Students' Perceptions of themselves and Science: Implications for Instruction

Shannon Gadbois

& Nicole Haverstock

NSERC CRYSTAL CRSNG CREAS

Broad influences on science learning…

- Recognition of science literacy as "essential human capital" *(Hodson, 2006)*
- Science curriculum documents that emphasize the connection between science in and out of school *(e.g., Chin, et al, 2007)*
- science education as a priority *(Lewthwaite, 2001)*

Instructional Approaches that influence science learning…

- Learning situations that encourage students to self-evaluate, establish their own process of inquiry, and collaborate
- Opportunities for students to represent ideas in many ways
- "Continuity" of instruction *(e.g., Smith, MacLin, Houghton, Hennessey, 2000)*

Extracurricular Opportunities and Science Learning…

Extracurricular science opportunities:

- enhanced understanding of the *nature* of science *(e.g., Richmond & Kurth, 1999)*
- "restricted" benefits with some misconceptions remaining *(e.g., Bell, Blair, Underwood, & Lederman, 2003)*

Extracurricular opportunities …affect and science learning

- Informal science education emphasizes science *issues*, partnership building, and the encouragement of emotional connections with science learning (e.g, *Pedretti, 2006)*
- Authentic science opportunities allow students to contribute to solutions of real problems – result is, in part, an emotional connection to the content *(e.g., Roth, 2005)*

“Other” factors influencing science learning…

Teacher

- Science knowledge, Experience, class size, resources

Students’

- Prior experience and knowledge
- attitudes, interest
- perceptions of self as learner and of science

Students' Self-perceptions and interest in science

Self-perceptions

- influence the behaviours individuals demonstrate and the goals they set *(Harter, 1999)*
- occur with the implicit assumption of a comparison with in-group members (*Onorato & Turner, 2001)*

Why perceptions important?

- Boys have more positive attitudes about science compared to girls *(Breakwell & Robertson, 2001)*
- Positive relationship between science attitudes and performance and this relationship may be stronger for girls *(Sorge, 2007; Weinburgh, 1995)*

Self-perceptions and attitudes

- Girls are less likely to perceive themselves as scientists as adults *(e.g., Stake & Nickens, 2005)*
- Women are still significantly under-represented in science professions *(e.g., Wilson, Gadbois & Nichol, in press; CAUT Almanac, 2005)*

The present study

- What is the nature of boys and girls' underlying perceptions about science and scientists, the self as learner and possible scientist?
- How might these perceptions inform or influence classroom instruction?

Our expectations:

- Girls and boys will not differ in their general descriptions of themselves as learners
- They will differ on:
  - Preference for science
  - Perceptions of scientists and what scientists do
  - Their perceptions of themselves as possible scientists

The data

- One-to-one student semi-structured interviews
- Focus on students personal reflections as an index of their attitudes about science and their knowledge of it
- We were particularly interested in the “adjectives” or “descriptors” students used (e.g., *Grindstaff & Richmond, 2007)*

Participants

- 116 students (61 boys; 55 girls)*
- 6 classes, across 4 schools

Good at learning?

Boys

- YES (82%)
- Maybe (14%)
- Don’t know (4%)
- NO (0%)

Girls

- YES (85%)
- Maybe (9%)
- Don’t know (6%)
- NO (0%)

How do you know you're a good learner?

Boys

- Quick learner (32%)
- Get good marks (25%)

Girls

- Listen/pay attention (23%)
- Quick at learning (23%)
- Get good marks (18%)

How do you like to learn?

Boys

- Hands-on (30%)
- Visually (18%)
- Listen to learn (15%)
- Quickly (15%)

Girls

- Visually (29%)
- Hands-on (21%)
- Read to learn (11%)
- Have fun (11%)

Most favourite

Boys

- 34 % - math
- 28% - science
- 20% - gym

Girls

- 25% - science
- 17% - ELA
- 16% - math

Why favourite

Boys:

Why Math?

- Good at it/it's easy (48%)
- content (39%)

Why Science?

- Content (38%)
- Doing experiments (31%)

Girls:

Why Science?

- Doing experiments (48%)

Why ELA?

- Reading and writing (72%)

least favourite and why…

Boys

- 30% - ELA
- 27% - math

- ELA
  - Writing (50%)
- Math
  - Hard/confusing (36%)
  - Not good at it (29%)

Girls

- 54% - math
- 27% - don’t have one

- Math
  - Hard/confusing (50%)
  - Boring (21%)

Describe a scientist

Boys

- Discovery, invention (18%)
- Conduct research (17%)
- Help others, find cures (14%)

Girls

- Conduct research (22%)
- Intelligence, smart (16%)
- Appearance references (15%)

Scientists do things you would like to do?

Boys

- YES (29%)
- Maybe (29%)
- NO (36%)
- Don’t know (6%)

Girls

- YES (41%)
- Maybe (10%)
- NO (43%)
- Don’t know (6%)

Yes, would like to do what scientists do because…

Boys

- YES
  - 39% make discoveries, invent, help others
  - 33% like specific content
- NO
  - 36% want to do something else

Girls

- YES
  - 33% like specific content
  - 33% like activities
- NO
  - 32% wouldn't like to do what scientists do
  - 27% want to do something else

Life as a Scientist…

Boys

- 23% work in lab doing experiments/research
- 21% figure out things/discover things no one else has
- 14% difficult/stressful
- 14% busy/lots to do

Girls

- 26% work in lab doing experiments/research
- 17% figure things out/discover things no one else has
- 16% busy/lots to do
- 13% long days

How does science help us every day?

Boys

- 14% help/inform others
- Provide us with information re:
  - save environment (14%)
  - Planets (12%)
  - cars/alternate fuels (10%)
  - develop technology (10%)

- Girls
- Provide us with information re:
  - Health issues (33%)
  - Animals/plants (14%)
  - Planets (12%)

Summary of Gender Comparisons:

Similarities

- Prefer science compared to other subjects
- Believe they are good learners

Differences

- Regarding preferred and least preferred courses
- reasons for preference
- ideas of scientists & what they do
- ideas about their possible selves as scientists
- emphases on scientists' lives

Implications for the classroom?

- Should students have a better conceptual understanding by grade six
- Does it matter that there are differences between boys and girls at this age?
  - Individuals don’t start to differentiate specific elements of their self-perceptions until late adolescence