

# Can assessment improve quality of labwork?

Gunnel Grelsson  
Department of Educational Measurements,  
Umeå University, SE-901 87 UMEÅ, Sweden,  
gunnel.grelsson@edmeas.umu.se

Christina Ottander  
Department of Mathematics, Technology and Science Education,  
Umeå University, SE-901 87 UMEÅ, Sweden,  
christina.ottander@educ.umu.se

## Introduction

Science labwork give students an opportunity to work with concepts and learn basic skills in natural sciences (Ganiel & Hofstein, 1982). Furthermore, lab and field skills should be seen as a desirable learning outcome, because of their specific utility in employment, research, and for scientific literacy. However, there is concern about the effectiveness of lab work in facilitating the students understanding of scientific inquiry (Högström, Ottander, & Benckert, 2006; Wellington, 1998).

Practical achievements are separate from other achievements (Tamir, 1972), and a specific goal of biology education in upper secondary school in Sweden addresses labwork and field investigations (Table 1). Knowledge about how this goal is fulfilled and the assessment practice of it is, however, incomplete (cf. Ottander & Grelsson, 2006).

## Problems with target achievement

The Swedish syllabus prescribes a goal-related tuition and grades are criterion related. Goals and standards for biology in upper secondary school emphasize five skills for labwork: to plan, carry out, interpret, evaluate and present. A deeper analysis of the goals and standards, however, show inconsistencies in that planning and presentation are only specified in the goals and evaluation only appear in the standards (Table 1).

**Table 1.** Example of goal and standards concerning labwork in Swedish upper secondary school (<http://www3.skolverket.se/ki03/front.aspx>).

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### Goal Biology A:

"Pupils should be able to **plan** and **carry out** field studies and experimental investigations, **interpret** these, as well as **present** their work orally and in writing".

### Standards

Pass: "*Pupils **carry out** investigatory tasks in accordance with instructions, and evaluate and **discuss** results with some assistance.*"

Pass with distinction: "*Pupils work together on **designing** and **carrying out** an investigation, as well as **interpret** the results on the basis of theories introduced and hypotheses set up.*"

Pass with special distinction: "*Pupils **apply** scientific ways of working, **interpret** results, and **evaluate** the validity and reasonableness of their conclusions, on the basis of theories and hypotheses set up.*"

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The goals and standards are thus hard to interpret and transfer into practice and confusing for both students and teachers. A case study showed that the focus of most labwork instruction was on content goals, the practical skills not emphasized (Ottander & Grelsson, 2005). Many students thought that practical skills and laboratory reports have little or no importance for grades (op. cit.). Furthermore, others have shown that the importance of labwork for learning is not obvious for many students (Ganiel & Hofstein, 1982).

## The assessment practice

In the Swedish school assessment is continuous throughout a course, and conducted by the teacher on that specific course. The teachers in the case study did not assess labwork systematically, but were interested in learning and practicing an assessment model transparent for the students and with potential to use formatively.

Goals, instructions, and standards of experimental exercises are intimately connected and must be treated together when planning the labwork. Concerns about affective dimensions of labwork are also important. Furthermore, both the goals and outcome of a labwork should be communicated with the students to make them recognize the value of the process for their learning outcome. Otherwise the purpose with the labwork will not be fulfilled.

## Which way now?

- ◇ Will more explicit and formalized standards help overcoming the problems with interpretation of goals and assessment criteria?
- ◇ Will a focus on the goals and standards of labwork in the assessment practice make them clearer to students (cf. Table 2)?
- ◇ Would self-assessment focusing on the learning process as a complement, and thereby provide better assessment practice?
- ◇ Should teacher education put more emphasis on didactical aspects, as for example organizing, planning and assessing labwork (cf. Ruiz-Primo & Shavelson, 1996)?

**Table 2.** Example of standards for pass with distinction specified in a students labsheet in genetics, developed for the Swedish National Test Bank

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During the performance your teacher will assess if you, in cooperation with a class mate, can

- design a method testing a given hypothesis,
- carry out the investigation, and collect, and document data.

In your presentation your teacher will assess whether you by your self can

- describe your investigation method and present data,
  - interpret data and evaluate whether the results are consistent with the hypothesis or not.
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Poster presented at the 8<sup>th</sup> Annual conference of Association for Educational Assessment – Europe (AEA Europe): Assessment for Educational Quality, Stockholm, Sweden. 8-10 November 2007.