DOI: https://doi.org/10.53555/nncse.v5i1.389 **Publication URL: http://nnpub.org/index.php/CSE/article/view/389**

MANAGEMENT OF LARGE-SCALE THESIS PRODUCTION

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Abstract: -

This study focuses on investigating several parameters that may influence the production of student theses in a university setting. This knowledge is valuable in determining future changes in any of the parameters that may influence the production and quality of the graduation work at the department. During the period of the study, there have been several changes in the process of thesis writing at the department, trigged by internal and external factors. The analysis has been done in steps where new variables have been calculated from other variables, for instance, the number of days from start to finish. There is no exact way of measuring this period so in the study the start date is considered to be the date of the students registering for the thesis course, the completion date is set to be the date of the last grade of the project. On the aggregated level three variables have been studied to determine the change over time, completion rates, change in grades and the time it takes for a student from registration to completion. During the studied period, projects started from 2010 and through to 2014; there is noticeable a sharp increase of noncompeting between 2011 and 2012. One reason for this could be the introduction of new grading criteria, but the increases are not dropping off but continue to rise. Projects started in 2010 have a non-completion rate of about 17 percent, for projects started in 2014 has this increased to about 42 percent. The time from the start to completion has increased during the studied period, from an average of 175 days in 2010 to 331 in 2014. There is a sharp increase in the length to completion in 2012, possibly caused by the introduction of a new grading process. A total of 47 supervisors fulfilled the requirements of the study by starting at least ten projects in the period of this analysis. Twenty-eight of the supervisors have at least 50 percent completion rate, this group of supervisors also have a shorter time to completion, on an average 319 days as compared with the group that has lower completion rate the average time to completion is 399 days. Recommendations from this study are in three separate strategies: recommendations on a viable process for improvement of the production process, recommendations on immediate changes in management directives regarding supervision and finally recommendations towards a new management style in general.

Keywords: - *Management of Large, Scale Thesis Production*

INTRODUCTION

This study focuses on investigating several parameters that may influence the production of student theses in a University setting. We do this to gain knowledge about to what extent different parameters has an effect on actual outcomes. This knowledge is valuable in determining future changes in any of the parameters that may influence the production and quality of the graduation work at the department.

At the Department of Computer and Systems Sciences of Stockholm University, 1,551 thesis projects started in the period 2010 until summer 2015, and a total of 140+ supervisors were engaged in assisting the students to successful completion of their theses to graduate. During the same period, there were several changes in the structure and processes of the thesis course. A stricter review process, with revised grading criteria, was introduced in 2011, and in 2012 a practice with a separate examiner started. From 2010 a support system was introduced and has been evolving gradually since then. In 2010 a new policy regarding supervisors was in effect, all academic staff had to supervise at least three projects per year. Summer 2012 the higher education authority criticised the department for lack of quality in the master thesis. The process for thesis production as well as the grading criteria has been revised several times from 2011. The number of changes over the period the study covers makes it hard to determine what effect each type of change has had, this should lead to a rethink in how to apply changes in the future. The result of this study should lead to a rethink in the management decisions regarding supervision, with the introduction of system support to follow the production of individual supervisors and reward high producing individuals. New supervisors would be required to undergo training as supervisors.

Related research in supervision and management of supervision

When looking for research on supervision and management of thesis production the area of PhD supervision is what probably is encountered first after all this involves several years of supervision as compared to bachelor and master thesis that supposed to finish within one semester. For doctoral supervisors there are several handbooks to consult (Taylor and Beasley 2005) to give one example, covering all aspects from recruiting to an examination of the PhD student. This study is into undergraduate thesis production. Still, the experiences of previous studies into supervision of PhD students apply to supervision in this context as well.

Supervision styles

One field covered by previous studies into supervision of thesis projects describe the process in the term of various supervision styles. The concept of styles can, therefore, be useful to explain the outcome between individual supervisors in productivity. As can be expected there are different styles of supervision, and the style may have an effect on the outcome of the graduation project, which even if it is outside of the scope of this study, it is something to consider when making management decisions.

Kathleen Gallacher (1997) presents a comprehensive overview of what is called supervision models. These models could easily be called styles as well and include for instance differentiated, developmental as well as peer supervision. There is a difference between supervision, mentoring and coaching where supervision has a strong control focus (in the aspect of quality), mentoring focuses on the transfer of knowledge and skills, finally coaching is focusing on fine-tuning of skills and analyse practices (Gallacher 1997). Others claim that the most effective supervision is achieved by mentoring (Manathunga 2007, Pearson and Brew 2002, Price and Money 2002, Wisker et al. 2003). It is at the same time argued that there be an inherited difference between supervision and mentoring, out of the view that power and pedagogy are connected, and supervision is one form of pedagogical practice. Supervision has this connotation of power (Manathunga 2007), who suggests that the concept of power needs to be considering in mentoring. John Frow put forward two different relations between supervisor and student; one is a relationship built on a master having a non-professional student, and one reproductive relation master to disciple (Frow 1988). The latter lacks the counter-transferable ingredient and therefore criticised, and that this always accompanies the transference in the master-student relation (Giblett 1992).

There are other dimensions of styles as discussed by Alison Lee and Bill Green (2009) regarding metaphors. Lee and Green take their point of departure for this discussion in part from

David Lusted's theories on learning, which focus on the importance of the interactions between learner and teacher, this relationship builds knowledge (Lusted 1986). From this basic assumption Lee and Green talk about supervision as metaphors instead of supervisor styles, there are some differences in these concepts but also some overlap. The benefits of metaphors are that they act as a channel for something else outside of the metaphor only (Lee and Green, 2009). Three types of metaphors, all claimed to be in general use is discussed. The first type of metaphor is *Authorship* where the research is a form of authorship, and the candidate should take this seriously, as the candidate create the work that results in the thesis, and they own the work themselves (ibid). The second type of metaphor is *Discipleship* characterised by initiation and transformation processes, where the relationship is more like that of a guru and a disciple (Lee and Green 2009). This metaphor is in three stages; leaving the known, transition and finally the rebirth. Finally, the third metaphor, which is much richer, diverse and complex is called *Apprenticeship* and include the master-apprentice metaphor. In summary metaphors in supervision is to be used as a resource for thoughts and actions (Lee and Green 2009). Another aspect of knowledge building through interaction is presented as perceived supervisor contribution (de Kleijn et al. 2012) which conclude that the students perceived connection with their supervisor influence the grade and the satisfaction for the student.

Supervisor's contribution

A thesis project involves challenges for the student not only from the point of working alone and with unfamiliar contexts. The assessment is also a challenge as there are at least two goals to achieve, the learning and the assessment goal (Todd

et al. 2006). One contribution to overcoming these challenges is the interaction between the supervision and student; this makes the student more satisfied with the process and results in better grades (de Kleijn et al. 2012). The cognitive style of the supervisor is influencing the outcome of the thesis work, in particular when the cognitive style is analytical (Armstrong 2004). As discussed above there are several studies concerning the effects of different styles of supervision and its relation to the outcome of the thesis projects, the supervisor's contribution to a successful graduation project should be addressed in management decisions. The aim of managers of thesis production would be to reduce dropouts and increase the quality of the theses. This study focuses on describing the completion rate and the time to completion, indirectly addressing the dropout. The quality of the actual thesis is not part of this study; indirectly the quality of supervision is addressed in the study.

Managing higher education

Although there are several factors that point towards some developed management and organisational structure for higher education, this is underrepresented in organisational theories (Kreysing 2002). Kreysing claims that the lower levels of, the higher education organisations have a strong position, while the central management has less influence on structural and strategies (ibid). That is what is known as a *loosely coupled system* (Weick 1976). In education it is put forward that certification is who does the work and inspection is to determine the quality of the work. Both of these activities can have loose or tight control, and in educational organisations, the certification is deemed to be tightly coupled, under control, on the contrary, the inspections tend to be more loosely controlled (ibid). Among the coupling mechanisms two are mostly in focus, technical core and authority, the technical couplings are task-induced authority includes responsibilities, positions, rewards or sanctions, factors that supposedly holds an organisation together (Weick 1976). In the situation with the loosely coupled environment, the administration is disturbed by the fact that things happen in a way that is not intended. Wieck (1976) gives fifteen traits of loosely coupling, some of these found in educational organisations, decentralisation, a delegation of authority, the absence of linkages such as feedback from output to inputs and curricula for which there are limited prerequisites. Important factors in education are professors, principals, classes and other interested parties as a consequence will point to that a more loosely coupled system will leave more room for self-ruling actors. As a result of this, the experience of efficiency may be higher without the more controlled tightly coupled system, and the professor's notion of control emanates from interested parties expectation that the professor should link the learning intention with teaching actions (ibid).

Loose coupling as management strategy

Advocates of loose coupling as strategy points towards the specific effects of the strategy that is suitable for higher education as it is utilising the benefit of academic freedom. As the graduation projects by definition are unique projects, the successful supervisor often needs to use various skills and experiences to guide the project to a successful a completion, the strategy of loose coupling appears to be a suitable choice. Judge the management goals in foremost three effects, modularity, a variation of requisite, and discretion. Modularity attained by a decrease of mandatory relationships, a loosely coupled system can register environments more precisely by the requisite variety and discretion takes on two forms, behavioural, that promotes autonomous actions and cognitive which is the possibility to register and construct meaning (Orton and Weick 1990).

Background

During the period of the study, there have been several changes in the process of thesis writing at the department, trigged by internal and external factors. An IT-based support system (the SciPro system) was introduced in 2010 and revised several times during the period. The purpose of this system was to support the thesis process both for the student and for the supervisor. The criteria for grading has also been changed several times during the period studied. There was also an evaluation of the thesis quality by the national agency of higher education started in 2010 and published with unfavourable results in 2012; this prompted a change in the process already before the result was made public.

The SciPro system – a background

The intention with the system initial design is to provide a semi self-adaptive and flexible IT artefact for individualisation of supervision on a large scale supporting knowledge creation. It was intended to focus on the dialogue in supervision and include content that assists the students mastering of the thesis writing (Hansson et al. 2009). Work on developing the system started with a purely administrative component, the matching of students with supervisors. The system was expanded with components to administer the final seminar and automatic text matching (which had been compulsory for some years but seldom performed). Further development of the system moved in the direction of more tightly coupling and more control of the process, further away from the self-adaptive and flexible system to a more rigid process controlled by the system.

The design concept of the system aimed at providing faculty and students with an ICT-based tool enabling mass-individualisation of supervision. A lot of the feedback students need for their thesis work is general information about the structure, theory, and methods in science. This information could be provided in a much more engaging, flexible, economical and time-efficient way, leaving the unique dialogue between students and supervisor to innovative and critical aspects of that particular project. The quality of learning is a great deal dependent on the quality of communication (Kalman and Leng 2007). In a situation when a large number of students need quality education, part of this communication has to be provided in other ways than unique private face to face dialogues (Hansson et al. 2009).

Changes in grading criteria

As stated above the grading criteria was changed during the period in this study, the aim of this revision, as with previous revisions, was to increase the quality of thesis and attain a uniform grading process. It has been a long-standing tradition at the department to review the grading criteria of theses at regular intervals, sometimes quite frequently. Autumn 2009 a group started working on establishing a set of mandatory grading criteria. The first version discussed by the group working with the criteria was composed of three parts, the work process, the content of the thesis and finally the presentation of the thesis. The process was judged in 10 different subsets and given from zero to two points each, the total number of points transformed to a grade according to a set formula. For the content of the thesis there were seven factors graded as above, and finally, the presentation judged from four different aspects. Final grade derived from the lowest grade on the three parts graded. After discussions in the workgroup, the criteria changed to a simpler model, the work judged by awarding from zero to three points on central areas, other areas had a maximum of two points. There was a total of nine areas of academic work and academic presentation and five areas of the work process judged; some had a mandatory of at least one point for a pass. The number of points total was then directly transformed to a grade. The criteria were presented for the rest of the faculty spring 2010 and extensively discussed. This template for grading was revised again fall 2011; the major change was substituting the three points with two points. The model for the criteria has remained the same, but the weight of some has changed as well as the requirements for each level of points.

Changes to the work process

Another action to improve the quality and uniformity in handling undergraduate theses was to revise the process. Major revisions of the thesis process started as the system support was being developed, faculty discussed the proposed change during 2011. From 2012 grading of the theses was the responsibility of a specially appointed examiner, the supervisor and reviewer made their suggestions for a grade with the help of the grading criteria previously discussed. Before this change, the grading of a thesis was a joint responsibility of the supervisor and reviewer.

There is a complication when attempting to evaluate the effects of the changes as there are problems in deriving the cause of observed changes, some changes may have had a positive effect on the variable studied while other changes may have had a negative effect on the variable.

Design of study

In this section the detail of the design of the study will be described, this includes both the source of the data, the selection criteria and how the data is analysed. In some analysis, it would have been possible to make a different judgement on what data the analysis should be built on. One example of this is how to determine the starting point of the graduation project, in this study this is determined to be the date of registration, in other studies the date of the creation of the project used to the start date. The choice of registration date is due to that this will give the time it takes for a student to finish the course, the actual project may be restarted several times during this period.

Study administrative data is available in the department's administrative system called Daisy. This system contains information on all students and their results together with courses etcetera. This system used as data source for this study as being the most reliable and confirming in vital parts of the official records.

Data on all started thesis projects on bachelor and master level extracted with the identity of the students, supervisor, and reviewer together with data on start and finish date, grade. All started thesis project from 2010 up to and including spring semester 2015 was selected, the extraction of data took place at the end of summer 2015.

The first step was to analyse this data on an aggregated level. For this, the relevant data for each analysis was extracted in PSPP (https://www.gnu.org/software/pspp/) and then transferred to Excel to generate graphs. For analysing of how many days from start to finish of projects the number of days was calculated using the function in Excel. This procedure generated the aggregated results to give an indication of the outcome of all the actions that had been taken by the department to improve the thesis projects, see details under Background above. The study comprises 1,551 projects; out of this 718 had been completed at the time of the data extraction.

As the aggregated analysis indicated that only a small portion of the projects completed in one semester, which was determined to be within 150 days, the analysing of the completion rate only included projects started from 2010 up to and including 2014. The exclusion of projects started in 2015 motivated by the fact that only a minor part of the projects finish in one semester, which would have given a false high non-completion rate for projects started in 2015.

From a management perspective, it is interesting to gain information on the production from several points of view. The smallest unit of production in the thesis process is the supervisors, so an analysis of this factor conducted in detail. There were some 140 supervisors involved in the projects. After a deduction of supervisors that was not employed directly by the Department, about 90 remained. Their production measured on two factors, completion rate and the average days to completion. This initial analyse contained several extreme values, supervisors that only had one or two projects during the period. As the directive from the management was that all supervisors had to start two or three projects per academic years, the supervisors who had started at least ten projects during the period was selected for the final analysis.

The analysis has been done in steps where new variables have been calculated from other variables, for instance, the number of days from start to finish. There is no exact way of measuring this period so in the study the start date is considered to be the date of the students registering for the thesis course, the completion date is set to be the date of the last grade of the project. Also, some of the data excluded in the material, for instance, there was a small number (less than 20) of thesis projects that followed the old study plan with a grade of pass or fail only.

Findings

The overall aim of the study was to determine if all changes made to the handling of undergraduate thesis projects at the department had improved regarding time to completion and increased rate of completion. On the aggregated level three variables have been studied to determine the change over time, completion rates, change in grades and the time it takes for a student from registration to completion. All three of these are reasonable goals for initiating changes in the protocol and procedures for thesis production, this type of change would be motivated and driven by lowering the dropout rate, increase the quality and reduce the time it takes for projects to complete. In this case further motivated by the criticism from the higher education authorities evaluation of the quality of master education, the drive to increase the quality of thesis, in general, was started before this evaluation.

Completion rate - findings

During the studied period, projects started from 2010 and through to 2014; there is noticeable a sharp increase of noncompeting between 2011 and 2012, see Figure: *1*. One reason for this could be the introduction of new grading criteria, but the increases are not dropping off but continue to rise. Projects started in 2010 have a non-completion rate of about 17 percent, for projects started in 2014 has this increased to about 42 percent. Some of the explanation for this increase is the fact that also the time to completion during the period has increased, so over time the non-completion rate for these can be expected to drop, but probably still have an increase.

One of the driving forces behind the introduction of IT support for the supervision process was to be able to handle more theses per supervisor. There was also, a policy change aiming at increasing the production requiring all faculty to supervise at least 2 or 3 thesis project per academic year.

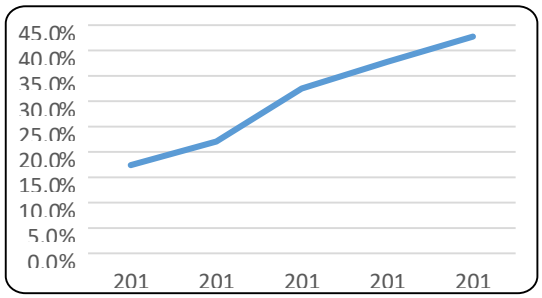

Figure: 1 Non-completion rates for thesis projects by start year

In one aspect the production has increased, the number of thesis project started, see Figure: *2*, which has almost doubled during the period. The increase is especially noticeable for the year 2012, which also has a sharp increase in some non-completions. One possible explanation for the increase in both of these is the introduction of new master programs, six new programs started in the period. Of these some are aiming at a distance and/or international students, effectively increasing the number of students that are expected to start a thesis project. From the viewpoint of inflow to the thesis course the productivity has increased at the same time the number of thesis projects not completed has increased. With increasing number of projects started together with an increasing share of uncompleted projects, the number of non-completed projects is increasing at a high rate. The number of not completed projects started in 2010 was 28 at the time of the extractions of data. For projects started in 2012 this has increased threefold with some 90 projects not completed, and for projects started in 2014, we see an even higher numbers of projects not completing their thesis, some 130 projects uncompleted by the time the data extraction. A hypothesis to explain this is that the current organisation of thesis production has reached its capacity ceiling and there is a need for management changes to increase the completion rate. As already mentioned this number can be expected to be lower in reality as it takes a longer time to complete.

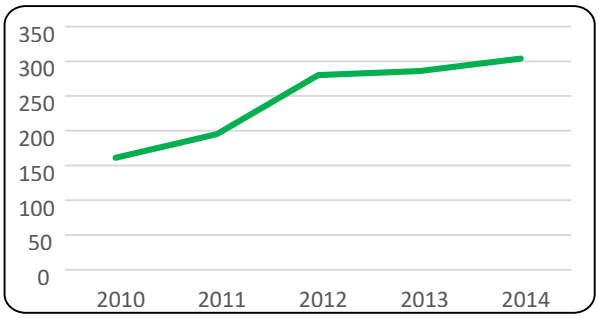

Figure: 2 Number of started thesis project per year

Change in grades distribution

A major motivation for all the actions in changing the supervision process and grading criteria was to ensure a raise in quality of the thesis. The first step in evaluating the increase in quality is to define the concept of quality in education, and specifically for theses. Next step would be to construct some measurement to use in observing the quality. The question of quality and how to judge quality in the thesis is outside of the scope of the paper, even if it is an important factor in the

management perspective of large-scale thesis delivery. For this study the pragmatic viewpoint of using the grade of the thesis as one aspect of quality, being well aware that even with the changed grading procedure there is still some element of subjectivity in assigning the grade. There is a possibility that factors that are not visible in the actual thesis may affect the grade.

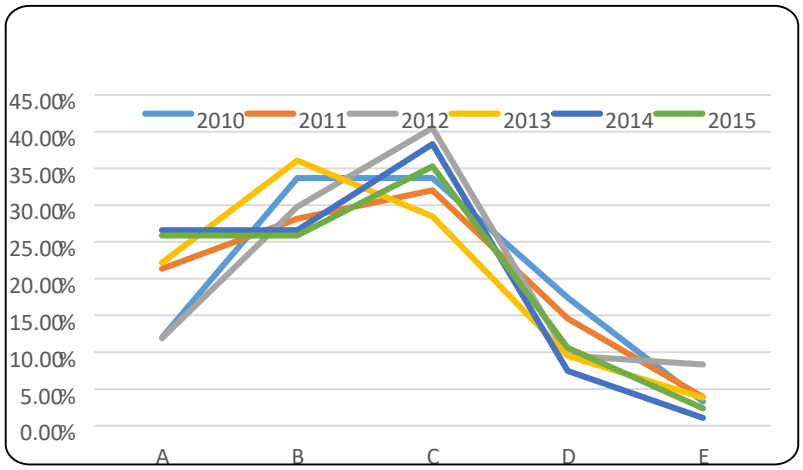

Figure: **3 Grades by start year of thesis project**

There are two observations in this data, see Figure: 3, the share of grade A has increased, and grade E has decreased to just a few percent's of grades awarded. As a consequence of the discussion above on increases quality, it is hard to evaluate if the quality, in fact, has improved. There are some possible reason for the diminishing number of low grades, one being the grading criteria which award a higher grade even if only one or two criteria that are judged to be above the minimum requirement. Another possible explanation is that supervisors are working more to get the students to achieve a higher grade.

Time to completion

The time from the start (the date of student registration on the thesis course) to completion (the date of the last grade of the thesis course) has increased during the studied period, from an average of 175 days in 2010 to 331 in 2014, see Figure: *4*. There is a sharp increase in the length to completion in 2012, possibly caused by the introduction of a new grading process where grade proposals are handed in by the supervisor and reviewer and finally decided on by an examiner (the previous process only had supervisor and reviewer).

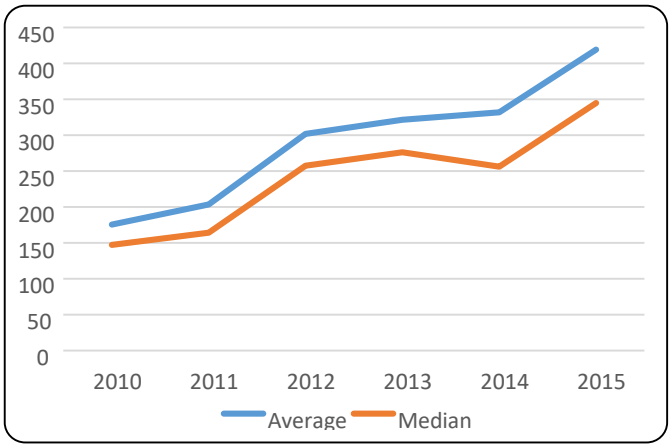

Figure: **4 Days to completion**

In this study the completion on time has been set at 150 days, the projects for the majority of students are running for one semester which is about 150 days. Of all completed project, only about 11 percent completes within 150 days, and after a full year, there is still about 35 percent non-completion of the projects. Some of these will never finish, and some will take even longer time to completion, the longest time to completion in the data is over 2 000 days.

Supervisor's production

During the period that the data covers some 140 supervisors was assigned at least one thesis project to supervise. As discussed by among other (de Kleijn et al. 2012, Todd et al. 2006) the interaction between student and supervisor is a factor that affects the students' performance.

Therefore it was decided to investigate if there was a significant difference between supervisors. Two factors for the individual supervisor was studied, the share of the completed thesis project and the time it to took to completion. More than 140 supervisors are in the data, excluding those not employed by the department as well as those who had not meet

the target of starting on an average of two projects per year. A total of 47 supervisors fulfilled the requirements of starting at least ten projects in the period of this analysis, see Figure: *5* below. Twenty-eight of the supervisors have at least 50 percent completion rate, this group of supervisors also have a shorter time to completion, on an average 319 days as compared with the group that has lower completion rate the average time to completion is 399 days.

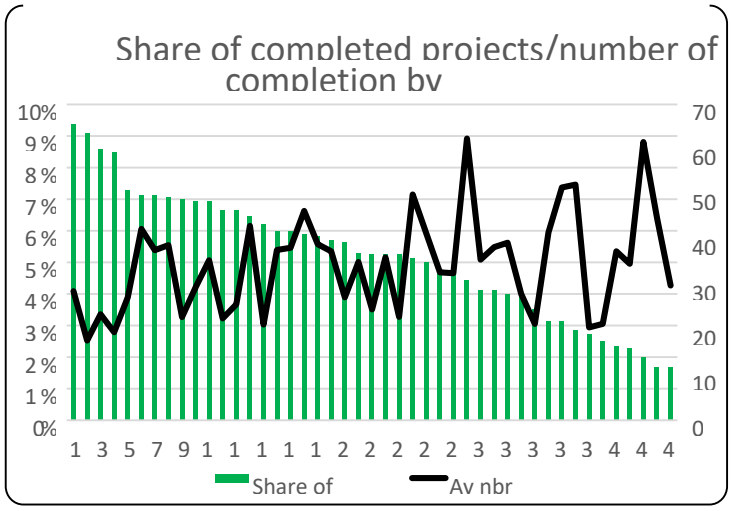

Figure: **5 Share of completed projects and average number of days to completion**

The diagram in Figure: *5* indicates that there is a correlation between the number of days it takes to complete a thesis project and the rate of completion, where the supervisors who have a high rate of completion also have a shorter time to completion. In the correlation diagram in Figure: *6*, it is clearer that these two factors are correlated, but it is probably not causality between these variables, but both are dependent variables.

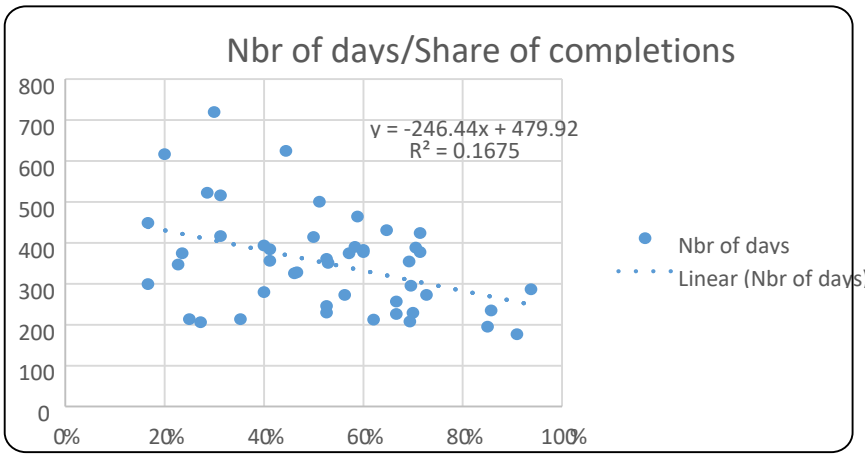

Figure: 6 Correlation of completion rate to number of days to completion per supervisor

A plausible theory is that the independent variable affecting both of these variables are to be found in the supervisor's way to supervise the students towards completion within a reasonable time. It may be the supervisor's skill in the field of the thesis project, the supervisor's ability to interact with the students or some other personal skills affecting the process of supervision. The study indicates that it is in this area implementation of some form of measures should be if improvement in those two variables is desirable.

During the presentations of the preliminary data to faculty and managers, other suggestions explaining the results is;

-Variations in the complexity of different subjects of the thesis -Variations on the number of projects the supervisor has been supervising, or

-How many ideas for thesis projects that were the supervisor's ideas contrary to student ideas.

After analysis of these hypotheses, there are no significant differences that explain the outcome. In Figure: 7 below the rate of completion for each supervisor are compared with the rate of ideas posted by the supervisor for the students. The theory behind this would be that a supervisor with projects from ideas generated by the supervisor would lead to a higher completion rate, it is in the supervisors own interest to get the projects completed. It shows that the supervisor with the lowest completion rate has more than 80 percent of thesis project based on the supervisor's suggestions for the suitable project. Among the supervisors, with high completion rate, the supervisor's suggestion is in a minority of the projects.

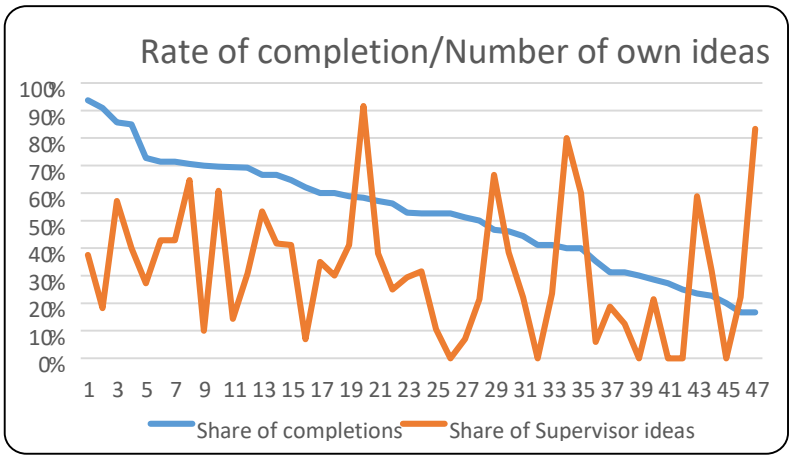

Figure: **7 the rate of completions compared with rate of supervisors ideas**

Recommendations

Recommendations from this study are in three separate strategies: recommendations on a viable process for improvement of the production process, recommendations on immediate changes in management directives regarding supervision and finally recommendations towards a new management style in general.

Recommendations on a viable process for improving the thesis process

[There is a] *need of forming a theory of experience in order that education may be intelligently conducted upon the basis of experience …* (Dewey and Boydston 1984) This quote is firstly related to the *Experiential Learning Theory*, put forward by among other John Dewey, Jean Piaget, Carl Jung and others. Some hallmarks of this theory are that learning is a process, learning is an adaptation to a holistic process and, learning is creating knowledge (Kolb and Kolb 2005). The definition of learning according to this theory is "*the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience*" (Kolb 1984). The quote is also related to design of education and the notion that educational processes be evidence-based. Evidence-based practices in education are aiming at designing practices that will increase the outcome for the student (Cook and Odom 2013). Cook and Odom also point out that "No practice will work for every single student: this is a reality of education" (2013). This standpoint, that research in the field of education are challenging, is among other based on the complexity introduced by the variation of research subjects, learners. The researcher needs to take into account the effects perceived by the individual learner and the context in which the learning is experienced (Odom et al. 2005).

One very important factor in the success of education is the teacher, or in the case of graduation work the supervisor. Thus part of the improvement of the process is an enhancement of the supervisors' skills. This enhancement needs to take into account among other the conception that change is a gradual process that for many are challenging, requiring continuing support and follow up after the initial training. A new supervisor should also receive continuous feedback from the students learning experiences (Guskey 1986).

Given these factors, the process for thesis production is suggested to be gradual and evaluated at regular intervals, the effect of one change well documented before another change introduced. External demand forced some of the changes described in this study, but they still should be properly evaluated before further changes introduced.

Suggested practice for introducing changes to the thesis process is to evaluate the outcomes of the present process to find weak areas, taking into account the challenges involved in research of education mentioned above. After the evaluation decides on what changes would be desirable to improve the process, evidence-based judgment should be the guiding this decision. Design how the proposed changes should be evaluated once implemented and evaluate after implementation to determine the effects on the learning outcome and production, including the notion of not introduce an abundance of actions that may obscure the results from each other.

Recommendations on immediate changes in directives regarding supervision

This study shows that there are significant variations in the rate of completed project, and the time it takes, between individual supervisors. It appears that there are weak indicators that explain this difference to be due to external factors like the subject, the ratio of supervisor initiated topics etcetera. The reason for the difference is probably multiple and diverse between individual supervisors.

Currently, there is a general directive that all faculties should supervise two or three projects per academic year and projects are assigned accordingly. The time for supervision together with other tasks within teaching make up the commitment of the faculty members teaching hours, and the allotted number of hours for supervision is assigned based on the number and type of projects supervised.

To increase the rate of projects that are completed, the directive regarding at least two to three projects per academic year for each faculty member be adjusted so that supervisors with high completion rates are encouraged to accept more projects per year, and other teaching activities reduced accordingly. For new supervisors and supervisors with lower completion rates support is given in the form of formal training and mentorships. Finally, calculate the allowance of hours only out

of actual credits taken by students in their thesis course. Part of this allowance calculated only after the actual finishing of the project.
To make this calculation possible the administrative system should be updated with a function to make follow up on actual production for supervisors possible. This function should include the rate of completion and an average number of days to completion, besides the number of credits and completed projects.

Recommendations towards a new management style for education management
As discussed above in the section on management of supervision the notion of loose coupling as a management style, is a suitable alternative for management of thesis production. Based on the general setting for graduation work, it is for most students a new situation where they are not asked to repeat and memorise knowledge but to produce knowledge, and most projects consist of a unique set of contexts requiring a flexible approach to planning and execution. As discusses above in the section of managing higher education, the most well-suited management strategy is loose coupling as described by Wieck (1976). Exactly the quality the loose coupling is designed to support. The skills of the supervisor are at the very core of what is to be learned instead of supervisors occupied with routines and set timeframes.
Some advantage of a loose coupling style of management is that it may provide mechanisms that are sensitive and adaptive, making it possible to adjust for the individual project without having to adjust for the overall and general process. Furthermore, the loosely coupled system in preserving uniqueness can handle increasing number of novel solutions, thus enhancing creativity and adaptability.
The present support system for thesis production in the department steam from the notion of tightly coupled system, more control than supports of the process. The basic notion of the system appears to focus on making sure all projects follow the set steps and timeframe of the work. As indicated in this study this seems to have prolonged the time from start to finish and lowered the rate of completion on an aggregated level.
The recommendation is not the implementation of loose coupling without any management mechanism to follow up and judge the outcome, but rather it should be combined with what is called *Controlled autonomy* (Kreysing 2002), which implies a balance between the management and the subject experts.
The instrument for the management in this situation is the follow-up information discussed above. This follow-up will provide the management with information needed to adjust guidelines or administer support to supervisors. The support system should move towards supporting flexibility and adaptability to support both student and supervisor. The set requirements limited to only what is required by regulations, the road to completion would be set by the project members and supervisor and used as a guideline rather than a fixed path to follow.

Discussion
A study like this have several hurdles to overcome, those involved in the supervision process may have another picture of the state of affairs and other explanations for what the data in this study shows. Other studies, with other design and other treatment of data, may come to other conclusions. This study focus on measuring the time it takes from the start of the thesis course to the last grade awarded, even if the student restarts the projects several times. If measuring the time from start to finish of the individual project will probably show shorter time to completion, and possibly also lower dropout rate. This study focuses on change over time, with the extent of changes, applied to the activity and showed not only the lack of improvement regarding the rate of completed projects but also that the share of unfinished thesis projects increasing but also that the time to completion has increased.
Even if the treatment of start date as used in the study are well justified there are still a risk of getting some false results because a student registering for the thesis course but don't start working on the project until a later time. Even so, this would anyhow be a failure to complete the thesis in the expected time allotment. The strategy to measure the length of the project from registration to final grade aligns with the concept that a three-year education should be completed in three years, not in four or five years.
The number of changes imposed on the thesis process during the period of the study is a liability for successful improvements of the process as it is difficult to isolate the effect of one change from another. There could be changes that are improving the process along with changes that are detrimental to the process. Therefore the recommendation regarding a viable process for improving the thesis process as stated above is appropriate.
As in many pedagogical practices, the teacher is important for the overall outcome also in the thesis projects where the supervisor and student work even more closely than in the classroom. Even if alternative theories have been offered to explain the difference in the completion rates and time to completion between individual supervisors has been refuted the actual explanations has not been the aim of this study. Alternative explanations suggested by faculty to explaining the differences in completion rates and time to completion was; the complexity of the subject, the number of projects for the individual supervisor, the share of supervisor generated ideas. This study has not found any correlations between these proposed explanations and the production, there may be individual differences where this can be a factor, but for the group of supervisors in this study, it is not the explanation.
Future studies in this area should investigate if there has been a change in completion rate and time to completion for projects started spring 2015 and later, and, establish some form of best practice for supervisors that promote production in higher volumes with maintained quality. The best practice could then be incorporated into the training of new supervisors and offered as support to supervisors not reaching the goal of production.

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