacher in the tube. Realistically, teachers could exit the tube before 30 years. The discussion was to include instilling professionalism, attitude formation, positive reinforcement, and peer/administrative support. The pros of keeping a teacher versus training a new one was a major factor.

The recognition factors were to include those giving the teacher personal gratification, peer recognition, and awards. The timing of awards, as well as the application process, was to be addressed. Recognition in its present form, as well as innovative awards and rewards, was to be considered. Recognition has many forms from monetary to verbal and any would be open. The overall opinion was that the three (recruitment-retention-recognition) were a triangle, and each coexisted with the others. A recognition factor or the availability of one in the future could be a recruitment factor. Likewise, a retention factor that kept a teacher in the profession past 30 years, at the top, was a type of recruitment, albeit a recruitment of an experienced teacher from within. In a very successful school system, even being recruited could be perceived as a recognition of your potential as a HQT.

Introduction
Turnover is a common reason for shortage; severe shortages occur in some geographic areas and levels and not others.

- Pathways to teaching as a career include community college, colleges and university education programs, para-educators (teacher aides in the schools), post baccalaureate degree (ranging from 3–4 weeks of training to Masters of Arts in Teaching [2–year program]).

- Consider the following four areas to gauge the value of the training program.
  1. Rigorous entrance requirements
  2. Substance of pedagogy
  3. Mentorship components
  4. Evaluation components

- Transition to the classroom is also important, and many teachers listed administrative support as being critical to staying in the profession. Richard Ingersoll, who has analyzed data from the U.S. DOE survey information, cites 3 major reasons why teachers leave the profession:
  1. Lack of administrator support
  2. Low salary
  3. Negative perception of the profession by administrators, students, and the community.

- Look at staffing plans and structuring of the school day to provide mentoring of new teachers.

- The typical teacher has insufficient time during the school day to provide or receive professional development.

Discussion

- Retention is the key issue, but the three issues form a triangle.

- The culture of teaching and professionalism is critical in our country.

- Teachers who are recruited through alternative programs have strong science content.

- Students from low SES attend schools in which a high percentage of teachers are not highly qualified; schools are hard to staff, and the teachers do not receive the support and mentoring they need, so many leave within a short period of time.

- Our goal should be to advocate that an emphasis on pedagogy be included in any program.

- The definition of the HQ teacher for a kindergarten teacher is different than for a high school AP Physics class.

- The negative impact on student performance from having a poor teacher for a year can only be made up by two or more years of excellent teaching.

- We need an operational definition of the standard components of the HQT evaluation for a science teacher by level.

- In NCLB, the content knowledge of the teacher is emphasized over the pedagogy.

- Teachers must have a rapport with their students to be successful; some techniques for relating to the students can be taught.

- K–4, 5–8, 9–12 national standards promote strong content knowledge at all levels. State requirements for teacher training programs vary. The number of hours in science can be from 3 to 6, while some states have more than 15 hours.

- Certification, as established by the states, should include a specific number of hours of science, and many more for instruction in biology, chemistry, and other subjects at the 9–12 level, as well as a certain number of years of experience as a precertification intern.

- The retention process for new teachers should include a solid knowledge of the content standards of the course provided through the education preparation program.

- Mentoring can include peer mentoring, e-mentoring, and union involvement.

- Research from Johns Hopkins provides viable science education data.

- Promotion opportunities for teachers, to encourage them to stay in the classroom as mentors. These opportunities can include a pay increase and a reduced teaching schedule, along with a third level of super-mentors to help the mentors.

- Is there research on science teachers who leave the profession compared with other content-area teachers who leave? (Companies can and do seek science teachers because they can retrain them more easily due to their science/math background).

- Alternative routes to teaching: the diversity and perspective of the teachers trained in alternate routes add value to schools.

- Induction processes that the schools offer can make a difference: Help with the paperwork processes for implementing curriculum, grades/grading strategies, and soon—combined with mentoring—can help retain teachers.

- Administrators should be part of the mentoring and service instructional leaders for the mentors and their assignees.

- Providing a career ladder for experienced, HQ, and mentor -evel teachers, including administrative-level pay at the top, can keep excellent teachers in the classroom.

- Current organization of the school year may impede our professionalism; year-round schools may offer alternative professional development opportunities and enhance the perception of teaching as a profession.

- Teaching assignments should be balanced according to the teachers' training.

- The culture, and the system as a whole, has issues. We need to focus on the culture of teaching science.

- Imagination, new models of staffing and schedule design during the school day—with mentors, career ladders, and professional development during the school day—have implications for increasing retention.

- Induction is critical: New teacher institutes vary from state to state and district to district.

- Teachers in hard-to-staff schools are often ill-prepared for the culture shock.

- New teachers should be introduced to their mentor teachers early, have daily or weekly visits for up to 5 years, and have mentors who carry a mentoring load of less than 5 new teachers. Otherwise the teachers will continue to leave one district to go to other school districts; while at the same time, the need for new teachers every year is escalating.

- Have a "War on Ignorance" to get the federal money! But we need to examine how we are spending the dollars we have perhaps taking a hard look at what we are doing and have done for years, and evaluate the results.

- We need research on different staffing models during the day and how those have impacted the environment in the schools.

- Perhaps science paraprofessionals could be implemented, giving science teachers needed support, including time for mentoring and professional development.

- Minnesota research on the timing of the start of the day has shown a positive impact. Trial programs, with parents' approval of the research to be conducted, are needed. The research must be statistically valid.

- Look at innovative programs that have worked, and find ways to replicate them.

- How do we help teachers "advance," and how can we reward teachers to help them feel appreciated and supported? For some teachers, being given professional leave or being allowed time for science club meetings, and other activities are their only rewards.

- State organizations have rewards and recognitions for science teachers. What effect do they have on teacher retention?

- Awards should be given early and often, yet balanced with substance. Examples include Teacher of the Year awards, new teacher awards, PAEMST, grants, stipends for conferences, discounts on state or national association membership, and so on. (The downside: Teachers don't apply because of the vast amount of time required for applications. Streamline applications/nominations to reflect that administrators and teachers have time budgets.)

- What innovations can we promote to make a difference?

- How do we entice bright young people to come into teaching, and what advancements should we establish to create promotion opportunities?

1. Mentorships for the first years
2. Released time to think and plan
3. Autonomy to make decisions
4. Funding for materials or supplies

- Teacher award programs should include those that recognize teachers without also asking them to apply for the award themselves (i.e., supervisor driven).

- In some states, new teachers don't teach alone; they team teach for a year with a mentor, who teaches by modeling, conferring, reflecting, and constantly improving their work; this helps both teachers.

- What is the cost associated with getting a new teacher vs. retaining the teacher you already have?

- Connect veteran teachers with new teachers promote excellent curricular materials, and make use of the time and money invested in veteran teachers.

- Help teachers learn about professionalism: applying for grants, conducting action research, reflecting on their work, and belonging to state and national professional organizations. Help teachers take charge of their own careers.

- NCLB is under funded at the national level: Testing burden on states promotes the lowest cost alternatives, but the investment in the future is critical. We need to promote science for all.

- Future teachers need early interactions in classrooms that are taught by HQ teachers who use inquiry and standards and provide a good role model.

- Research on the effective aspects of mentoring would be helpful. Our issues focus on the national government and funding from the states.

- Research drives funding, and scientists should excel at conducting their research.

- What new models of staff and design can we suggest?

- Adopt the internship model used by engineering?

- Provide more opportunities for pre-service teachers to work with classroom teachers in teams of 2, 3, or 4.

- Rural schools have few luxuries, and the reality of the teaching responsibilities in rural systems is overwhelming.

- Union support for science teachers can make a difference. Science teaching is different from teaching other subjects because of the requirements of labs and the handling of materials. So

we should ask the unions to negotiate for a lab prep period for science teachers during the day or week.

From the discussion/brainstorming, three major recommendations were proposed by the committee.

1. According to Ingersoll and others, the turnover rate for science teachers, especially those new to the profession, is higher than that of many other occupations. Nearly 30% leave after 3 years in the classroom, and 40% after 5 years. An NSTA science teacher survey in 2000 found that nearly 40% of science teachers polled were considering abandoning the profession due to job dissatisfaction therefore,

   Be it resolved that NSTA will advocate funding from the federal government for data-driven research on recruiting and retaining Highly Qualified preK–12 teachers of science by launching in-depth research and development efforts (that include innovative models), building on what is known about the compensations, preparation, and support that teachers of science need.

2. Given that many states and districts have created new teacher induction programs, but few have the capacity to fully implement them,

   Be it resolved that CAAGs will lobby and advocate their state boards of education and other leaders for fully-funded implementation of induction and mentoring programs for entry-level teachers of science for the first three to five years of their careers.

3. Teaching has been perceived as a career with limited opportunities for advancement while remaining a classroom teacher therefore,

   Be it resolved that CAAGs will advocate state and local boards of education to change the culture of teaching by implementing models of staffing designs for the classroom teacher of science that allow for differentiated opportunities for advancements in order to retain those who are highly qualified teachers of science.

   Rationale: This has the potential to provide long-term and sustained professional development during the school day and throughout the school year, while at the same time promoting opportunities for advancement and reward. In today's high-tech world, there are multiple career opportunities for those with strong science backgrounds.

Sample questions for CAAGs groups to use to open discussions are given below:

Recruiting Teachers

1. How has the HQT requirement of NCLB impacted the recruitment of qualified teachers in your state?
2. Should highly qualified prospective science teachers, including teachers entering the field through alternative certification methods, be provided additional incentives not normally given to teachers, such as differential or merit pay, in hard-to-staff areas?
3. What action can the NCSE take to address these issues?

Retaining Teachers

1. How has the HQT requirement of NCLB impacted the science teachers in your state?
2. How are states responding to the increasing need for science teachers as retention rates decline?
3. What does your district/state do to retain the HQ science teacher?

Recognizing Teachers

1. How are states and districts supporting teachers who do not meet the HQT requirement?
2. What does your school/district do to recognize quality science teachers?
3. Are HQ science teachers used as mentors or content coaches for new recruits?

These questions will lead to others, and wheels will begin turning. We, as science teachers, must provide the impetus.

The Highly Qualified Teacher and Assessment and Accountability
Leader: Dave White
Facilitator: Gail Hall

Participants in Focus Group: Wanda Clarke (NE), Sharla Dowding (WY), Vanessa Westbrook (TX), Susan Clay (OH), Ruth Ruud (PA), Carolyn Clontz (OR), Robby Cramer (MI), Christine Bertrand (CA), Roy Hanson (ID), Tillman Kennon (AR), Sharon Janulaw (CA), Linda Dudley (MO), Richard Hogan (AZ), Deborah Lynn O'Gorman (NV), Len Sharp (NY), and Mark Mettert (IN)

Background

The NCLB legislation requires that all states assess science by the 07–08 school year at three grade clusters (elementary school, middle school, and high school). The current legislation does not mandate that states include science scores as an indicator of adequate yearly progress for accountability. This difference in the accountability requirement for science compared to mathematics, reading, and writing offers the possibility that science assessments can be developed for the purpose of providing valuable assessment feedback rather than simply identifying low-performing schools. However, the challenge in meeting this goal is significant.

Compatibility between classroom assessment (formative and summative) and external assessment can be fostered by making external assessments more accessible to classroom teachers through their involvement in the development and interpretation of these tasks and by helping teachers embed large-scale assessment in the instructional program in meaningful ways (National Research Council, 2001). Helping teachers acquire the skills and expertise needed to develop local science assessments will ensure the greatest degree of match between what is valued at the local level and what is assessed. Locally developed systems increase the buy-in of teachers by involving staff at all phases of the development and implementation process (Robinowitz and Ananda, 2001).

If schools are going to build a capacity to ensure that all students have the opportunity to learn science, teachers need to be supported and empowered to make decisions that are crucial for effective learning (National Science Resources Center, 1997).

Discussion Questions

In order to develop strategies that will enable teachers to become highly qualified in the area of assessment literacy and strategies that will empower teachers to assume leadership roles related to science assessment issues at the school, district, state, and national level, the Science Assessment and the Highly Qualified Teacher Focus Group discussed three guiding questions:

1. What practices, resources, and support should we encourage in our states, districts, and schools?
2. What practices should we discourage?
3. What actions can we take as representatives of our states' science teachers?

Summary

Following introductions and a "Warm Up" activity addressing science assessment, focus group members engaged in three breakout sessions: classroom science assessment, common (local) science assessment, and external (state) science assessment. Breakout session group members reflected on the Background Paper "The Highly Qualified Teacher and Assessment and Accountability," responded to the discussion questions, and generated recommendations that emerged from those discussions (see appendix 1).

The focus group synthesized the recommendations resulting from the breakout sessions and prioritized three areas for immediate action. These actions include

1. Providing teachers with expertise in assessment around what is valued and what is assessed
2. Encouraging the development of assessment items and tasks that require higher-order thinking skills and lab-based performance assessment
3. Directing state organizations to encourage teachers to become involved in all aspects of science assessment (criteria, development, reporting, and use) at all levels (state, local, classroom)

Resolutions

In response to the action items identified above, the Focus Group on Science Assessment and the Highly Qualified Teacher developed and submitted the following resolutions.

1. Whereas good assessment feedback is necessary in order to inform our schools' science programs, our teaching practice, and our students' understanding of important science concepts, and highly qualified teachers need clear expectations published and disseminated to district sites and individuals to empower them with the assessment tools necessary to be highly qualified.

   Be it resolved that the National Congress on Science Education advocate that all teachers use clearly defined assessments that embed higher-order thinking skills, and lab-based performance components which include inquiry, manipulation of materials, and problem-solving skills.

2. Whereas the National Research Council (*Knowing What Students Know: The Science and Design of Educational Assessment*, 2001) states that compatibility between classroom assessment and external assessment can be fostered by making external assessments more accessible to classroom teachers through their involvement in the development and interpretation of these tasks, and by helping teachers embed large-scale assessment in instructional program in meaningful ways. If instruction should drive assessment, the instructors should be involved in the development of the assessments.

   Be it resolved that the National Congress on Science Education recommends that the Chapters and Affiliated Groups encourage their members' involvement in the development of assessments at all levels. Said involvement may include such activities as: Chapters,

Affiliated Groups and Associated Groups, disseminating information on assessment development opportunities and urging their members to contact and educate stakeholders on the necessity of teacher involvement in the assessment development process.

3. Whereas in 7/01 session CNG19 resolved that student assessment at any level be accompanied by ongoing professional development that 1) provides knowledge of standards-based content; 2) models effective science teaching strategies; 3) emphasizes the analysis of assessment data; and 4) applies the data results to the improvement of teaching…

   Be it resolved that NSTA examine the feasibility of an ongoing professional development program on assessment that might include
   1) Knowledge of research-based assessment models;
   2) Emphasis on the quality criteria for assessment development
   3) Examples of effective science assessment methods;
   4) Emphasis on the analysis of assessment data;

Appendix 1: Breakout Group Recommendations

Classroom Level

1. Practices, resources, support to encourage
   - Staff development in different forms of assessment
   - Modeling of assessment in science lessons
   - Collaboration time for teachers
   - Collaboration teams for subject areas
2. Practices to discourage
   a. Reading about science instead of doing science
   b. Drill to teach to the test instead of teaching the student to be a lifelong learner
3. Actions to take
   - Continue to offer opportunities to learn about science and assessment methods
   - Offer incentive for teachers to attend staff development that gives appropriate science learning

Local Level

Develop assessment endorsement program (university) with the goal of providing teachers with expertise in developing assessments that match what is valued and what is assessed. Components of this program would include;

1. Research-based assessment philosophy (e.g. Stiggins: *Assessment for Learning*)
2. Quality Criteria for Assessment Development
   - Alignment with standards
   - Opportunity to learn
   - Freedom from bias
   - Developmental appropriateness
   - Reliability
   - Mastery Level

3. Statistical Analysis
    - Validity
    - Reliability
    - Understanding CRTs and NRTs
4. Resources
    - Test banks (constructed responses, selected responses, portfolio)
    - *Understanding by Design* (Wiggins/McTigh)

State Level

1. States should establish clear, well-published guidelines using science examples to teach science literacy.
2. Assessments at all levels need to include performance testing and test items that require high-level thinking skills rather than just recall.
3. Teachers need to be included in test development in meaningful ways.
4. States should avoid off-the-shelf tests with little or no teacher input and avoid testing with no feedback on informing instruction.
5. State organizations need to communicate to their membership and encourage members to be involved in the process of test development; contact legislators, and others about issues (as a group and as individuals); know their state board; and use all resources-newsletters, conferences, listserv, and so on) to get the message out.

The Highly Qualified Teacher: Equity, ESL, and Diversity Issues
Leader: Tiah E. McKinney
Facilitator: Dr. Cherry Brewton

Participants in Focus Group: Donald Johnson (MI), Norma Guillory (LA), Robin Curtis (VA), Scott Capes (KS), Gail Marshall (GA), Joe Moore (GA), and Joan Wagner (NY)

Background/Issues
The "highly qualified teacher" requirements of the No Child Left Behind Act of 2001 (NCLB) appear to challenge equity in our nation's schools. Science educators must move progressively forward with the reform effort to ensure equal access and opportunity for all students.

According to the law, highly qualified teachers must be certified or licensed, hold a bachelor's degree, and have demonstrated competencies in their teaching area. By the end of the 2005–2006 school year, all states must ensure that every core subject classroom teacher, including every science teacher, is highly qualified.

Yet the Association of Community Organizations for Reform Now (ACORN) reveals in its study on the implementation of NCLB in 23 states plus the District of Columbia and 64 school districts that 14 states have not defined what "highly qualified" means in their states, thus putting local school districts in a quandary as to how to comply with NCLB.

Additionally, the Southeast Center for Teaching Quality (2002) asserts that the responsibility for defining "highly qualified" rests with states and that NCLB's definition of "highly qualified" is minimal and inadequate. Given the growing diversity of public school students, the Center believes that teachers not only must have strong content knowledge, but also must have the skills to provide standards-based quality instruction for *all* students.

The Center further asserts that if states are left with too few resources to recruit, prepare, and retain the most qualified teachers for the hardest-to-staff schools, they will likely set the quality bar as low as possible to address teacher shortages. Could this lead to continued disparities in that some teachers are more highly qualified than others? Another important issue is the challenge of recruiting experienced teachers for schools in urban, low-income, and diverse areas (Dendo, Grant, and Jackson, 2001). More than ever, rural and urban districts are experiencing shortages in the number of new and experienced teachers and expressing concern about pay disparities, multiple subjects to teach, and lack of support/mentoring.

Finally, by 2020, students of color will represent nearly half of the elementary and secondary population (Gollnick and Chinn, 2002). We will see an increase of English-language learners, students with disabilities, and economically disadvantaged children. A major concern is that schools cannot provide equity without highly qualified teachers—those who are prepared to help students reach their potential and promote equity in key components of educational equity—adequate access, instruction, materials, attitudes, interactions, language, and assessment. The Northwest Regional Educational Laboratory's Equity Center provides a description of these key components (NWREL, 2001).

Summary of Discussion/Resolutions

Instruction

Demographic projections reveal an increase in English as a second language (ESL), students with disabilities, and economically disadvantaged students. In order to effectively teach science to these diverse populations, teachers need to be prepared beyond the current requirements of NCLB: Be certified or licensed, hold a bachelor's degree, and demonstrate competencies in one's teaching area.

Be it resolved that NSTA supports the identification and dissemination of effective PK–16 instructional models that have proven to increase academic achievement among diverse populations.

Increase Awareness

There is an alarming achievement deficit within groups such as special needs populations, those of low socio-economic status, and ESL. The Highly Qualified Teacher will need to be able to effectively address these deficits.

Be it resolved that NSTA place a greater emphasis (through conferences, publications, and on-line courses) on how to match instructional strategies to the special needs of individual students.

Be it resolved that the NCSE advocates to differentiate instruction based on the authentic quantitative analysis of student achievement data.

Definition of Highly Qualified

Whereas the federal legislation "No Child Left Behind" mandates that all teachers be HQT by the end of the 2005–2006 academic year and defines that "highly qualified teacher" means certified or licensed, holds a bachelor's degree, and demonstrates competencies in the teaching area. This definition is limited, as it does not clearly define these competencies in the area of science instruction as it relates to equity, ESL, and diversity issues.

Be it resolved that the Congress advocates the creation and development of a study to identify best practices in science instruction as it relates to equity, ESL, and diversity issues for PK–16.

Driving Questions

1. What can we do that would help teachers be more effective in addressing issues of diversity?
2. What type of mentoring, shared experiences can be provided to teachers to increase their effectiveness/students' level of engagement?
3. How can we create a core training model ("Train the Trainer") that would disseminate to others – specialized in "closing the gap"?
4. What can teachers be trained to do with student test data that would influence/inform their teaching/instruction?
5. Sensitivity training for teachers.
6. Which strategies are needed to address achievement of the NCLB subgroups?
7. How can we train teachers to use the differences to inform instruction, rather than ignore differences in the spirit of political correctness?
8. How can we make students more accountable for their behavior (ex. "Skill streaming")?
9. How can we influence teacher-training programs to require pre-service teachers to experience diverse student populations (ex. *Understanding the Culture of Poverty*, Ruby Payne)?
10. How can we use effective resources, such as TESA (Teacher Expectation – Student Achievement) and Connecting with the Learner—Michigan Dept. of Ed/NCREL?
11. How can we get districts to be more proactive in matching teacher strengths with the variety of teaching environments?

Action Plan

1. Work out PD strategies relative to equity, ESL and diversity.
2. Call for presentations relative to equity, ESL and diversity.
3. Call for Action Research projects relative to equity, ESL and diversity.
4. Call for articles relative to equity.
5. Train teachers to be "strategic planners," then in turn train students to be "strategic planners" for their learning and success.
6. a. Identification of the problem "Achievement Gap"
   b. Theme for future conferences/articles/PD, and so on—"The Gap—What Does It Mean?"
7. Creating buy-in on all levels: teachers, students, administration, teacher organizations, universities, school boards, parents, community
8. At state conferences, establish special sessions for parents regarding equity: School Board Associations—conference offering workshops/sessions/poster session regarding equity.
9. Create position paper—review what has been written.
10. Recognize schools, teachers, SBA that demonstrate effective student achievement—disseminate through BaP, Share-a-thons—include all students, not just these on the honor roll.