

# Materials Science Need and Impact

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# Two major questions

- Does Materials Science motivate students?
- What does industry want materials students to know?

# What does industry want?

- Spring 2004 survey
- Industrial members of ASM
- 257 respondents from a cross section of industries

# Top responses

- Understand that defects in materials cause product failures (av. 4.50 on a 5 point scale)
- Understand the impact of materials processing on properties and production (av. 4.26)
- Basic knowledge of relationships between properties, structure and processing applied to specific materials systems (av. 4.04)
- Processes that effect microstructure and properties (av. 4.04).

# What knowledge do technicians need?

- Basic understanding of materials and processes
- Communication skills (reading, writing, speaking)
- Computer skills
- Math skills
- Problem solving, critical thinking

*In general, our technicians and engineers are grossly undereducated. There needs to be a much greater emphasis in material science, as well as a greater background in practical applications of science.*

*Engineers join the workforce with an inadequate scientific background, little practical application knowledge and a severe lack of written and communicative skills. Most have little self-discipline and expect their diploma to grant them wealth and privilege.*

# What will workers need 5 years from now?

- Business-specific materials knowledge
- Courses in materials science
- College degrees
- Problem solving skills

# How can we meet these needs?

- Enhanced approaches to science using real materials
- Secondary level materials science courses to enhance interest
- Enhanced training and educational programs at community and four-year colleges

# High school materials course

- Taught in approx 100 high schools in the US over 10 years
- Teachers trained by NSF programs and by ASM Teachers Camps
- Basic properties and processing of all classes of materials

# Materials Science and Technology: High school course

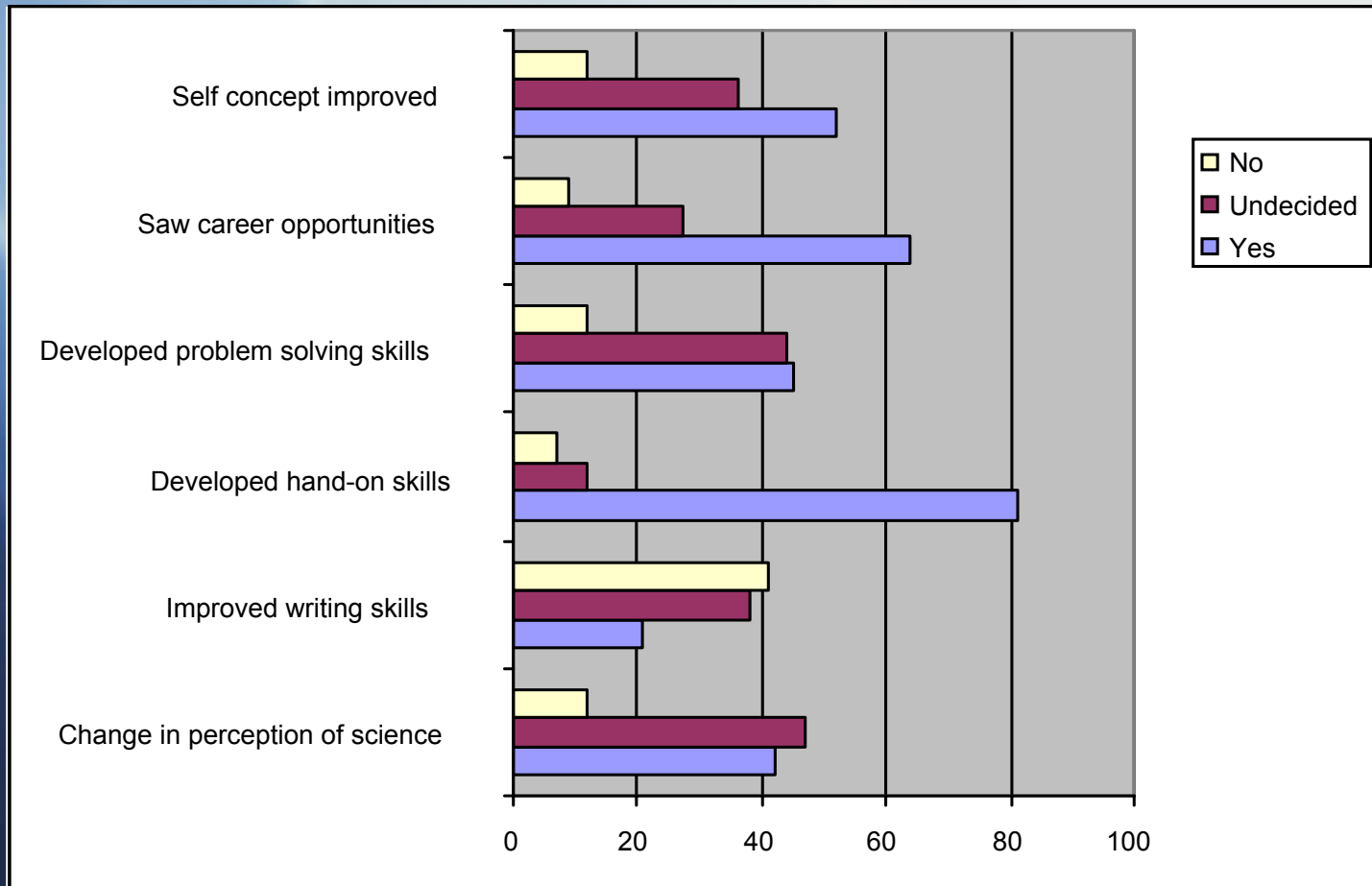
- Hands-on activities and labs (75%)
- Metals, ceramics, polymers, composites
- Real science connections to chemistry and physics (and biology)
- Students learn that they deal with science when they deal with everyday materials

# Student Survey

- 221 surveys returned
- 11th grade (44% )
- Male (65%)
  
- “Materials Technology Education Program Impact on Secondary Teachers and Students,” T. Stoebe, G. Whittaker and K. Hinkley, *Journal of Materials Education* 24, 23-30 (2002).

# Results from student responses

Figure 1: Results for selected responses to student survey



# Student Survey

- Would students recommend this class to other students?
  - 76% said yes
  - 19% said probably
  - 5% said no

# Student Comments

*I love working with materials. I learn so much easier by working with my hands*

*It was a non stop action class. Almost everyday we are doing something new. I got to make a lot of cool stuff that I can keep forever*

*My friends used this class as a stepping stone to get into the Manufacturing Internship at Boeing*

# Other Findings

- Students become more interested in further science study after taking this course
- Significant enhancement in the understanding of science and in career opportunities in science and technology
- Provides a means for motivating teachers to engage students more in real science and to motivate students toward more understanding of science and engineering.

# Additional survey of teachers

- 2004 survey
- 62 returned out of 200 surveys
- 76% using materials concepts in their science or technology courses
- 50% have other colleagues in their school using materials concepts in their science classes
- 44% teaching a separate materials science course in high school
- 95% would use materials science concepts in their classes if resources were available

# Impact on Teachers

- Students becoming more aware of materials science and technology as a career field
- Teachers like the relationships to other areas of science, math and engineering
- Raises interest in science among their students to enhance learning

# Teacher comments

*Students develop a feel for the material world, understand better the importance of studying chemistry, math and physics, and maybe develop new career paths as a result*

*If there is a better way for a student to learn relevant science, I don't know of it. The connections between the class and life are absolutely solid*

*MST is one of the most worthwhile classes I have had the pleasure of teaching. When the teacher enjoys the material so do the students.*

# Conclusions

- High school materials science motivates students to study more science and to understand basic materials relationships
- Materials science raises interest in science and enhances student learning and interest in science

- This demonstrates that the MAGSET focus on materials as a gateway to science has considerable potential
- High school material science provides one means for educators to start meeting the stated needs of industry
- And can be an appropriate means for enhancing general science literacy

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