



Girls and education – physics not an option?

Ellen Karoline Henriksen, University of Oslo, Norway

Anne Borg, Norwegian University of Science and Technology

Camilla Schreiner, University of Oslo, Norway







We will look at:

- Girls in upper secondary physics education – some statistics
- Factors influencing young people's educational choice
- What is it about physics that makes girls turn away?
- How can we attract more girls to physics education?



www.aaas.org







Girls in upper secondary physics

Examples of proportion of girls in highest-level physics classes in some countries:

Country	Course	Prop . Girls	
UK		22 %	
Norway	"Physics 2", optional in year 13	~30 %	
New Zealand		~34 % *	
Germany			
Israel		25 %	
USA	Physics II / honors / AP physics	38 %	







Factors influencing educational choice: Eccles' expectancy-value model

Young people make educational choices based on:



- **Expectancy of success** (based on previous experience, teacher and parent expectations, ...)





Factors influencing educational choice: Traits of youth in late modern societies

- Everyone wants to work with something worthwhile and fulfilling. What do girls in late modern societies find worthwhile and fulfilling? Postmaterial values: environment, justice, care for others,...
- Youth in late modern societies feel culturally liberated and build their identity (or so they feel) independently of home background, social class, parents' interests and values and so on
- Creativity and innovation are highly valued (designers and movie directors are "heroes")
- Youth express their identity through choice of
 - Music clothing friends education





The Relevance of Science Educati







UNIVERSIT OF OSLO

www.ils.uio.no/english/rose

F. My science classes

To what extent do you agree with the following statements about the science that you may have had at school?

Give your answer with a tick on each line. If you do not understand, leave the line blank.)

	Ľ	Disagree			Agree	
۱.	School science is a difficult subject	1				
2.	School science is interesting		12			
3.	School science is rather easy for me to learn			1 3		
1.	School science has opened my eyes to			U		
	new and exciting jobs					
ō.	I like school science better than most other subjects					
δ.	I think everybody should learn science at school					
7.	The things that I learn in science at school will be helpful					
	in my everyday life					



I would like to become a scientist



Working with something I find important and meaningful Social worker, actor, singer – or work in a pet shop and help animals





Who do you want to be

when you grow up....?







Example from Norway:



Meteorology became a profession that suited a girl





Can physics do the same?





What is it about physics that makes girls turn away?

Some research findings:

- Carlone (2003): "Prototypical physics" (physics envisioned as difficult, hierarchical, objective, etc.) is maintained and reproduced in physics classrooms, thus undermining the goals of a more inclusive physics.
- Angell et al (2004): Traditional "physics content knowledge" is emphasised over experimental, historical/philosophical and science/society approaches, and the subject seems to attract and reward pupils with this traditional orientation
- Osborne & Collins (2001) described the British science curriculum as having "a foundationalist emphasis on basic concepts"







What is it about physics that makes girls turn away? (cont:d)

More research findings:

- Boys and girls hold different notions of what it means to understand physics: Girls think they understand a concept only if they can put it into a broader world view, whereas boys appear to view physics as valuable in itself and are satisfied if there is internal coherence among the physics concepts learned (e.g. Stadler et al., 2000).
- Osborne & Collins (2001): Girls wish to know *why* things happen in science (the causal question) rather than only *what* happened (the ontological question).
- Girls, more than boys, emphasise a "social element" of knowing physics: understanding the world and explaining things to other people.





What is it about physics that makes girls turn away? (cont:d)

More research findings:

- Haüssler & Hoffman (2000): German boys' physics-related self concept was higher than their general school-related self concept, whereas the opposite was true for girls.
- Students in general, and girls in particular, regard physics as a particularly difficult subject with a high workload (e.g. Angell et al., 2004).







How can we attract more girls to physics?

Measures that have "proved" to help:

- Instructional materials addressing girls' interests, such as the human body and issues of social relevance
- Teaching strategies that enhance the self-confidence of girls, like collaborative groups



• Strengthen girls' selfconcept in physics





How to attract girls to physics (cont:d)

- Inform them about range of opportunities available in physics: Starting your own business based on a good idea; contributing to solving the world's energy challenge, contributing to understanding climate, doing collaborative research (e.g. CERN), ...
- Give them inspiring experiences with physics in school from an early age – through choice of physics education contents, contexts, and teaching approaches:
 - Relevant contents and contexts to the real world
 - Work forms that encourage cooperation
- Girls feel secure in choosing physics if encouraged by a person whom they trust (parents, teachers, advisers,...) -
- Inclusive, applications-rich physics teaching with frequent use of group work





Showing how physics is relevant to girls' aims, interests and identity

 Health, for instance medical imaging technology, cancer treatment





MRI image of brain

Working together: Teamwork, e.g. in engineering, to achieve a common aim



Showing how physics is relevant to girls' aims, interests and identity (cont:d)

Visualize the kinds of tasks and the everyday working life of a (female) physicist



Electronics graduates from Oslo developed technology for "zooming in" on sound and established a company



Demonstrate how creativity, innovation and entrepreneur-ship may also be realized through a physics career







Factors influencing recruitment, retention and gender equity in science, technology and mathematics higher education

EU-funded research project starting in 2009 with 6 European partners and ~ 30 international associated partners

Interested in collecting IRIS data in your country? Contact e.k.henriksen@fys.uio.no



References



- Angell, C., Guttersrud, O., Henriksen, E. K., & Isnes, A. (2004). Physics: frightful, but fun. Pupils' and teachers' view of physics and physics teaching. *Science Education, 88,* 683 706.
- Baker, D. og R. Leary (1995). Letting Girls Speak Out about Science. *Journal of Research in Science Teaching* 32, 3-27.
- Carlone, H. B. (2003). Innovative science within and against a culture of "achievement". *Science Education 87,* 307-328.
- Eccles (Parsons), J., Adler, T., Futterman, R., Goff, S., Kaczala, C., Meece, J., & Midgley, C. (1983).
 Expectancies, values, and academic behaviors. In J. T. Spence (ed.), *Achievement and achievement motivation* (pp. 75–145). San Francisco, CA: W.H. Freeman.
- Häussler, P. & Hoffmann, L. (2000). A curricular frame for physics education: Development, comparison with students' interests, and impact on students' achievement and self-concept. *Science Education 84*, 689-705.
- Illeris, K., Katznelson, N., Simonsen, B., & Ulriksen, L. (2002). *Ungdom, identitet og uddannelse [Youth, identity and education]*. Frederiksberg: Roskilde universitetsforlag
- Osborne, J & Collins, S. (2001). Pupils' views of the role and value of the science curriculum: a focus-group study. International Journal of Science Education 23(5), 441-467.
- Schreiner, C., & Sjøberg, S. (2007). Science education and youth's identity construction two incompatible projects? In D. Corrigan, J. Dillon & R. Gunstone (Eds.), *The Re-emergence of Values in the Science Curriculum (*pp. 231-248): Sense Publishers.
- Schreiner, C. (2007). Har realisten gått ut på dato?, P2-akademiet (Vol. XXXVII, s. 77-91). Oslo: Transit.
- Stadler, H., Duit, R. & Benke, G. (2000). Do boys and girls understand physics differently? *Physics Education 35*, 417-422.
- Zohar, A. and Sela, D. (2003). Her physics, his physics: gender issues in Israeli advanced placement physics classes *International Journal of Science Education 25 (2),* 245-268