

Supervision at Luleå University of Technology

A Quantitative analysis

Mats Westerberg

In this report, I will analyze the questionnaires sent out to PhD Students and Supervisors at LTU to examine differences between groups and patterns in an attempt to better understand the supervision situation at LTU.

PhD questionnaire

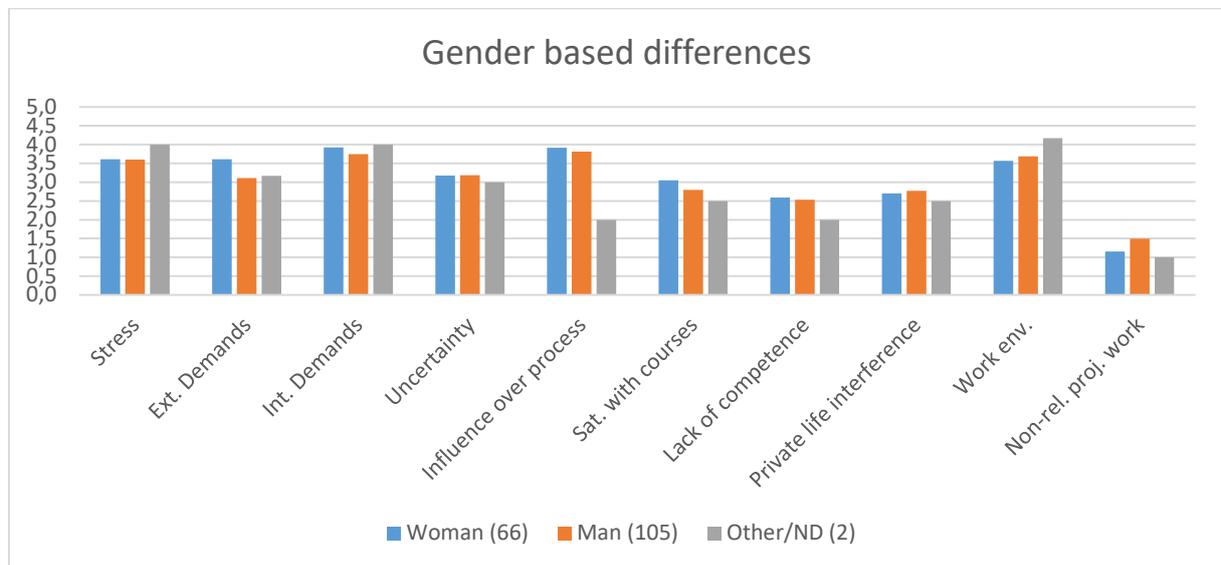
Based on the all quantitative questions in the PhD student questionnaire, I first made a factor analysis to see if there were overarching concepts where two or more questions could be merged. I also kept single item variables that seemed to catch important aspects of the study. This led to the following variables that will be used in the following analysis:

Variable	Operationalized with the following question/statement
Stress	How often do you experience stress in your role as a PhD student?
External demands	Others demand too much on what I should accomplish/achieve I have too many different tasks to fulfil in the PhD student role I must cater too many interests (e.g. supervisors, financiers, qualification requirements etc.)
Internal demands	I demand too much on what I should accomplish/achieve
Benign work environment	Harassment and offensive treatment do not exist I have a work environment free from threats and violence I have a work environment free from stressful conflicts
Uncertainty	I cannot control the duration of the review and publishing processes I do not know how far ahead I am in relation to the degree objectives
Influence over process	To what extent can you influence the content and design of your education? To what extent do you receive supervision when you request it?
Satisfaction with courses	To what extent do you consider the portfolio of subject-specific third-cycle courses at your research unit or division to be satisfactory? To what extent do you consider the portfolio of general third-cycle courses at LTU to be satisfactory?
Lack of competence	I experience I do not have the competence required for the role
Private life demands	I have too many commitments outside of the PhD student role (i.e. "private life") that require time and attention
Non-PhD-related project work	Many PhD students participate in projects. If you estimate, how much of your work in projects does not lead closer to your doctoral degree objectives? Please answer on a scale of 0-100%

I have also used control/grouping variables that was found in the questionnaire as follows:

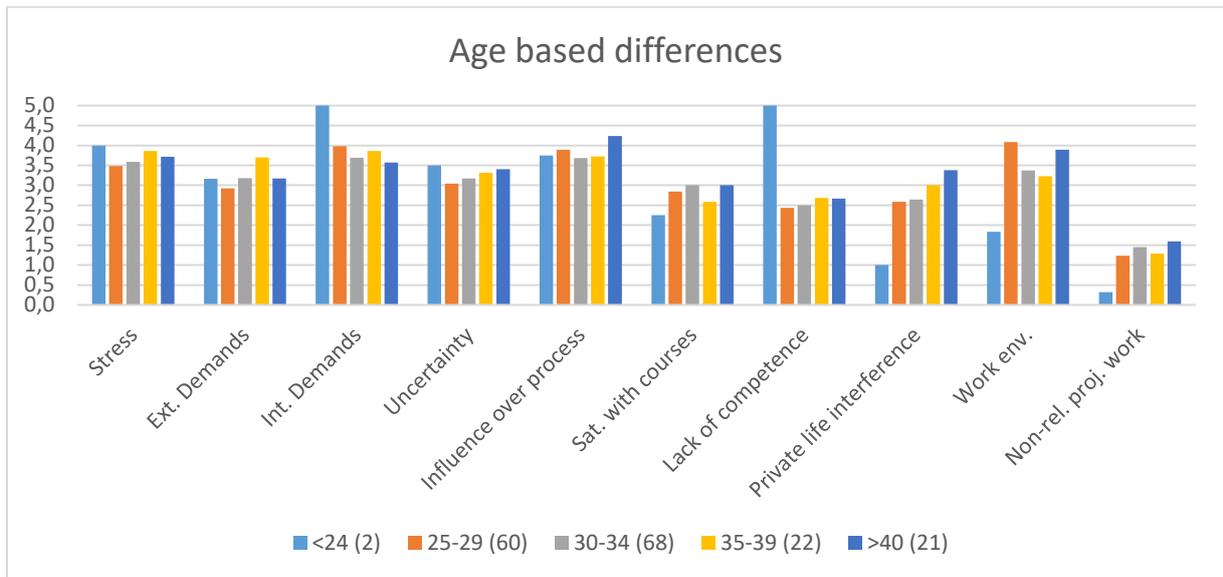
Variable	Operationalized with the following categories
Gender	With gender we mean gender identity, i.e. the gender you identify with. (Male, female or other/do not want to disclose)
Age	Five groups: <24, 25-29, 30-34, 35-39 and >40
Faculty	TFN or FFN
Department	ETS, HLV, KKL, SBN, SRT, TVM or "do not want to disclose"
Stage in PhD process	How much of your four years of doctoral studies has passed? (Not including e.g. departmental duties, parental leave or sick leave) Five groups: 0-24%, 25-49%, 50-74%, 75-100% and >100%, but still no degree
Type of PhD position	What is your main source of income? Six categories: "Employed as a PhD student at the university", "Employed as a lecturer (adjunkt) at the university", "Employed but not at the university (external employment)", "Grant/Scholarship", "Employed as a research engineer at the university" and "Other"

I first will display descriptive results where the ten variables will be shown divided based on the control/grouping variables shown above. Where I find interesting differences I will analyze these differences. If we look at gender, the differences are quite small, but worth noting is that women tend to experience higher external demands and men tend to have higher non-related (to their PhD process) project work. The two persons in the category other are different on some variables, but since there are so few individuals, it is not possible to draw any conclusions from this.

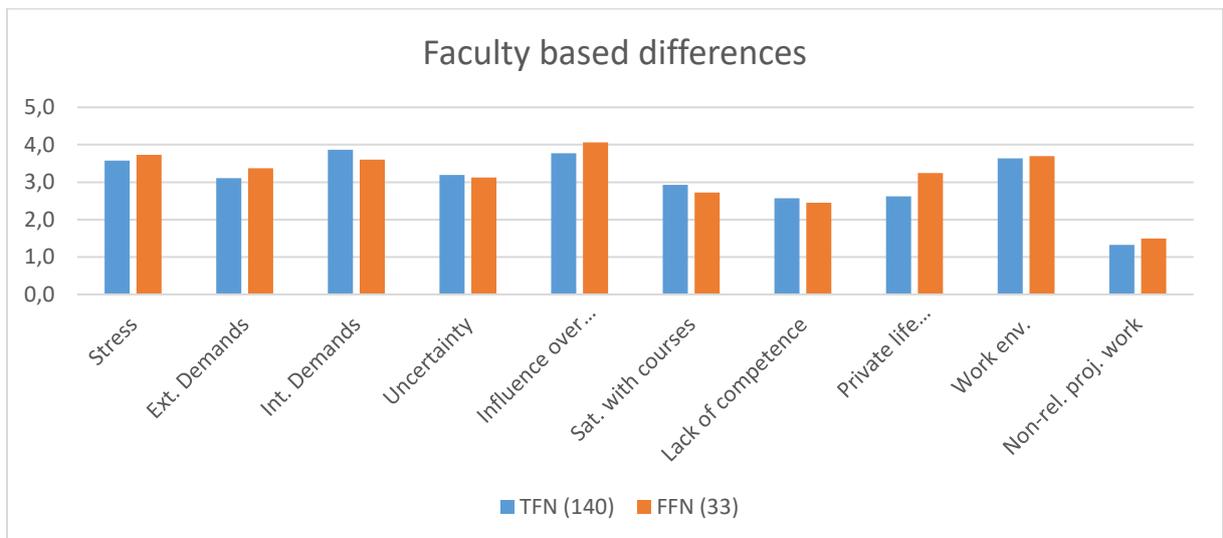


Turning to age based differences, it seems the youngest PhD students experience more stress and it seems it comes from higher internal demands and a feeling of not being competent enough for the role as PhD student. However, as this also is only two individuals it is hard to infer too much from this, but perhaps those that start a PhD process at a very young age need different supervision taking into account a possible lack of "real world" experience and a "school record" where they want to ace all tasks and get the highest grades. As a PhD process contain many tasks that never fully can be "aced" regardless of time spent on them, stress from internal demands is likely to occur. Looking at the other age groups, there seem to be small differences. Not surprisingly, private life demands tend to increase

at higher age probably due to family demands (such as dropping of or picking up kids or staying home to take care of them when they are sick.).

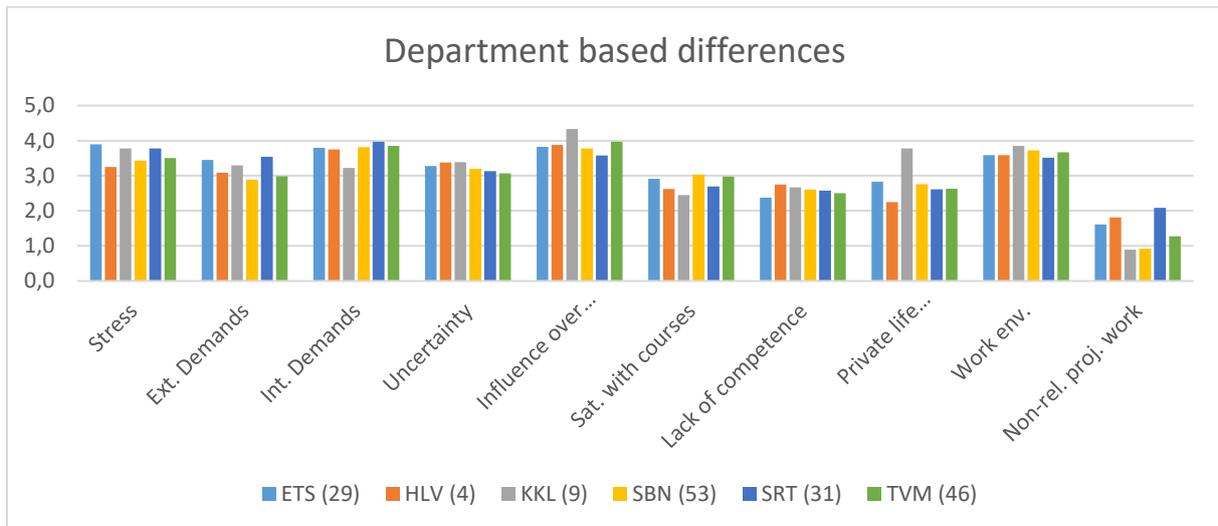


Differences based on faculty are all small and probably more based on other factors that faculty connection. For instance, the higher score on private life demands for FFN is mainly due to the PhD students tend to be older here.

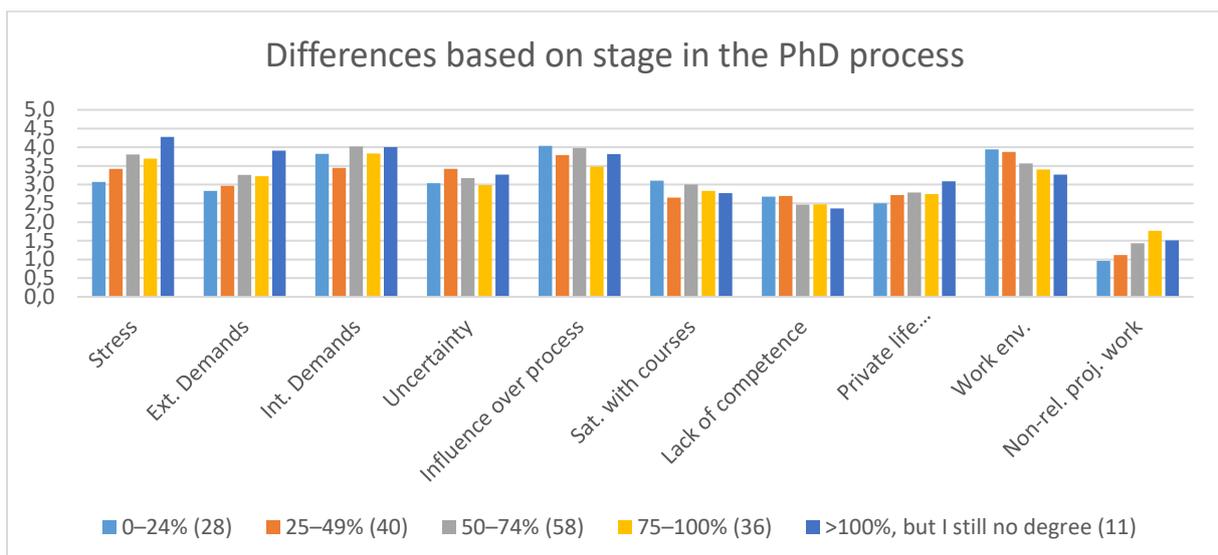


When looking at differences based on department, it is clear that departments do differ on some of these variables. As noted above, some differences are due to that the departments have a different age structure among their PhD students, which explains the high private life demands of KKL. Regarding the main variable – stress – it seems HLV do a good job, having the lowest score. However, since there are only four students that have participated, this might be a biased result. As stress is part of the subject matter that is dealt with in courses and projects at HLV, it would not be strange if they have a better grip on this. Regarding non-related project work, it seems ETS, HLV and SRT are struggling the most with this, while KKL and SBN keep it quite low. As the financing situation in many subjects today is such that it is virtually impossible to get a “clean” research grant, it becomes more and more important for supervisors to handle situations where the funded projects demands much more than just research from the researchers, including PhD students. If done well I see this as an opportunity to learn more skills as PhD student, by for instance writing reports for companies/public organizations,

presenting for management teams and other tasks that can be handy as a PhD wherever you are. But if it is done badly, the external demands increase which may lead to stress.

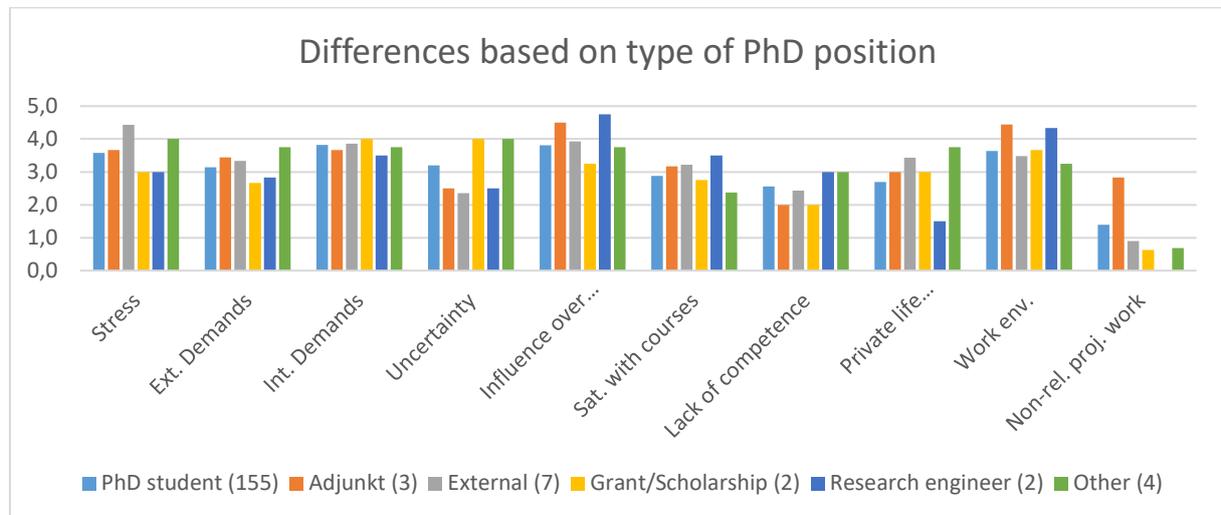


Perhaps the most interesting grouping variable is the next – the stage in the PhD process. As can be seen, many variables have a clear pattern here. For instance, stress tends to increase as you get further in the PhD process and then plateau at the end, unless you have used all time, but still has no degree, which understandably can be a very stressful situation. The exact same pattern is true for external demands, hinting that it might be these external demands that is behind the stress. Interestingly, the experienced work environment gets less and less benign over time. Perhaps this also is related to the increase in external demands. Another clear pattern is the increase in non-related project work, but here the final stage shows a decrease in non-related project work. Could be a sign that the supervisors are trying to keep non-related project work away from the PhD student that is working hard to get the PhD degree. The slight increase in private life demands is in line with the results on age above – the older the PhD student, the more likely family matters will interfere.



The final grouping variable is based on type of PhD position, where the traditional PhD student position is by far the most common. As can be seen, all other positions only have 2-7 individuals in each. Thus, it is not possible to draw much inference from this analysis. However, it seems interesting that those on scholarship/grant experience the least stress (together with research engineers) although this type

of position has been criticized for being prone to create stress due to its insecurity. It also seems the Adjunkts tend to do more unrelated project work, perhaps du to that they have been part of the organization before the PhD position and their capacity to “pitch in” is known.



Turning to bi-variate and multivariate analysis, I will first display the bi-variate correlation matrix for the ten variables. The strongest correlations (higher than .35) are highlighted with an orange color, while other significant (at 0.05 level) are highlighted with a paler orange. A correlation between two variables means that they have shared variance, which means that they are linked to each other. However, it is not possible to infer causality, i.e. that one variable causes the other. Looking at our main variable, stress, we can see that stress is highly correlated with external demands and a more hostile work environment. Moreover it has also a significant correlation with internal demands, a lack of influence over the process and more non-related project work. Likewise, external demands is apart from the high correlation with stress also highly correlated to a more hostile work environment, a lack of influence over the process and non-related project work and significantly linked to higher internal demands as well as higher uncertainty.

	1	2	3	4	5	6	7	8	9	
1. Stress										
2. Ext. Demands		.587**								
3. Int demands		.234**	.165*							
4. Benign work env.		-.387**	-.443**	-0,009						
5. Uncertainty		0,104	.227**	-0,128	-.197**					
6. Influence over process		-.268**	-.404**	0,000	.343**	-.232**				
7. Satisfaction with courses		-0,135	-0,088	-0,142	0,080	-0,053	.198**			
8. Lack of competence		0,064	-0,008	0,105	0,010	.197**	0,110	-0,002		
9. Private life demands		0,126	0,090	-0,041	0,075	0,137	0,061	0,061	.241**	
10. Non PhD-related project work		.251**	.387**	.174*	-.195*	0,075	-.161*	0,018	-0,058	-0,049

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

As can be seen in the correlation matrix, most highly correlated are found in the first two columns. The only other high correlation is the one between a better influence over the process and a more benign work environment. As can be seen, three variables (Satisfaction with courses, Lack of competence and Private life demands) have only one significant correlation with another variable in the set and are thus not that important if we want to understand relationships between the set of ten variables. The other seven variables have 3-6 significant correlations with other variables. However, in order to tease out how they are related in a more robust way, we need to apply multivariate methods. We will turn to this next by applying hierarchical regression on this set of variables.

In a hierarchical regression analysis a dependent variable is explained by a set of independent variables (including control variables) that are entered in two (or more) steps. As stress is the main variable that we try to make sense of, it will be entered as dependent variable in the analysis. Then we add our controls (Gender, age, faculty, department and stage in the process) in a first baseline regression. In a second step all independent variables are entered to see if they can add to the explanation of the dependent variable. In the table below we can see that the control variables alone can explain almost 14 % of the variance in stress and the variables that are significant in explaining stress is the stage in the PhD process and working at ETS. When all variables are added in the second step, the explained variance increases to almost 45 % and we can see that working at ETS no longer is linked to higher stress. The stage in the PhD process is still explaining some stress, but the main variable to explain stress is external demands. Also internal demands and a more hostile work environment explains stress significantly. Thus, based on this model stress is mainly coming from high external demands on the PhD student, but is also in some part explained by a more hostile work environment, more internal demands and that the PhD student is in the later stage of the PhD process.

	Stress		External demands	
Gender (woman)	0.01	0.02	-0.04	-0.06
Age	-0.02	-0.07	0.11	0.09
Faculty (TFN)	0.05	0.07	-0.03	-0.07
Department KKL	0.08	0.08	0.02	0.09
Department SRT	0.10	-0.03	0.24***	0.17**
Department TVM	0.01	-0.01	0.04	0.06
Department ETS	0.16*	0.11	0.16*	0.13*
Stage in PhD process	0.31***	0.18**	0.16**	0.03
External demands		0.44***		
Internal demands		0.12*		0.18***
Benign work environment		-0.16**		-0.29***
Uncertainty		-0.05		0.10
Influence over process		-0.02		-0.27***
Satisfaction with courses		-0.07		0.05
Lack of competence		0.07		-0.01
Private life demands		0.09		0.08
Non-PhD-related project work		0.02		0.19***
F-ratio	3.28	7.30	3.16	7.87
R square	.138	.445	.134	.447
R square adj	.096	.384	.091	.390
Significance	0.002	<0.001	0.002	<0.001
R ² Change		.307		.313
F (R ² Change)		9.52		11.0
Sign (R ² Change)		<0.001		<0.001

*p<0,10, **p<0,05, ***p<0,01 Regression coefficients shown are beta coefficients

Based on that external demands were the main factor behind stress, it seems interesting to also examine what lies behind external demands. Thus, in the other hierarchical regression analysis, external demands is the dependent variable and the rest (except stress) is used as independent variables. As can be seen in the third column in the above table, the control variables can explain a fair share of external demands. Slightly more than 13 % is explained and as with stress, the stage in the process and working at ETS are significant variables. However, the strongest variable is working at SRT. When adding all the other independent variables, working at ETS and SRT still remains significant, although at a rather low level. Still, to some degree these two departments have PhD students that experience a higher external demand that can't be explained by any of the other variables. However, the strongest factors explaining higher external demands is a more hostile work environment, a lack of control of the process, more non-related project work and higher internal demands from the PhD student. Almost 45 % of the variance in external demands can be explained by the variables used.

Based on the results, it seems important to focus on how to:

- 1) Create a work environment that is supportive and where a PhD student better can handle the challenges that will come up in the process
- 2) Help the PhD student find ways to get better influence over the PhD process so the he or she does not feel that the process is not in his/her control
- 3) Find ways to work smart with projects that is not 100 % about PhD research – so that the non-related project work still is valuable to the PhD student.
- 4) Help the PhD student cope with their own (too high) ambitions when they create performance anxiety.

To complement the analysis using multiple regression, I will also do a cluster analysis. In this analysis we seek to find groups of individuals that share a common pattern based on the variables we work with. The analysis was made by entering all variables except controls and stress into a K-means cluster analysis, where I tested to have 3-5 clusters. When examining the clusters, the four cluster solution gave the most interesting result. The basic idea with cluster analysis is to find groups or clusters that are maximally different on the variables used. As noted, I did not use stress as a clustering variable, but instead I wanted to see if the formed clusters also were different on the stress variable. As can be noted in the table below, where numbers are cluster means, the four clusters are indeed different on the stress dimension, where cluster 1 could be seen as a low stress cluster, cluster 2 and 3 as moderate and cluster 4 as high on stress. The highlighted numbers represent stressors or variables that can be linked to increasing the stress level. In cluster 1 it is only a moderately high internal demands that could cause stress. In Cluster 2 it is a somewhat elevated uncertainty about the process, high internal demands, a feeling of lacking competence and private life demands that can cause stress. In cluster 3 it is both external and internal demands, a feeling of lacking competence and a very high rate of non-related project work that can cause stress. Finally, in cluster 4 external and internal demands, a rather hostile work environment, limited influence over the process, uncertainty and a rather high level of non-related project work that can cause stress.

	1	2	3	4
External demands	2,6	3,1	3,5	4,0
Benign work environment	4,3	3,7	3,9	2,3
Uncertainty about process	2,9	3,4	3,0	3,5
Influence over process	4,0	4,0	4,1	3,2
Satisfaction with courses	2,9	3,0	3,1	2,7
Internal demands	3,6	3,9	4,3	3,7
Feeling of lacking competence	1,8	3,9	2,8	1,8
Private life demands	2,4	3,3	2,7	2,6
Non PhD-related Project work (%)	11	11	77	40
Number of students	61	50	26	36
Stress level	3,2	3,6	3,8	4,2
	Low	Moderate		High

As stage in the PhD process earlier have been important to understand stress level, I made a cross-tabulation of cluster belonging and stage in the PhD process. As can be seen, there is a over-representation of early-stage PhD students in the lower stress clusters and a similar over-representation of later-stage PhD students in the higher stress clusters. This almost fully explains the extreme stages, i.e. that almost no student that is new is in cluster 3 or 4 and that almost no student that is in the final stage is in Cluster 1 or 2. But for those in-between (the vast majority), stage in the PhD process do not predict which cluster you belong to.

		Cluster Number of Case				Total
		1	2	3	4	
Stage in the PhD process	0–24%	14 (50 %)	10 (36 %)	2 (7 %)	2 (7 %)	28
	25–49%	16 (40 %)	13 (32 %)	5 (12 %)	6 (15 %)	40
	50–74%	21 (36 %)	14 (24 %)	10 (17 %)	13 (22 %)	58
	75–100%	10 (27 %)	10 (27 %)	7 (19 %)	9 (25 %)	36
	>100%, but still no degree	0 (0 %)	3 (27 %)	2 (18 %)	6 (55 %)	11
Total		61 (35 %)	50 (29 %)	26 (15 %)	36 (21 %)	173

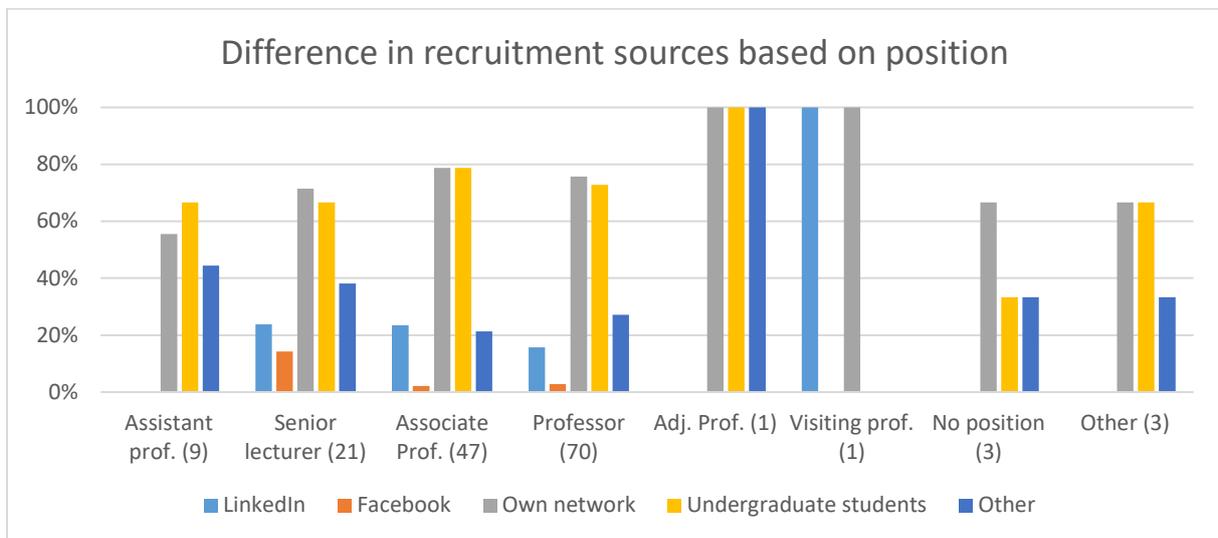
Based on this analysis it seems there are quite many PhD students (about a third of all students) that do their work without much stress and the only stressor is a moderate internal demand. Since we do not know anything about their performance, we only know that the working situation is benign, but perhaps these students have too little pressure to perform well. Getting rid of the external demands will of course have both positive and negative effects. A good balance between internal and external demands will often help the process forward. However, it is important that the external demands are in line with the goals of the PhD education. For instance, if non-related project work truly is unrelated to the PhD process, it will become a source of stress and a reason to be unhappy about the PhD position.

The Supervisor questionnaire

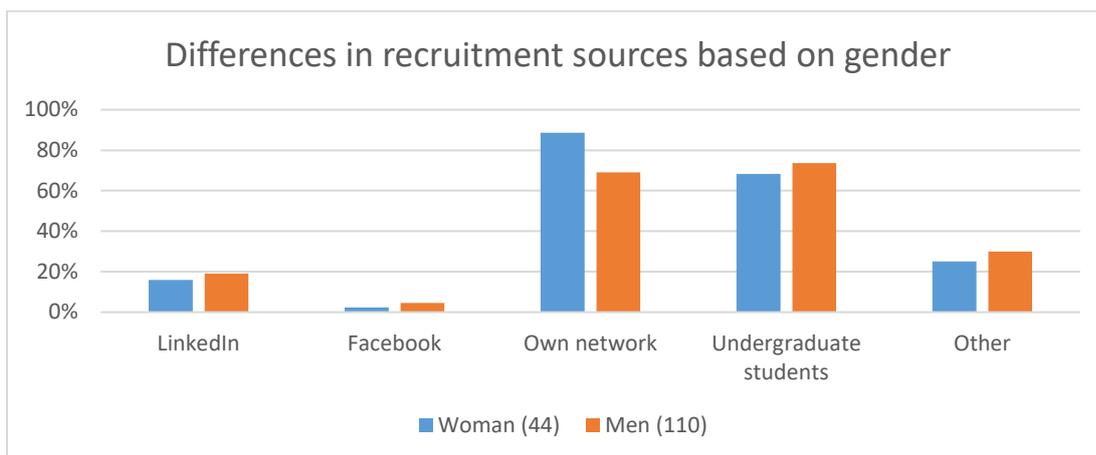
In the Supervisor questionnaire there were no real dependent variable (as stress was in the PhD questionnaire) and rather few variables that could be analyzed using quantitative analysis. Therefore, I will only present a number of diagrams showing how the supervisors are different on recruitment/HR aspects based on their position or gender.

As the categories Adjunct professor, Visiting professor, no position and other have so few individuals, I refrain from commenting on them. Therefore, I will only comment on differences between Assistant professor, Senior lecturer, Associate professor and Professor.

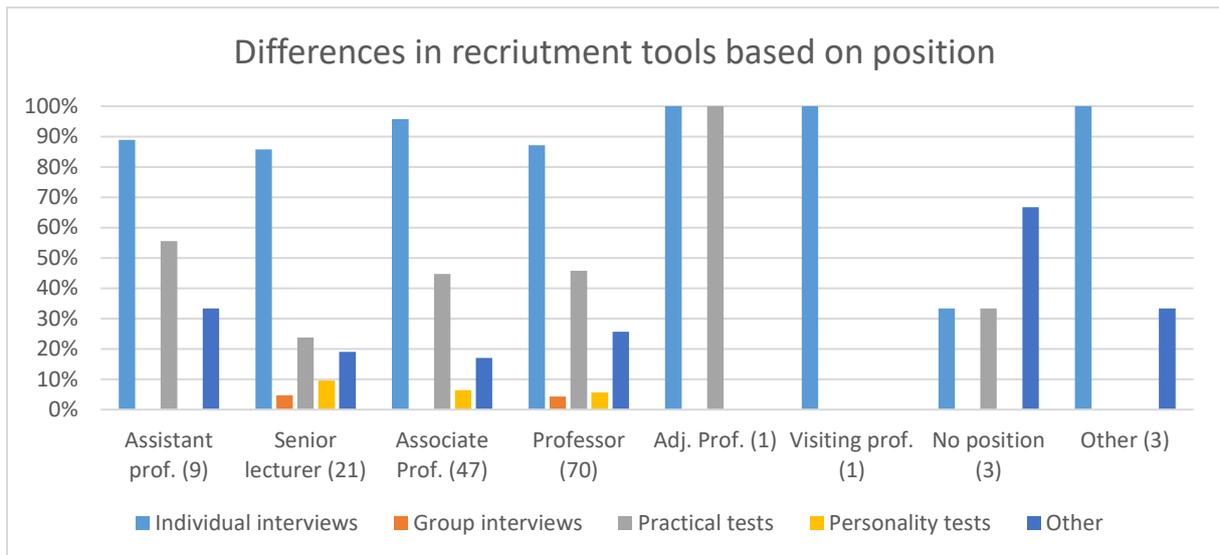
For recruitment sources, it seems the own network and undergraduate students are most used, followed by other sources and leaving LinkedIn and Facebook behind. For some reason, it is only senior lecturers that use Facebook more than marginally.



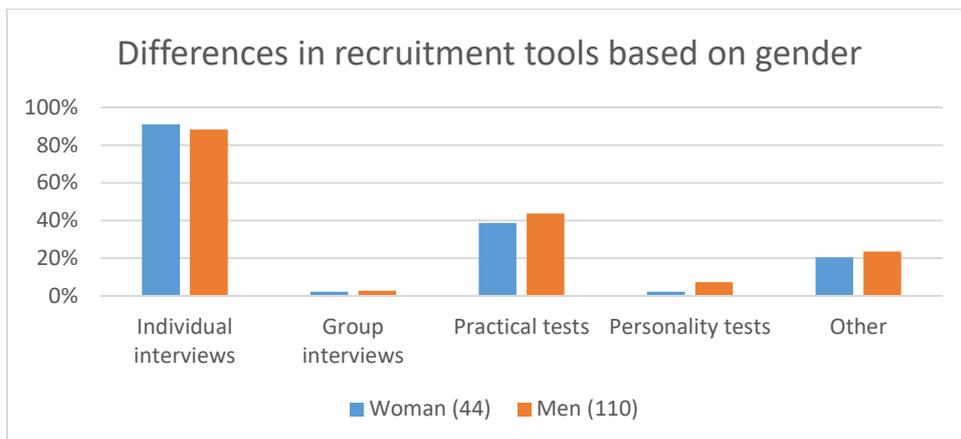
Differences between gender is marginal for most sources. To some extent women are more prone to use their network, perhaps due to that they have a better network?



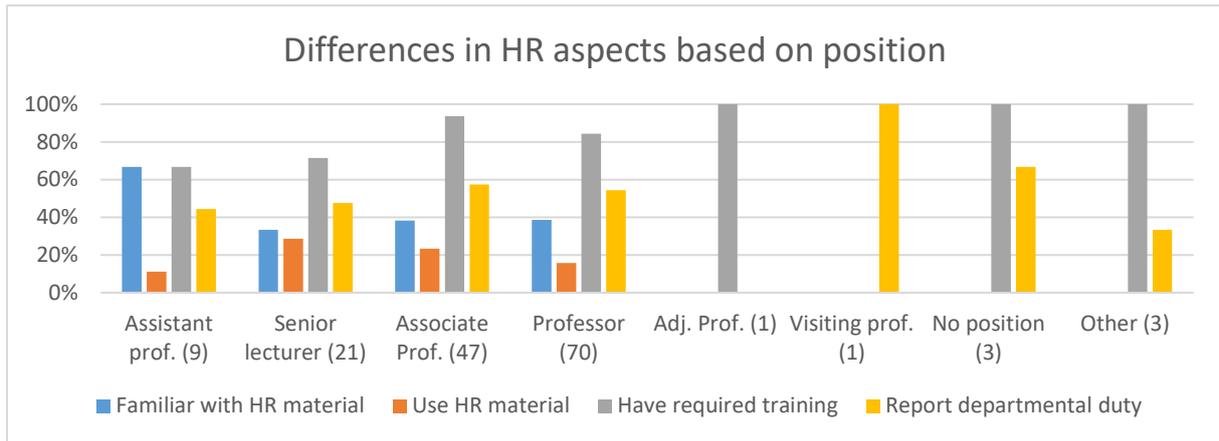
For recruitment tools, the differences are not spectacular. Individual interviews are by far the most used tool, followed by practical tests and other methods. Personality tests and group interviews are hardly used at all.



Differences based on gender are marginal – where personality tests at a low overall level are mainly done by men.



On the HR aspects, it seems the divide between whether you are familiar with the HR material and whether you use it is quite different. Assistant professors know about it better than all other categories, but use it the least. For senior lecturers it is the opposite – they have the least knowledge, but the best use. Overall, it is a low usage where the reason for this needs to be investigated. Having the required training seems most important for associate professors which seems natural as part of becoming an associate professor is to build competence in supervision. Professors may have acquired their competence “on the job” to a greater extent which can explain the small gap between professors and associate professors. Regarding whether departmental duties are reported, there are small differences. However, the level is rather low. Maybe this is the reason for the rather high report of non-related project work from the PhD students. Half of the supervisors do not report departmental duties.



Again rather small differences based on gender. However, it seems women are both less aware of the material HR supplies and also use it less. Again, this is something to investigate. Women have the required training to a higher degree.

