Student preparedness in Ph.D. education

- an assessment of supervisor and student perceptions of fulfilling Swedish third-cycle learning outcomes

Authors & affiliations

Kimberly Nicholas, Centre for Sustainability Studies, LUCSUS, Lund University
Emily Baird, Department of Biology, Lund University
Christian Brackmann, Department of Physics, Lund University
Barry Ness, Centre for Sustainability Studies, LUCSUS, Lund University
Simon Niedenthal, School of Arts and Communication, Malmö University
Anna Torstensson, Centre for Mathematical Sciences, Lund University
Sofia Waldemarson, Department of Immunotechnology, Lund University

Abstract

The aim of this study was to assess the perceptions of Ph.D. candidates and supervisors regarding how well Ph.D. students fulfill the learning outcomes specified for third-cycle higher education in Sweden. Data were gathered using a survey sent to doctoral students and supervisors at five departments at Lund University and one department at Malmö University. The investigation concentrated on 18 skills outlined in the learning objectives and on specific analyses of student and supervisor ratings, gender differences, and differences across departments. Responses from 123 survey participants show that skills for *specialized knowledge* and *specific method* competencies were rated most highly by respondents, while skills relating to *contributing to others' learning*, *ethics*, *presenting to society*, and identifying *limitations* of research were rated lower than average. In 14 of the 18 skills, supervisors rated the students' competencies higher than the students rated themselves. Although the highest-rated skills were rated similarly by male and female respondents, there were gender differences for other learning objectives (e.g., *ethics*, *personal knowledge*, and *autonomy*). Responses from the Biology and Physics departments revealed differences in both how students and supervisors rate Ph.D. candidate performance and certain individual learning objective skills. Our results demonstrate large differences in the appraisal of learning outcomes in individual cases by students and supervisors, and that these assessments can be influenced by gender and academic culture. For the third-cycle learning outcomes to actually promote student learning and be a useful tool for quality assurance, supervisors and students must be aware of their existence, and care must be given to apply and assess the generic learning objectives in the context of particular disciplines, with the consideration of the specific needs of

individual doctoral students. Embedding the learning outcomes in individual Ph.D. study plans would be a good initial step to meet this goal.

Introduction

The nature of graduate and post-graduate teaching and learning has undergone a massive paradigm shift over the last few decades. The ever-increasing globalization and commercialization of higher education has generated the need for improved standardization and quality assessment (McCallin and Nayer 2012). The response to this need has been the development of frameworks of intended learning outcomes that facilitate the standardisation and quality assessment of education at course, degree and post-graduate award levels. One mostly indirect consequence of this widespread introduction of intended learning outcomes has been its profound impact on the approach to and philosophy of education at the doctorate (or tertiary/third-cycle) level. This is because, to meet the learning outcomes, educators are required to focus on what the students are learning, rather than on what the teachers are teaching (the dominant paradigm in traditional teaching methods), thus transforming from a teacher-centered to a student-centered education model (Lindberg-Sand, 2012).

By introducing learning outcomes for the doctorate degree level, universities have better and more concrete means to describe what students will do and achieve throughout the period of doctoral education. At the same time, the implementation of these outcomes establishes the supervisor's role as an educator that is responsible for helping students to achieve these learning outcomes, and the department's institutional role in supporting this goal. Thus, intended learning outcomes can be seen as a tool to improve and facilitate supervision as they can help both the student and the supervisor to understand what is expected of them, to better define learning goals, and to recognize when these goals are achieved.

Most studies on third-cycle education in Sweden and in other countries concentrate on assessments of general Ph.D. student wellbeing (HSV 2008, SLU 2011, Pyhältö, et al. 2012, Golde 2000); there has been little attention in the literature to their achievement of learning outcomes. In Sweden, generic learning outcomes have been defined for all doctoral degrees by the federal body *Universitets- och Högskolerådet* (UHR, see *Appendix 1*). These learning outcomes were first established in 2006.

In an effort to explore the significance of the Swedish third-cycle learning outcomes for Lund University, Lindberg-Sand and Sonesson (2011) distributed a survey to 14 faculties, inquiring about the extent to which an "average" Ph.D. student was assessed on each learning outcome. Evidence from this survey suggested that, even five years later, they had not been integrated into the third-cycle education framework (Lindberg-Sand and Sonesson, 2011). The results of that survey suggested that the learning objectives were not used in the assessment of graduating Ph.D. students, and that the Ph.D. students at this

stage were not achieving many of these outcomes. One of the main reasons for this finding may be that most supervisors and Ph.D. students are not aware of the existence of these intended learning outcomes, a possibility confirmed by a recent (September 2013) informal survey of 10 supervisors and 10 Ph.D. students carried out at the Department of Biology (Emily Baird, personal communication).

The goal of this study is to explore the relationship between the third-cycle intended learning outcomes and current researcher education across different departments and universities in South Sweden. In particular, we used a survey to assess the perceptions of doctoral students and their supervisors at Lund and Malmö Universities regarding Ph.D. student achievement of the 18 specific learning outcomes outlined by the UHR. In the typically informal process of doctoral education, the supervisor is not the only factor that may be influencing the achievement of learning outcomes. We also investigate the effect of gender in these perceptions, and compare results between two departments to examine the effect of departmental or institutional culture. Finally, we provide suggestions for improvement in achieving the PhD learning outcomes.

Methods

We used the learning objectives outlined for Ph.D. student education in Sweden (Appendix 1) to design an online survey to assess student and supervisor perceptions of attainment of these objectives (Appendix 2). Each learning outcome skill was formulated into a single dimension and rated on a five-point scale from “very well” to “very poorly”. Supervisors were asked how well they found that students demonstrated these skills, and students were asked how well they felt prepared in these skills through their graduate studies. We also solicited information about gender, years of study, and national academic background (whether the respondents had received their education within or outside Sweden).

The survey was distributed via email to all supervisors and Ph.D. students in the home departments of the study researchers, which included five departments from Lund University (one department from the Faculty of Natural Sciences (Biology), three from the Faculty of Engineering (Centre for Mathematical Sciences, Department of Immunotechnology, and the Division of Combustion Physics at the Department of Physics), and one faculty-free independent center (the Lund University Centre for Sustainability Studies)), and one department from Malmö University (the School of Arts and Communication). The survey remained open for ten days and participation was encouraged by departmental announcements and email reminders. The survey was also translated into Swedish (Appendix 3) to further facilitate responses from native Swedish speakers. Results were analyzed using R statistical software (The R Project for Statistical Computing).

Results

Respondent Demographics

In total, 123 survey responses were received: 71 (58%) from students, and 53 (42%) from supervisors. Two respondents did not indicate their gender, but of the remaining 121, 53 (43%) were female and 69 (57%) were male. The largest response groups came from the departments of Biology (27 students and 23 supervisors, in total 41% of our sample) and Physics (18 students and 9 supervisors, 22% of our sample). Male respondents were evenly divided between student and supervisor roles, while nearly twice as many female respondents were students compared with supervisors. The majority of student respondents (77%) had received their Master's education in Sweden, minimising the effect of differences in educational background on the results.

Overall skill ratings

For simplicity, italicized abbreviated terms are used throughout the report for the skills addressed in the survey (see Table 1 for a list of the skills and their abbreviated terms). Skills regarding *specialized knowledge* and *specific method* were rated most highly (average rating above 1.0, corresponding with an average rating of achieving a skill "well" or better; Figure 1). Skills relating to academic presentations, and more general research skills relating to methods and *analysis*, *autonomy*, and *planning* were ranked below "well," between 0.5 and 1. Four skills (*contribute*, *ethics*, *present to society*, and *limitations*) were ranked below 0.5 on average, close to a "neutral" rating of zero (Figure 1).

Table 1. Questions as worded in the survey for Ph.D. students (see Appendix 2 for the survey for supervisors) and the abbreviations used in this report.

Based on your experience as a Ph.D. student, how well do you think you have acquired the following skills?	**Abbreviation**
broad knowledge and systematic understanding of the research field	*broad knowledge*
up-to-date specialised knowledge in a limited area of the research field	*specialized knowledge*
familiarity with research methodology in general	*general method*
familiarity with methods of the specific field of research in particular	*specific method*
the capacity for scholarly analysis and synthesis to review and assess new and complex phenomena, issues and situations autonomously and critically	*analysis*

the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively	*formulate*
the ability to plan and use appropriate methods to undertake research and other qualified tasks within predetermined time frames and to review and evaluate such work	*plan*
the ability to make a significant contribution to the formation of knowledge through his or her own research	*contribute*
the ability to present and discuss research and research findings authoritatively in speech and writing in national contexts	*present nationally*
the ability to present and discuss research and research findings authoritatively in speech and writing in international contexts	*present internationally*
the ability to present and discuss research and research findings authoritatively in speech and writing in dialogue with the academic community	*present academically*
the ability to present and discuss research and research findings authoritatively in speech and writing in dialogue with society in general	*present to society*
the capacity to contribute to social development and support the learning of others both through research and education	*learning*
intellectual autonomy	*autonomy*
the ability to make assessments of research ethics	*ethics*
specialised insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used	*limitations*
the ability to identify the personal need for further knowledge	*personal knowledge*
disciplinary rectitude (correct behavior or thinking)	*rectitude*

Student and supervisor ratings

For 14 out of the 18 skills assessed, supervisors rated student's skills as the

same or more highly than the students ranked themselves (red crosses higher than blue in Figure 1). This was especially notable for *specialized knowledge* and *specific method*, where the supervisor's ratings were almost a full point above the student's self-assessments. Despite the high rankings by supervisors for a majority of the skills, students rated themselves more highly than the supervisors did for four skills: *personal knowledge*, *autonomy*, *ethics*, and *limitations*.

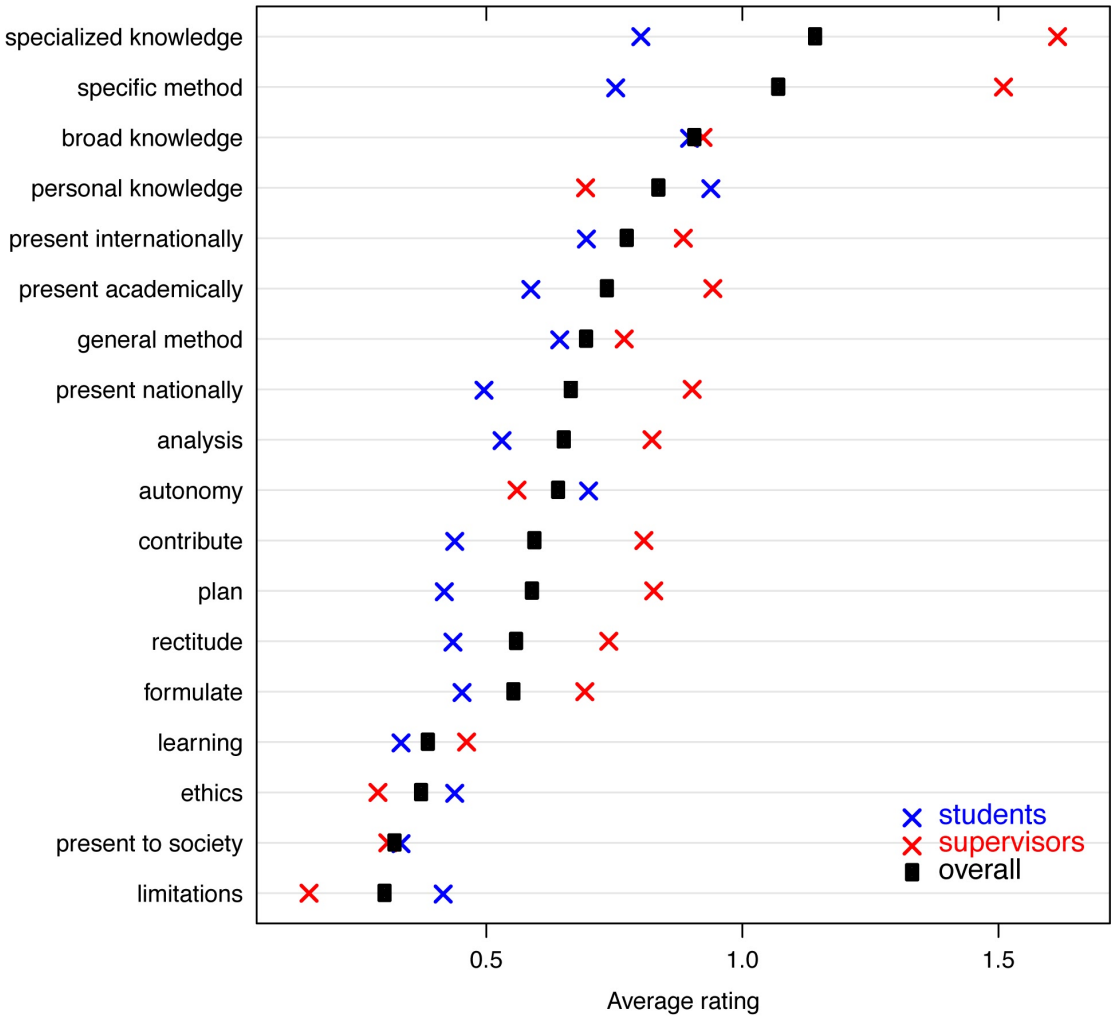

Figure 1: Average ratings for all participants in the survey (N=123, black boxes), as well as separate ratings for students (N=71, blue crosses) and supervisors (N=53, red crosses).

Gender differences

There was little gender difference in the two skills rated most highly overall, *specialized knowledge* and *specific method* (which however show big differences between student and supervisor ratings) when comparing male and female students and supervisors (Figure 2). For the remaining skills, male supervisors (filled dark blue boxes) gave the same or higher ratings than female supervisors for 14 out of the 18 categories, with especially high ratings in the ability to *present nationally* and *contribute* (Figure 2).

For several skills, female supervisors (dark purple filled circles) gave the lowest

rating of all 4 groups, including *personal knowledge*, *ethics*, *present to society*, and *limitations*. Female supervisors gave the highest ratings for *broad knowledge* and the abilities to *present academically*, and to *plan* and *formulate*. Note that, while the three groups of male students, male supervisors, and female students are equally sized (around N=35), there were half as many female supervisors in our sample (N=18).

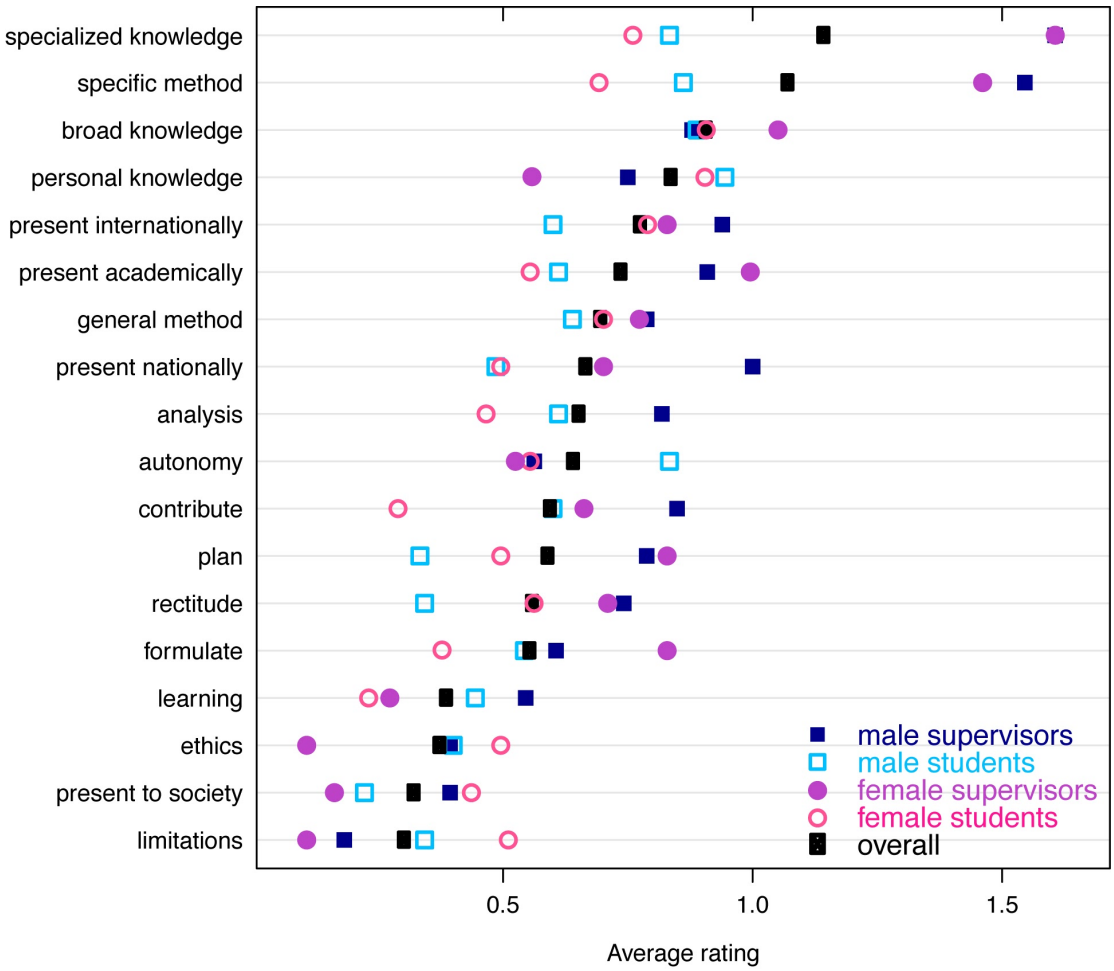

Figure 2: Skill ratings between males (blue squares) and females (pink circles), compared with the average overall rating across the entire sample (black square). Supervisors are shown in darker colors with filled shapes, and students in lighter colors with open shapes. Responses are for male supervisors (dark blue filled square, N=33), female supervisors (dark pink filled circles, N= 18), male students (light blue open square, N=36), and female students (light pink open circle, N=34).

Male students (open light blue squares) rate themselves lowest in their ability to *present internationally*, as well as skills in *general method*, *plan*, and *rectitude*, but highest in *personal knowledge* and *autonomy*. Female students (open pink circles) rate themselves highest of the four groups in *ethics*, *present to society*, and *limitations*. They rate themselves lowest among all 4 groups in seven categories, notably their ability to *contribute*.

Department differences

In an attempt to investigate the effect of academic environment on the results, responses from the two most highly represented groups, the Division of Combustion Physics (a division at the Department of Physics at LTH) and the

Department of Biology, were compared. The survey results from students and supervisors of these groups are presented in Figure 3.

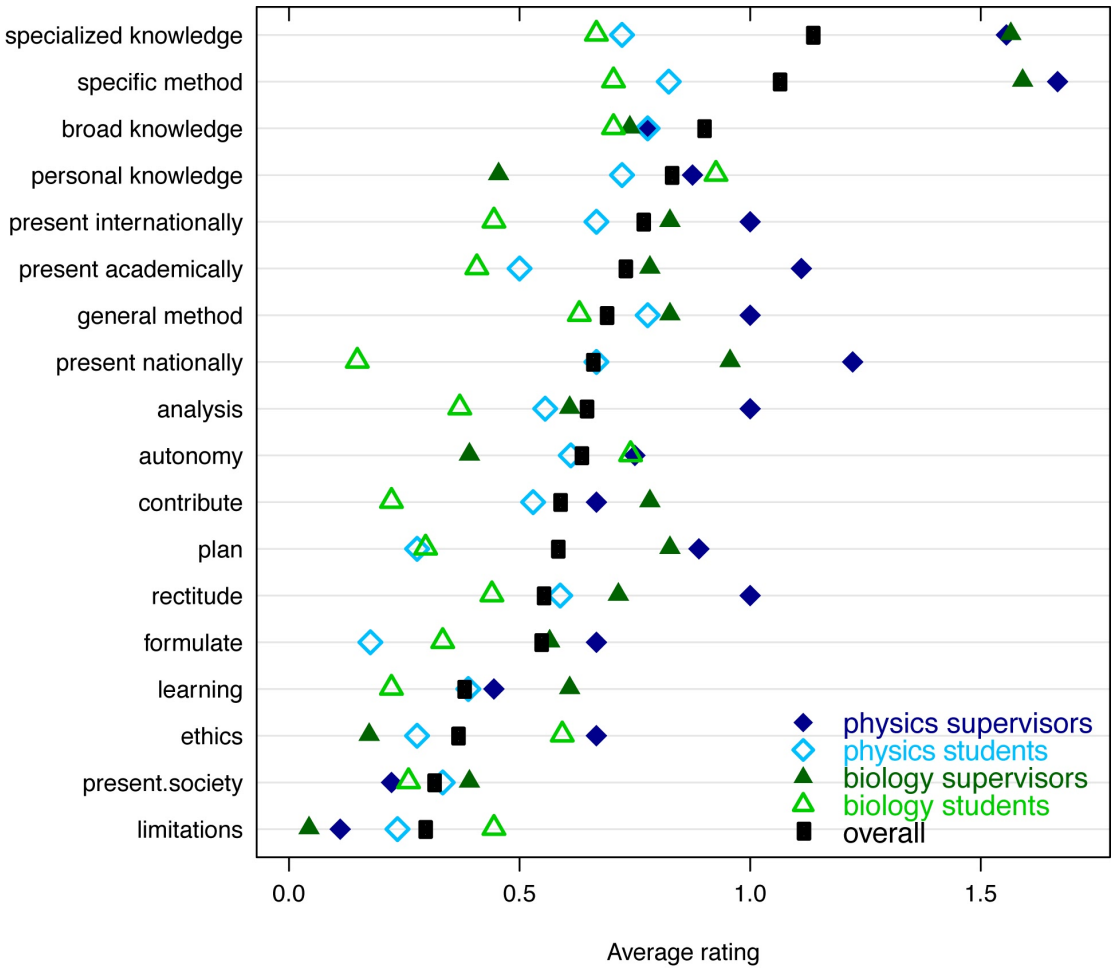

Figure 3: Comparison between Division of Combustion Physics/Department of Physics (blue diamonds) and the Department of Biology (green triangles). Students are shown in lighter, unfilled shapes, and supervisors in darker, filled shapes. Data are shown for physics supervisors (N=9), physics students (N=18), biology supervisors (N=23), and biology students (N=27), compared with the overall mean (black squares) for all participating departments (N=123).

The differences between the supervisors or students from the biology and physics departments is smaller than the difference in ratings between students and supervisors within each department (Figure 3). Physics supervisors (green filled diamonds) give the highest ratings (or equal highest) of all 4 groups for 12 of the 18 skills and especially rate *presentation skills* (*national*, *international*, and *academic*), *analysis*, and *rectitude* highly compared with the other groups (Figure 3). Physics students (blue open diamonds) generally rate themselves substantially lower than their supervisors do, although they rate themselves more highly than biology students do in 13 skills (Figure 3). Biology supervisors (green filled triangles) generally rate students highly, except in *personal knowledge*, *autonomy*, *ethics*, and *limitations*, where they have the lowest ranking of all 4 groups. Biology students rate themselves low, the lowest (or tied for lowest) of all 4 groups for 12 out of 18 skills. However, biology students rate

themselves highest for *personal knowledge* and *limitations*. A comparison of relative student-supervisor ratings between the departments indicates notable differences for *personal knowledge*, *academic* and *national presentation*, *analysis*, *autonomy*, *contribute*, *formulate*, *learning*, and *limitations*.

Discussion

General trends

The overall rating of different learning outcomes can be divided into three categories: high ratings (mean >1.0) meaning the skills are being well achieved, medium (0.5-1.0), and low (<0.5) (Figure 1). The highest-rated items, where survey participants agreed that Ph.D. students were being well prepared, were *specialized knowledge* and *specific method*. Furthermore, *broad knowledge* and *personal knowledge* were rated highest in the medium category. This may not be surprising as many of these can be considered core activities in research projects, which by default are very knowledge-intensive. Another reason for these being highly ranked might also be that these skills relate to the traditionally emphasized content knowledge and understanding, while other categories refer to personal competences which may be more subjective, and more difficult to teach, to learn, and to rate.

The four items that were rated lowest included *learning*, *ethics*, *present to society* and *limitations*, skills that focus on judgment and approach, including outcomes that are observed in the behavior of the student. Does this result suggest that these areas are considered the least important by students, perhaps because they are not considered to be related directly to research? While this is a possibility, it should be noted that these outcomes represent values that are more difficult to assess through the thesis and oral defense than skill- or knowledge-oriented learning outcomes.

Ohlin (2007) performed a survey of how Ph.D. students and supervisors at the department of Immunotechnology experienced the formative examination in Ph.D. education. This survey was undertaken in 2007, which was before the formal learning outcomes according to the Bologna Declaration (2007) had come into full effect, although some adjustments at that stage had been incorporated into Högskoleförordningen (now known as UHR, Ohlin 2007). The learning outcomes in the Ohlin survey are therefore similar to those investigated in the current study, although the phrasing differs in some areas and free-text answers were used. The results of the Ohlin study showed that the key skills, "knowledge of the subject" and "knowledge of method" were the most highly rated, followed by "identification of scientific questions and the execution/implementation and evaluation thereof," which agrees well with our results. Interestingly, "ability to contribute to society and the learning of others," "intellectual independence and scientific rectitude" and "insights into the possibilities and limitations of science" were not considered to be examined at all by Ohlin. This is also to a large extent consistent with the answers obtained in our survey. In general, it can be said that, although the goals of doctoral education have been changed slightly, not much has changed in the past seven

years when it comes to how doctoral student and supervisors find Ph.D. studies are being examined.

The study by Lindberg-Sand and Sonesson (2011) is, in many ways, more directly comparable to the current study. The different categories were similarly phrased (as both were based on the UHR's learning objectives), and the survey was also a cross-disciplinary one. The outcomes that were rated as very important by all groups were "advanced and specialized knowledge in a limited area" and "familiarity with methods of specific field," which is precisely the same as the highest ranked skills in our study. "Scholarly analysis, synthesis, and independent critical review" and "ability to make a significant knowledge contribution through research" were also quite highly ranked in the Lindberg-Sand study, while these were items more medium ranked in our study. As in our study, the "learning of others," "present to society" were ranked low in the Lindberg-Sand-study and "insights to possibilities and limitations of research" was ranked the lowest in both studies. To conclude, the overall picture presented in the Lindberg-Sand-study can, to a large extent, be confirmed in our study.

Differences between students and supervisors

The survey results revealed that supervisors rate students equally or above the students themselves for a majority of the learning outcome skills. It is difficult to determine if this can be attributed to supervisors having a strong regard for their doctoral candidates, or a general level of insecurity and inexperience amongst students, which was also denoted in many of the written comments on how to improve student capabilities. One additional explanation for the insecurity amongst students in our sample is their relatively early stage in their Ph.D. studies, where roughly 28% had studied fewer than two years, and over 60% had not yet reached the midpoint their studies. In contrast, supervisors, in general, had much longer experience and outlook on their respective disciplines, where over 54% had in excess of five years of advising experience.

The differences in supervisor and student assessments may also be related to the fact that our survey asked them to perform asymmetrical tasks. Students were asked to assess how well they feel they personally have acquired important skills, whereas supervisors were asked to reflect upon students "in their department." The gap between the student's individual experience and supervisor's memories of the department's graduates in general could account for some of the differences in response. An interesting idea for a followup study would be to survey the attitudes of matched pairs of students and supervisors.

For the skills *specialized knowledge* and *specific methods*, supervisors rated student competencies much higher than the students rated themselves. Supervisors also rated students well above the students themselves for the different student presentation abilities. Why the differences for these two areas are so large is difficult to determine, but it could possibly be attributed to the directed knowledge and competencies that the student develops within the field of study via research, working environment, and specific coursework (as

mentioned above). The four skills where students' self-perceptions were greater than advisors (i.e., *personal knowledge*, *autonomy*, *ethics*, and *limitations*) had, in general, a low general rating by both the students themselves and supervisors, pointing to areas that supervisors (and students) feel need greater attention in the Ph.D. education process.

Gender comparison

Regarding gender differences, two different types of comparisons can be made based on the survey. The first is to compare how male and female students rate their own abilities, and the second is to compare male and female supervisor ratings of Ph.D. students' abilities. Note that we have no information on whether the Ph.D. students that the supervisors rated are male or female, but since we asked about all (late stage) Ph.D. students in their department, we assume that supervisor ratings refer to both male and female students.

Female students rate themselves somewhat lower than the overall mean. This is not surprising given the fact that most of them are working at a male-dominated institute (LTH), and being in such a minority situation is known to increase the risk of low self-confidence (Elg 2003 and Etzkowitz 1994). Female students rate themselves as stronger when it comes to *rectitude*, *present to society* and *present internationally*, while male students rate themselves higher in *contribute*, *autonomy* and *learning*. This fits into the stereotype of women being stronger in and more focused on communication, while men are considered more active and autonomous. Note, however, that *learning* also has communicative aspects as it involves both contributing to social development and to support the learning of others. The fact that female students rate themselves higher in *rectitude*, and also somewhat higher in *ethics*, compared to male students, is also in line with a general belief that women are more ethical than men. There is some empirical evidence for such a gender difference, but findings are contradictory, and the associations found between gender and ethics are generally quite weak. (See Robin and Babin, 1997, for an overview.) Whether women are more ethical than men or not, a widespread belief that this is the case may in itself be enough to influence the responses to our survey.

Comparing the ratings made by supervisors, it is interesting to note that female supervisors rate students substantially lower than male supervisors do. There is a pronounced difference for the items *present nationally*, *learning,* and *ethics*. The latter two are judged as weak overall, but especially so by female supervisors. One possible explanation is that female supervisors consider these skills more important than what has been the traditional (and hence mostly male) view. Alternatively, female supervisors may have different or higher standards than male supervisors regarding these skills. The only skill where male supervisors gave the students substantially lower ratings than their female colleagues was *formulate*. This item describes a form of autonomy, which is a central trait of the stereotypical (male) researcher.

Department comparison

Biology supervisors give the lowest ratings for *personal knowledge*, *autonomy*,

and *limitations.* These skills are to some extent related, as independence and scientific maturity give insights into the need for further *personal knowledge* as well as the ability to identify *limitations*, in particular within one's own research field. The low ratings given by the biology supervisors on these skills indicate that they consider *autonomy* and related skills to be weak within the department's Ph.D. students. Physics supervisors and students show a more similar view on *autonomy*. The applied research of the physicists in the survey is, in many cases, carried out outside the university, for example in industry (Li, 2011), with a large degree of responsibility and decision-making put on the student. Thus, *autonomy* is more clearly demonstrated. Nevertheless, the skill *formulate* shows a bigger student-supervisor difference for physicists compared with biologists. To *formulate* research issues requires a certain degree of autonomy, so this observation suggests that there is some difference in the view on independence between students and supervisors in physics as well.

Physics supervisors overall rate presentation abilities higher than students, which rate *present academically* lower than both *present nationally* and *internationally*. The result is a bigger difference in supervisor-student rating compared with biologists. The applied research carried out by many of the physicists is presented in an engineering community, which perhaps makes students feel that they do not present their research in a more traditional academic context. For *present nationally* biology students rate themselves substantially lower than the supervisors do, and also much lower than on *present internationally*. One reason could be a lack of opportunities to present their research in a national (Swedish) context.

Physics supervisors rate students high on *analysis*. One explanation for this could be that the engineering education of many physicists strengthens analytical skills. Moreover, analysis carried out by the physicists could be restricted to certain types of information for which a high level of skill and confidence can be achieved. In contrast, biologists often need to analyze results obtained from a variety of methods, which makes for a broader education but less specialization in analysis, making the student perhaps less confident in rating analysis skills.

Students rate *contribute* lower than supervisors do with the biggest difference observed for biologists. Biology and physics can both be broad research fields. However, it might still be the case that the biology students in the survey are active in a broader research community and get the impression that their research gives a smaller contribution to the overall knowledge in the field. This could perhaps also account for a similar difference observed for *learning*.

The difference between supervisor and student ratings for *ethics* are similar for physics and biology. However, biology supervisors rate *ethics* lower than the students whereas the result is the opposite for physicists. Possibly, physics and biology respondents have made different interpretations of the concept *ethics*, which was not explicitly defined in the survey, or departmental differences may exist in the explicit training and informal norms regarding ethical issues.

Conclusions

Outcome-based learning is shifting the paradigm of third-cycle education in Sweden, but its practical impact on Ph.D. education and Ph.D. students is still emerging. Our results indicate that supervisors and students demonstrate greater certainty regarding the fulfillment of learning outcomes that are traditionally associated with researcher preparation and the execution of specific projects. Conversely, both supervisors and students indicate that the judgment-oriented learning outcomes are less successfully attained. These value-based learning outcomes are evident in student behavior, but are not as easily assessed in the thesis and oral defense.

Our results also raise new questions about the application of the generic learning outcomes in individual cases. We found that Ph.D. students tended to be more critical of their progress towards fulfillment of the learning objectives than their supervisors. Further, both gender and the academic cultures of specific departments played a role in the assessment of student progress. We noted that our female respondents were more critical in their appraisal of learning outcomes: female students rated themselves somewhat lower overall, and, when compared with their male counterparts, female supervisors rated students substantially lower. Our results also suggest that both female students and supervisors placed greater emphasis on *ethics* and *rectitude*, which are judgement- and values-oriented learning outcomes. Even more striking is the effect of academic cultures upon the application of learning outcomes. When comparing the responses from Biology and Physics, the two largest departments we studied, we identified substantial differences in how supervisors from each department rated their students in the areas of *autonomy* and *analysis*. In short, we found that the generic third-cycle learning outcomes are applied differently by different groups. We would argue that this reflects not just variations in individual interpretation, but also differences in group values within Swedish academia.

We believe that the Swedish third-cycle learning outcomes have merit. They provide clear and consistent criteria for assessing Ph.D. student progress towards completion, as well as comprehensive and achievable end goals for successful doctoral education. We also think it is likely, as Lindberg-Sand and Sonesson (2011) suggest, that these learning outcomes will be increasingly integrated into national quality assessment practices. Given the apparent importance of these criteria, it is surprising how little known they are. Although we were familiar with learning objectives for courses and degree programs at lower educational levels, the third-cycle learning outcomes were new to us, and numerous others at our respective departments. This points to the logical conclusion of our study: *we must make efforts to raise awareness of the learning outcomes within Ph.D. education, and to incorporate them in the teaching and learning activities involved in Ph.D. supervision*. The recognition and discussions of these criteria ought to take place throughout the entire Ph.D. supervision

process. One way this can be accomplished is through an increased transparency of the learning outcomes in the web-based Individual Study Plan system, which is currently under development at Lund University; in addition, they must also be presented and discussed in different university-wide academic development settings such as the Centre for Educational Development (CED). By raising these educational goals to conscious reflection and debate, we hope to improve the quality of Ph.D. student education by establishing the relevance of third-cycle learning outcomes to both the individual doctoral student and the university as a whole.

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Appendix 1

Doctor of Philosophy Learning Outcomes from the Swedish Higher Education Ordinance (Högskoleförordningen 1993:100)

Degree of Doctor
A Degree of Doctor is awarded after the third-cycle student has completed a study programme of at least 240 credits in a subject in which third-cycle teaching is offered.

Learning Outcomes
Knowledge and understanding
For the Degree of Doctor the third-cycle student shall

- demonstrate broad knowledge and systematic understanding of the research field as well as advanced, and up-to-date specialised knowledge in a limited area of this field, and demonstrate familiarity with research methodology in general and the methods of the specific field of research in particular.

Competence and skills
For the Degree of Doctor the third-cycle student shall

- demonstrate the capacity for scholarly analysis and synthesis as well to review and assess new and complex phenomena, issues and situations autonomously and critically;

- demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake research and other qualified tasks within predetermined time frames and to review and evaluate such work;

- demonstrate through a dissertation the ability to make a significant contribution to the formation of knowledge through his or her own research demonstrate the ability in both national and international contexts to present and discuss research and research findings authoritatively in speech and writing and in dialogue with the academic community and society in general demonstrate the ability to identify the need for further knowledge, and

- demonstrate the capacity to contribute to social development and support the learning of others both through research and education and in some other qualified professional capacity.

Judgement and approach
For the Degree of Doctor the third-cycle student shall

- demonstrate intellectual autonomy and disciplinary rectitude as well as the ability

to make assessments of research ethics, and

- demonstrate specialised insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used.

Appendix 2

Docentkurs Survey

Welcome!

Thank you for your time in completing this survey, which is being undertaken by researchers at Lund and Malmö Universities taking the Docent course at LTH.

The goal of the survey is to assess how well current PhD students feel they acquire skills considered important for PhD studies, and how well staff who supervise PhDs feel that the PhD students in their department are being prepared in these areas.

The results of the survey will be presented to the participants of the Docent course, i.e., current and future PhD supervisors, and will also be distributed to all who participate and leave their email addresses. We hope that these results will be used within the departments to continue to improve PhD education at Lund and Malmö Universities.

The survey should take no more than 10 minutes, and must be completed before September 27th.

For any questions about the survey, please feel free to contact a member of the survey team, listed below.

Thank you!

Kim Nicholas and Barry Ness,
LUCSUS; barry.ness@lucsus.lu.se
Simon Niedenthal, Malmö Hogskola:
simon.niedenthal@mah.se
Emily Baird, Biology: emily.baird@biol.lu.se

Sofia Waldemarson, Immunotechnology: sofia.waldemarson@gmail.com
Anna Torstensson, Mathematics: annat@maths.lth.se
Christian Brackmann, Physics: christian.brackmann@gmail.com

What is your academic role?

- ○ Current PhD student
- ◉ Supervisor or co-supervisor of PhD students

Next

Docentkurs Survey

Student Survey

Based on your experience as a PhD student, how well do you think you have acquired the following skills?

	Very well	Well	Neutral	Not well	Poorly
broad knowledge and systematic understanding of the research field	○	○	○	○	○
up-to-date specialised knowledge in a limited area of the research field	○	○	○	○	○
familiarity with research methodology in general	○	○	○	○	○
familiarity with methods of the specific field of research in particular	○	○	○	○	○
the capacity for scholarly					

analysis and synthesis to review and assess new and complex phenomena, issues and situations autonomously and critically	○	○	○	○	○
the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively	○	○	○	○	○
the ability to plan and use appropriate methods to undertake research and other qualified tasks within predetermined time frames and to review and evaluate such work	○	○	○	○	○
the ability to make a significant contribution to the formation of knowledge through his or her own research	○	○	○	○	○

the ability to present and discuss research and research findings authoritatively in speech and writing in national contexts	○	○	○	○	○
the ability to present and discuss research and research findings authoritatively in speech and writing in international contexts	○	○	○	○	○
the ability to present and discuss research and research findings authoritatively in speech and writing in dialogue with the academic community	○	○	○	○	○
the ability to present and discuss research and research findings authoritatively	○	○	○	○	○

in speech and writing in dialogue with society in general					
the capacity to contribute to social development and support the learning of others both through research and education	○	○	○	○	○
intellectual autonomy	○	○	○	○	○
the ability to make assessments of research ethics	○	○	○	○	○
specialised insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used	○	○	○	○	○
the ability to identify the personal need for further knowledge	○	○	○	○	○

disciplinary rectitude (correct behavior or thinking)	○	○	○	○	○

What do you think would be most helpful to strengthen the skill areas where you feel weakest?

What is your department?

- ○ Biology
- ○ Centre for Mathematical Sciences (LU or LTH)
- ○ Immunotechnology, Faculty of Engineering (LTH)
- ○ LUCSUS/LUCID
- ○ Physics, Faculty of Engineering (LTH)
- ○ School of Arts and Communication (MAH)
- ○ Other (please specify):

What is your gender?

- ○ Female
- ○ Male

In which country did you obtain your bachelor's degree?

- ○ Sweden
- ○ Outside Sweden

In which country did you obtain your master's degree?

- ○ Sweden
- ○ Outside Sweden

How many years of full-time equivalent study have you been pursuing your PhD?

- ○ 1 or less
- ○ 1-2
- ○ 2-3
- ○ 3-4
- ○ 4-5
- ○ 5 or more

Are you a PhD student funded by collaboration with industry (sv. Industridoktorand)?

- ○ Yes
- ○ No

Thank you so much for completing our survey. Please continue on to the next page to submit your answers and

exit.

Back Next

Docentkurs Survey

Supervisor Survey

How well do you think the students in your department, in particular those at the end of their studies, generally achieve the following skills?

	Very well	Well	Neutral	Not well	Poorly
broad knowledge and systematic understanding of the research field	○	○	○	○	○
up-to-date specialised knowledge in a limited area of the research field	○	○	○	○	○
familiarity with research methodology in general	○	○	○	○	○
familiarity with methods of the specific field of research in particular	○	○	○	○	○
the capacity					

	for scholarly analysis and synthesis to review and assess new and complex phenomena, issues and situations autonomously and critically	○	○	○	○	○
	the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively	○	○	○	○	○
	the ability to plan and use appropriate methods to undertake research and other qualified tasks within predetermined time frames and to review and evaluate such work	○	○	○	○	○
	the ability to make a significant contribution to the formation of knowledge through his or her own	○	○	○	○	○

research					
the ability to present and discuss research and research findings authoritatively in speech and writing in national contexts	○	○	○	○	○
the ability to present and discuss research and research findings authoritatively in speech and writing in international contexts	○	○	○	○	○
the ability to present and discuss research and research findings authoritatively in speech and writing in dialogue with the academic community	○	○	○	○	○
the ability to present and discuss research and					

research findings authoritatively in speech and writing in dialogue with society in general	○	○	○	○	○
the capacity to contribute to social development and support the learning of others both through research and education	○	○	○	○	○
intellectual autonomy	○	○	○	○	○
the ability to make assessments of research ethics	○	○	○	○	○
specialised insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used	○	○	○	○	○
the ability to identify the					

personal need for further knowledge	○	○	○	○	○
disciplinary rectitude (correct behavior or thinking)	○	○	○	○	○

What do you think would be most helpful to strengthen the skill areas where you feel PhD students are weakest?

What is your department?

- ○ Biology
- ○ Centre for Mathematical Sciences (LU or LTH)
- ○ Immunotechnology, Faculty of Engineering (LTH)
- ○ LUCSUS/LUCID
- ○ Physics, Faculty of Engineering (LTH)
- ○ School of Arts and Communication (MAH)
- ○ Other (please specify):

What is your gender?

- Female
- Male

In which country did you obtain your bachelor's degree?

- Sweden
- Outside Sweden

In which country did you obtain your master's degree?

- Sweden
- Outside Sweden

In which country did you obtain your PhD degree?

- Sweden
- Outside Sweden

For how many years have you been supervising or co-supervising PhD students?

- Less than 2
- 2-5
- 5 or more

How many PhD students in total have you supervised or co-supervised (including current students)?

- 1-2
- 3-5
- 6-10
- More than 10

Thank you so much for completing our survey. Please continue on to the next page to submit your answers and exit.

Back Next

Appendix 3

Enkätfrågor i svensk översättning

1. Vilken roll har du på Lunds Universitet/Malmö Högskola?
   a. doktorand
   b. doktorandhandledare eller biträdande doktorandhandledare
2. (**För doktorander**): Utifrån dina erfarenheter som doktorand, hur väl tror du att du har du tillägnat dig följande förmågor? (**För handledare**): Hur väl tror du att doktorander på din institution, särskilt de i slutet på sin forskarutbildning, i allmänhet, har tillägnat sig följande förmågor
   (Skala 1-5: mycket väl/väl/varken väl eller dåligt/inte särskilt väl/dåligt)

   a. brett kunnande inom och en systematisk förståelse av forskningsområdet
   b. djup och aktuell specialistkunskap inom en avgränsad del av forskningsområdet
   c. förtrogenhet med vetenskaplig metodik i allmänhet
   d. förtrogenhet med det specifika forskningsområdets metoder i synnerhet.

   e. förmåga till vetenskaplig analys och syntes samt till självständig kritisk granskning och bedömning av nya och komplexa företeelser, frågeställningar och situationer
   f. förmåga att kritiskt, självständigt, kreativt och med vetenskaplig noggrannhet identifiera och formulera frågeställningar
   g. att planera och med adekvata metoder bedriva forskning och andra kvalificerade uppgifter inom givna tidsramar och att granska och värdera sådant arbete
   h. förmåga att genom egen forskning väsentligt bidra till kunskapsutvecklingen
   i. förmåga att muntligt och skriftligt med auktoritet presentera och diskutera forskning och forskningsresultat i nationella sammanhang
   j. . förmåga att muntligt och skriftligt med auktoritet presentera och diskutera forskning och forskningsresultat i internationella sammanhang
   k. . förmåga att muntligt och skriftligt med auktoritet presentera och diskutera forskning och forskningsresultat i dialog med vetenskapssamhället
   l. . förmåga att muntligt och skriftligt med auktoritet presentera och diskutera forskning och forskningsresultat i dialog med samhället i övrigt
   m. förutsättningar för att såväl inom forskning och utbildning som i andra kvalificerade professionella sammanhang bidra till samhällets utveckling och stödja andras lärande
   n. intellektuell självständighet
   o. vetenskaplig redlighet
   p. förmåga att göra forskningsetiska bedömningar
   q. fördjupad insikt om forskningens möjligheter och begränsningar, dess roll i samhället och människors ansvar för hur den används.
   r. förmåga att identifiera behov av ytterligare kunskap

3. (**För doktorander**): Vad tror du skulle vara till störst hjälp för att förbättra de förmågor du upplever dig vara sämst på? (**För handledare**):Vad tror du skulle vara till störst hjälp för att förbättra de förmågor du upplever att doktorander är sämst på?

4. Vilken institution tillhör du?
    a. Biologi
    b. Matematikcentrum (LU eller LTH)
    c. Immunteknologi (LTH)
    d. LUCSUS/LUCID
    e. Fysik (LTH)
    f. Konst, kultur och kommunikation(MAH)
    g. Annan (ange vilken)
5. Kön
    a. Man
    b. Kvinna
6. I vilket land avlade du din kandidatexamen?
    a. I Sverige
    b. Utomlands
7. I vilket land avlade du din magisterexamen?
    a. I Sverige
    b. Utomlands
8. Hur många år (omräknat till heltidsstudier) har du varit doktorand?

För studenter:

9. Är du industridoktorand?
    a. Ja
    b. Nej

För handledare:

10. I vilket land avlade du din doktorsexamen?
    a. I Sverige
    b. utomlands
11. Hur många år har du varit doktorandhandledare eller biträdande doktorandhandledare?
    a. mindre än 2
    b. 2-5
    c. mer än 5
12. Hur många doktorander har du totalt varit handledare eller biträdande handledare för? (inklusive nuvarande doktorander)
    a. 1-2
    b. 3-5
    c. 6-10
    d. Fler än 10

Stort tack för din medverkan. Om du vill ha undersökingens resultat skickade till dig så var vänlig skriv in din epostadress i fönstret på webenkäten.