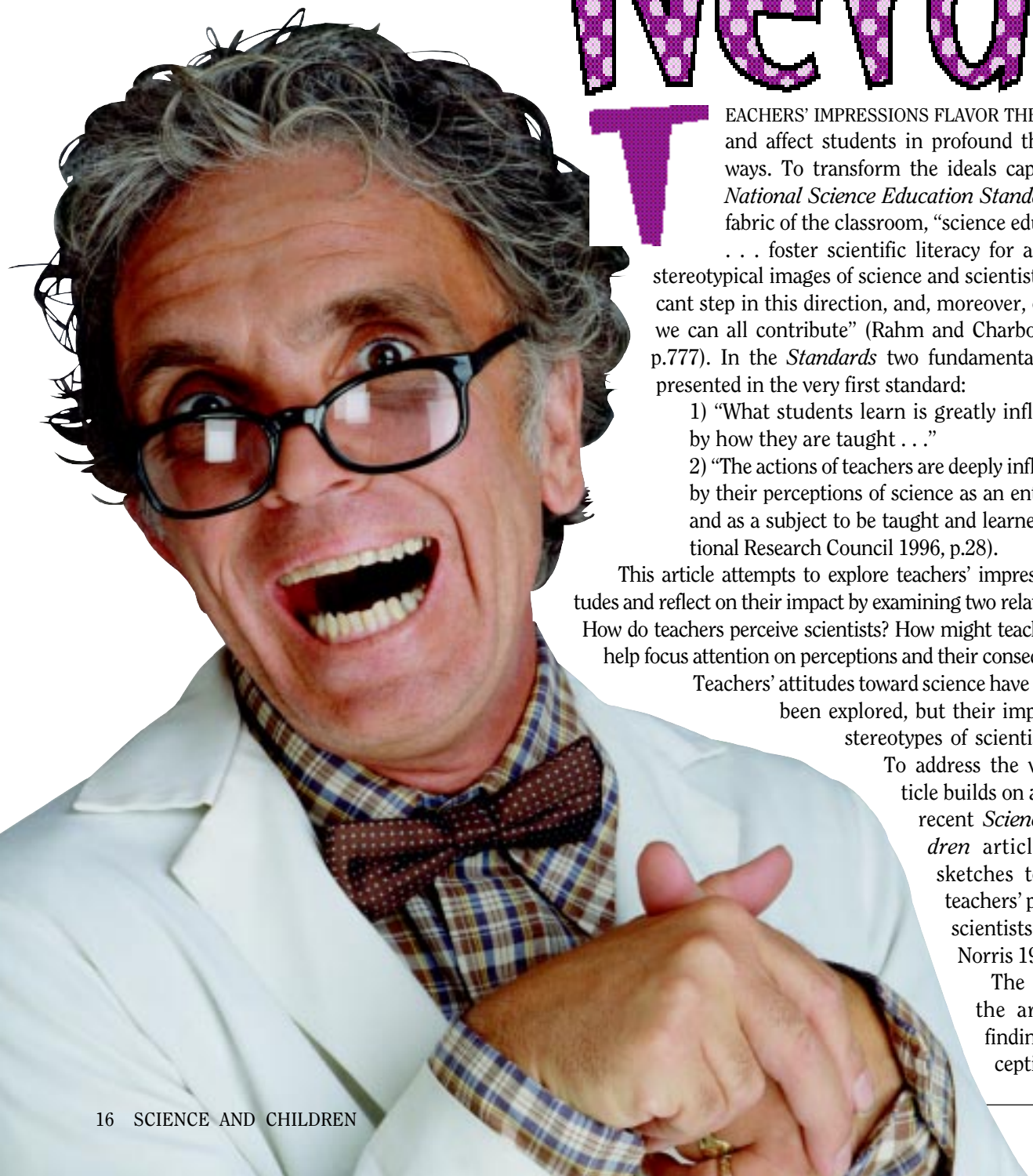
Scientists—Geeks & Nerds?

Dispelling teachers' stereotypes of scientists

By Thomas E. McDuffie, Jr.



TEACHERS' IMPRESSIONS FLAVOR THE CLASSROOM and affect students in profound though subtle ways. To transform the ideals captured in the *National Science Education Standards* into the fabric of the classroom, "science education must . . . foster scientific literacy for all. Dispelling stereotypical images of science and scientists is a significant step in this direction, and, moreover, one to which we can all contribute" (Rahm and Charbonneau 1997, p.777). In the *Standards* two fundamental axioms are presented in the very first standard:

1) "What students learn is greatly influenced by how they are taught . . ."
2) "The actions of teachers are deeply influenced by their perceptions of science as an enterprise and as a subject to be taught and learned" (National Research Council 1996, p.28).

This article attempts to explore teachers' impressions or attitudes and reflect on their impact by examining two related questions: How do teachers perceive scientists? How might teacher educators help focus attention on perceptions and their consequences?

Teachers' attitudes toward science have continuously been explored, but their impressions and stereotypes of scientists have not. To address the void, this article builds on and extends a recent *Science and Children* article that used sketches to determine teachers' perceptions of scientists (Mosley and Norris 1999).

The first part of the article shares findings about perceptions of a rela-

tively large sample of K–8 preservice and inservice teachers based on two focusing questions:

- What adjectives are used to describe scientists?
- What is the stereotypic image of scientists?

The second part of the article outlines strategies to heighten teachers' awareness of perceptions and their consequences.

Perceptions of Scientists

Since the pioneering work of Margaret Mead, investigators have found pervasive, but questionable, preconceived ideas of scientists among all levels of students (Mead and Metraux, 1957; Barman, 1997).

To determine the pervasiveness of stereotypes among present and future teachers, written and pictorial data were collected from educators. *Scientists* and *social scientists* (based on their respective academic disciplines) were defined for participants.

The participants were asked to list descriptors that they associated with both areas, then sketch their impressions of scientists and social scientists. Information was gathered within an instructional segment on collecting and organizing data. When the instructional component was completed, the research aspect of the activity was revealed and participants were invited to submit their descriptors and drawings for inclusion in the study.

A sample of over 550 preservice and inservice teachers from Eastern Pennsylvania and New Jersey shared relevant data about scientists. Approximately 40 percent were practicing K–8 teachers in the region's public and nonpublic schools who had enrolled in professional development workshops. Other participants included preservice teachers enrolled in elementary science methods classes. The population included a high representation of women (about 80 percent) and teachers from urban and suburban districts.

Written descriptors were categorized into a set of personal or professional characteristics. Adjectives indicated that about half of the participants viewed scientists as "smart" or "intellectual" while the responses of 25 percent of the group describe scientists as practical, concrete thinkers who solve problems experimentally and work precisely. The socially laden terms "geeks" or "nerds" were found in 13 percent of the cases.

From a research perspective, the collection and analysis of teachers' sketches were based on the Draw a Scientist Test (DAST) (Chambers 1983). The approach provided a nonverbal assessment with very minimal directions: "Draw a picture/sketch/image of a scientist." Drawings were analyzed based on factors such as gender, age, appearance, hair, and environment. While DAST has clear limitations, it seems to produce similar results to structured interviews suggesting that the technique accurately assesses test takers' perceptions of scientists (Finson, Beaver, and Cramond 1995).

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When applied to the present sample, teacher's drawings extend the longstanding view of scientists as middle-aged (71 percent) and male (84 percent). About half of the sketches included scientists wearing glasses and 36 percent with unconventional hair styles. Understandably, over 50 percent are drawn wearing laboratory coats, 40 percent of which have pocket protectors. A disproportionate number of drawings show a serious (43.7 percent) or crazed (5.8 percent) face. Although these results may be less extreme than the cartoon characters on children's television, parallel impressions are clear.

One finding that has received little notice elsewhere is solitude. In the drawings, scientists stood alone in an environment surrounded by objects of research (54 percent) or knowledge (15 percent); their environments almost never included other people. Drawings of social scientists by contrast tend to include other people. In this sense, teachers' sketches fail to depict science as a collaborative endeavor, yet many of today's investigations are team based. Moreover, work environments are limited to the laboratory rather than the broader world of investigation.

Overall, scientists are presented as serious, sometimes ominous, people who pursue science as solitary investigators working in an environment devoid of social interactions. In teachers' drawings, ethnic minority representation was practically nonexistent.

During the course of data collection, an additional question was introduced: "If you could choose only one person to invite to a special social event, would it be a scientist or a social scientist?" Eighty to ninety percent of the participants chose the social scientist. By implication, scientists are not a part of teachers' social circles.

Examining Beliefs

The persistence of the stereotype of scientists is extraordinary. Attributes

FIGURE 1. Examples of teachers' sketches of scientists.

and images presented by these preservice and inservice teachers are virtually indistinguishable—descriptors and drawings. Both subgroups describe scientists as intelligent, hardworking, and theoretical, but also as impersonal, boring, and nerdy. They are generally depicted as stern, older white males with unkempt hair and unfashionable clothes. Moreover, teachers' stereotypes are the same as their students on most significant characteristics (i.e., their drawings of scientists did not evolve with professional maturation). Are teachers unwittingly communicating a biased viewpoint and prompting children to create a distorted image of scientists?

The instructional scenario was developed on the following premise: "Teachers can be effective guides for students learning science only if they have the opportunity to examine their own beliefs, as well as to develop an understanding of the tenets on which the *Standards* are based" (National Research Council, 1996, p.28). The goal was to enable participants to express their impressions in a nonthreatening way and uncover stereotypes using group data. Because of time constraints, only the preservice groups formally reflected on the nature and potential consequences of their preconceptions during follow-up sessions.

To achieve this, teachers in the sample group discussed their impressions of scientists. When the groups' responses were analyzed, the teachers soon realized their impressions of scientists were similar to students'. Classification of the attributes found in the sketches was based on the DAST characteristics and informal quantification based on a show of hands. The inevitable laughter accompanying the analysis provided a perfect segue into the reflective phase of instruction.

The value of reflection to personal and professional growth is underscored throughout professional literature. Yost, Sentner, and Forlenza-Bailey (2000) provide a viable perspective on the process: "Reflection is an active, persistent, and careful consideration of any belief or supposed form of knowledge in light of the grounds supporting it and future conclusions to which it leads" (p.41). To promote true reflection on and confrontation with their stereotypes, teachers in the sample group wrote an essay that first summarized the group's perception of scientists, then described possible consequences of these views on instruction. Almost universally students suggest that

negative impressions must be recognized or they may be reflected in their teaching of science and communicated to young students. It may also be enlightening to have individuals trace the origins of their perceptions. Here is an example of one student's comment:

"When thinking of a scientist, I often get a mental image of a man wearing large, thick glasses and a clean white jacket of long length. This man is usually quite older since wisdom generally comes with age. He may also be balding or at least have an obviously receding hairline. The scientist usually has an intelligent and sometimes condescending personality. This perception of a scientist is supplied to us by the movie industry and the media. I remember many times as a child watching cartoons or movies that portrayed a scientist much the same as mentioned above. It may seem like an unfair generalization, but then stereotypes usually are."

Strategies for Changing Images

Using self-awareness as a springboard, teacher educators should provide information and design experiences to build more realistic, positive images of scientists and their work. Some instructional enhancements include guests (speakers/role models) who are able to communicate with teachers and students; teaming with industrial partners; and virtual or actual fieldtrips that show scientists' work world and the cooperation it demands.

Another less direct level of intervention includes research projects involving interviewing scientists, study of scientists' biographies, and more investigations and laboratory experiences within their science courses. Certainly, direct instruction or discussions about stereotypes in the media are also valuable.

A third consideration for teacher educators is career awareness. Teachers must abandon their stereotypic view if they hope to encourage females and minorities toward careers in science (Rosenthal 1993) and provide "career information, role models, equitable materials, and innovative practices" (Mason, Kahle, and Gardner, 1991, p.194).

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Implications of the Study

Teachers in the primary and middle grades—perhaps more than at any other instructional level—play a central role in sharing and creating perceptions and stereotypes about science and scientists. Future teachers as well as classroom professionals have distorted impressions of who scientists are and what they do.

Because awareness is necessary for any change in attitudes, teacher educators in classrooms and workshops must first sensitize teachers to the images they hold and may convey. The DAST approach complimented by the addition of descriptors readily highlights individuals' perceptions in a time-efficient manner while the reflections open avenues of possible instructional change.

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Resources

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