Develop newly graduated engineers

How the structures of in-house projects at ÅF can improve the development of newly graduated engineers

Master's thesis in Learning and Leadership

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Cover: Abstract representation of the model presented in the thesis.

Typeset in LaTeX
Gothenburg, Sweden 2018

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LENA MÅRTENSSON & ÅSA SÖDERLUND
Department of Communication and Learning in Science
Chalmers University of Technology

Abstract

The lack of employable engineers makes it highly interesting to employ newly graduated engineers. The drawback of newly graduated persons is that they lack experience. To make them develop, this study aims to investigate how the newly graduated employers learn today and how the learning can be optimised. To be able to investigate the learning, the two learning models, the sociocultural learning model and the experiential learning model were used as references. One company that has expanded a lot the latest years is the consultancy company, ÅF. Therefore, the need of new engineers is large and the possibility to employ newly graduated engineers is vital.

A survey about newly graduated engineers' learning during their first project at ÅF has been sent out to all newly graduated employers in Gothenburg. Totally 158 respondents have answered. To get a more objective view of the team's performance five section managers were also interviewed. The data were analysed using a combine inductive and deductive approach.

The result is that the two learning models combined describes the learning process for a newly graduated engineer at ÅF in a satisfactory way. However, depending on the reason of not learning from vague tasks and open environment, there might be a gap in the models, even when combining them.

To improve the development of the newly graduated engineers ten activities have been composed and ranked by how much they develop the new engineers and the effect on the team's performance together with how easy they are to implement. The ranking forms a two-dimensional model for learning activities to develop newly graduated engineers.

Every activity is affecting the team due to the development of the newly graduated engineers, making them contribute more to the team. Another way the team is affected is that it can take more or less time to support the newly graduates engineer. These activities will hopefully improve the newly graduated engineers' development.

Keywords: Newly graduated engineers, Introduction at work, Learning, Teamwork, ÅF, Consultancy.

Acknowledgements

CONTENTS

Glossary

Introduction   Not only things like showing the NGE around and fixing computer access, but also, supporting the NGE throughout his or her first project in various ways.

NGE   Newly graduated engineer

1
INTRODUCTION

Today's labour market shows an increasing lack of highly educated workers. Especially the shortage of engineers is large in many sectors. According to the Swedish Public Employment Service (Arbetsförmedlingen, 2018), engineer is one of the professions that, the coming years, will lack employable people. Companies need to work hard to be able to hire a sufficient number of engineers with adequate knowledge. One way to find engineers to employ is by turning to the newly graduated engineers (NGEs).

A disadvantage of hire NGEs is that they lack experience. The lack of experience forces the NGEs colleagues to spend time on helping which is not always appreciated by the colleauges. The NGEs take longer time to accomplish a task and they also have more training expenses to get started (Rollag, Parise, & Cross, 2005). According to Rollag et al. (2005) the loss in productivity due to new employees is between 1 and 2.5% of total revenues. Rollag et al. (2005) also states that it takes between eight to 26 weeks for new employees to become fully productive.

NGEs also have many benefits, often they are perceived as eager to learn and are not disturbed by that things possibly can go wrong, since they do not have the experience of it. Therefore, they can come up with a lot of different creative ideas[1]. This creativity can be an asset to the company if it is encouraged instead of pushing the NGEs into the companies' old ways of working and solving problems (Rollag et al., 2005).

The benefits of giving NGEs a proper and thoughtful introduction are many, but costly (Rollag et al., 2005). A new employee who gets a good introduction to both the company and the work itself will more likely be satisfied with their work and employer and therefore be committed to the organisation and remain in it (Acevedo & Yancey, 2011), as well as sooner starting to produce value. The introduction, in this study, does not only include showing the NGE around and fixing computer access, but also supporting the NGE throughout his or her first project in various ways.

ÅF is, with its 10 000 employees, one of Sweden's largest technical consulting companies, are active in most technical areas, and are rapidly growing (ÅF AB, 2018). ÅF, and most of the other consulting companies, either sending out consultants one

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[1]Oral reference: Jacob Riback, Operations Manager, PDO XFT, Digital Solutions, ÅF, 2018-02-06

by one to help with a client's project or take care of an entire project for a company, a so called in-house project. When sending out consultants one by one, the NGEs' lack of experience is a big problem because the companies that are buying from the consulting firm often want senior persons with a lot of experience[2].

In most types of in-house projects at ÅF the client has low impact, or no impact at all, of which people that should work in the team[3]. Therefore, in-house projects are a good way to provide an NGE a possibility to gain experience and grow as an engineer without having to interfere with the customer directly. In in-house projects ÅF also has the opportunity to design the introduction and support the NGEs as they want to instead of leaving it to the client.

In some of the areas at ÅF, it is common to have in-house project, but in others it is not. At Digital Solutions, the IT-sector of ÅF, in Gothenburg, this method of working is not implemented. They would like to start with this during 2018[4].

The in-house projects could make it possible for ÅF Digital Solutions, Gothenburg, to employ NGEs and let them develop in in-house project inside ÅF. However, if the NGEs are just placed within an in-house project without further consideration, it is highly possible that the new engineer does not learn as much as he or she could have done if the circumstances were designed to optimise learning. The quality of the project may also suffer from having engineers that do not learn and therefore not perform as well as they have the potential to do. To make the NGEs develop and contribute to the team, pedagogical models combined with theories about teams may provide some answers.

Earlier studies have been done about pedagogical models, success factors for learning at work, teamwork and the introduction at work. These studies are presented in Chapter 2 *Theoretical framework* and serve as the foundation of this thesis. This study aims to combine these four subjects, which not has been done before.

The researchers in pedagogical models, haven't been able to agree on one universal, comprehensive model for learning. Yet, two models that are likely to complement each other are the experiential learning model and the sociocultural model. The experiential learning model is based on constructivism and learning from experiences, it focuses on the learning that occurs when thinking and doing. The sociocultural model covers the effect of the current context and persons in the environment, it focuses on the outer influences. Since these two models are likely to complement each other it is interesting to combine them to investigate if that may make it possible to understand the learning of the NGEs. Felstead et al. (2005) have studied different success factors for developing at work and Hattie (2012) has studied what makes

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[2]Oral reference: Angelica Hellborg, Section Manager, Microsoft & Enterprise Information Management, Digital Solutions, ÅF, 2018-01-24

[3]Oral reference: Jacob Riback, Operations Manager, PDO XFT, Digital Solutions, ÅF, 2018-02-06

[4]Oral reference: Angelica Hellborg, Section Manager, Microsoft & Enterprise Information Management, Digital Solutions, ÅF, 2018-01-24

teachers successful at teaching in school. The two different types of success factors together with the pedagogical models may make it easier to gain understanding of how the learning of the NGEs can be improved.

Zheng, Swanström, Meneghetti, Panton, and Qayumi (2011) studied how surgeons were affected while working in teams with different experience. They showed that newly graduated surgeons significantly improved while working with senior surgeons and that senior surgeons slightly worsen, than when working with more experienced colleagues. This result is interesting, but the working environment and tasks are not similar to the ones at an IT-consulting company. Therefore, it is desirable to examine these circumstances.

To take full advantage of in-house project, in order to employ NGEs, a research about how NGEs develop and how they affect the team need to be done.

1.1 Aim

This master thesis assesses the ability of the experiential learning model and socio-cultural learning model to explain the NGEs' learning at ÅF. This is the base for the further investigation of how to incorporate NGEs in the work at the company and therefore make it easier to hire NGEs. The investigation is based on success factors for learning and how the team composition affects the team members' individual performance. The purpose of this master thesis is to help ÅF to improve the value of NGEs and to give them the best opportunity to develop as a consultant. The desirable outcome from the work of this master thesis is a useful model of how to incorporate NGEs in in-house project.

1.2 Specification of issue under investigation

First research question
Can the learning of newly graduated engineers be described through an experiential learning model combined with a sociocultural learning model, based on how the newly graduated engineers perceive their learning?

Second research question
How can ÅF make newly graduated engineers develop in an in-house project and how is this affecting the team's performance?

1.3 Delimitations and assumptions

This master thesis does not consider how different personality types may affect the team and thereby the learning experience for the NGEs. Neither will the thesis investigate how different people may learn in different ways and therefore benefits from different in-house project structures, nor how specific elements within the IT

sector is learned. The organisational structure at ÅF are not going to be taken into consideration.

An assumption that has been made is that all NGEs at ÅF have developed during their first time at ÅF. Another assumption is that NGEs are less competent than their more senior colleagues, this is, in general, supported by Rollag et al. (2005)'s research about new employee's productivity. An NGE is defined as an engineer that has worked less than two years. It is based on the fact that engineers with less than two years of experience are more unattractive to a client, due to their lack of experience[5].

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[5]Oral reference: Angelica Hellborg, Section Manager, Microsoft & Enterprise Information Management, Digital Solutions, ÅF, 2018-01-24

2

THEORETICAL FRAMEWORK

This chapter includes the two pedagogical models that will be investigated in this thesis. To get a broader understanding of the team context and learning in that situation an exposition of team composition and success factors for learning is given. The chapter finishes with a section about reflection, feedback, and mentorship. The choice of these subjects is based on what could lead to a better understanding of the combination of learning and introduction at work. But no previous studies have been done about the combination of pedadogical models, teamwork and success factors for learning in the context of introduction at work.

2.1 Pedagogical models

The experiential learning model, based on constructivism, and the sociocultural model, based on social interaction, are likely to complement each other. They are therefore forming the pedagogical framework of this master thesis. Here follows a description of the two models to gain a deeper understanding of the them.

2.1.1 Constructivism and an experiential learning model

According to a constructivist perspective of learning, a person herself builds the knowledge by thinking and reflecting about her experiences. Kolb (1984), a leading researcher in the constructivist learning, describes it as *"learning is the process whereby knowledge is created through the transformation of experience"* (p. 38). Kolb talks about two dimensions in learning, the grasping experience-dimension and the transforming experience-dimension. Grasping experience is defined as discover or understand thoughts or sense impressions. Transforming experience means that something is done actively, either in mind or in practice (Granberg, 2009). Kolb developed his own learning model and was inspired by the work of Dewey, Piaget and Lewin (Granberg, 2009).

John Dewey is known for the expression *"learning by doing"* which mean that to learn you must do a practical action, if you only hear the information you will not be able to use it later. This is what Kolb described as the outer action in the dimension transforming experience (Granberg, 2009).

According to Jean Piaget, it exists an equilibration in the human's mind when the information that come to ones mind is the same as the information that already

exists in ones mind (Phillips & Soltis, 2014). If a person gets any new information it either fits into the brain's schema or it doesn't fit into the brain's schema. In the second case the brain tries to either reinterpret the information so that it actually fits into the scheme or the scheme has to be rewritten. A learning is only happening if the scheme is rewritten (Phillips & Soltis, 2014). In Kolb's model, this is reflected in the concrete experience and the transformation by an inner action.

The psychologist Lewin, is the man that has inspired Kolb the most. Lewin defined the strongest learning process to start with a concrete experience and follows by a collection of observations that could be connected to the experience. These observations are to be analysed and summarise before learning occurs.
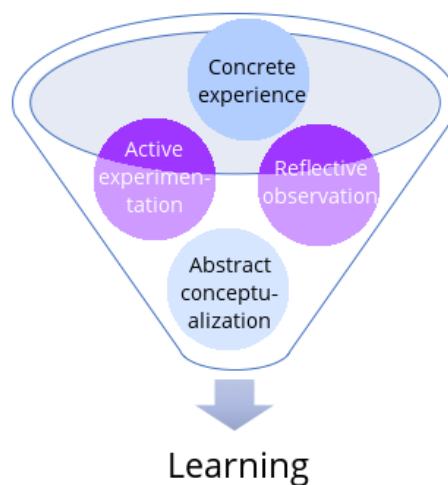
Figure 2.1: The experiential learning model. The four elements that must exist in order to learn according to Wilhelmson & Döös (2002)'s interpretation of Kolb's learning circle. All four elements need to be done before learning can truly occur. The light blue balls with black text represent the grasping experience and the dark purple balls with white text represents the transforming experience.

Based on these theories Kolb developed the experiential learning circle containing of the steps *concrete experience, reflective observation, abstract conceptualisation* and *active experimentation* (Dysthe, 2003). It also contained four different learning styles which will not be presented here. Wilhelmson and Döös (2002) simplified the circle to just contain the four elements of steps towards learning, from hereby called the experiential learning model, see Figure 2.1. The elements could appear in any order, because learning is a complicated process, but the important part is that every element need to be done in order to learn. *Concrete experience* and *abstract conceptualisation*, in the figure the light blue balls with black text, belong to the grasping experience-dimension. *Concrete experience* is to get a sense impression and *abstract conceptualisation* is to understand something with your thoughts or form ideas to action. *Active experimentation* and *reflective observation*, the dark purple balls with white text, belong to the transforming experience-dimension. *Active experimentation* is to do, try or test something in practice and *reflective observation* means to actively notice and think.

2.1.2   Sociocultural learning model

The sociocultural learning model is also called the sociocultural theory. From a sociocultural perspective of learning, communication is the most important condition to make a person learn and develop (Dysthe, 2003). It is not possible to ignore the context and environment when studing how a person learns. The interaction and cooperation are not only positive for the learning, they are critical. The sociocultural school of thoughts is based on the work of Dewey and Vygotsky, but have developed a lot by others during the last decades (Dysthe, 2003). In Dewey's work about learning and learning theory, he assumes that people collaborate with others and that the learning and knowledge are intertwined with the social environment. He also assumes that all people have different experiences and through communication they share these with others (Dysthe, 2003). Knowledge arises when people discuss, converse, listen, imitate and cooperate with others (Dysthe, 2003). By formulating what you think, and share thoughts with others, the knowledge gets deeper and the perspective gets wider due to more points of view and a bigger overall picture. Säljö (2014) describes the importance of communication like this:

"In a sociocultural perspective of human learning and evolution, communicative processes become totally centred. It is through communication the individual share knowledge and skills" (Säljö (2014), p 37, freely translated).

Vygotsky formed a theory of what people can do by themselves and what people can do with help from others. He called the theory the Zone of Proximal Development (ZPD) (Phillips & Soltis, 2014). The ZPD-theory is based on social interaction between two persons where one of the persons knows more about a subject than the other. The person who knows more can help the other person to learn through asking questions, discussing and giving tips. By doing this the more skilled person gives "tools" (for example, language, calculation systems, formulae, rules or concepts) to the more unskilled person. Through this assistance, the more unskilled person can do a lot more than she could have done by herself (Lake, 2012). The ZPD is just the gap between what a person can do by him- or herself and what he or she can do with help from others. In all these processes, communication and interaction between people are crucial (Dysthe, 2003).

There are several expansions of Vygotsky's theory, one of the most well-known is Engeström's activity theory. The activity theory includes an activity system, actions and operations, which all corporate when learning is created (Säljö, 2014). It can explain how people could learn things that are not defined or understood at the moment, in a fluctuating world (Engeström, 2001). The learning that occurs when an NGE is being employed is, in contrast, already known. There are much more to say about this complex theory, however, it is focused on a type of learning that is outside this thesis scope and it is considered too complex to be investigated in this thesis.

Another, and final, aspect of the sociocultural learning model is the situation based learning, most developed by Lave and Wenger (Phillips & Soltis, 2014). The situation based learning says that all learning occurs in a situation and the specific

situation is affecting the learning (Granberg, 2009). Lave and Wenger (1991) focus on learning of apprentices. It is crucial for the apprentices to work with the same tasks as the other in the team in order to learn. The participants in their working community should share the understandings about what they are doing and what it means in their lives and for their communities. The model is mostly used for people without education or special knowledge (Phillips & Soltis, 2014).

2.2 The team composition's effect on the performance of the team members

Most people interact with other people during their work days. A specific way to do this is to work in a project group or a project team. A team is defined as a small number of people that work together to a common agreed goal and are mutually accountable for their performance (Katzenbach & Smith, 2003).

When an NGE start to work in a project team at a company the factor that usually differs the most between the NGE and the other employees is the experience. The lack of experience, together with that the NGE is not familiar with the working tasks can make the NGE a low achiever in a project team (Rollag et al., 2005). If the NGE are going to work in teams with other, more experienced employees the team is going to be a mixed team where different levels of knowledge are represented. There are many studies about how low achievers and high achievers are affected by working together in mixed groups and how it affects the group's performance, and especially how the learning in the group is affected (Cheng, Lam, & Chan, 2008). Over all three main results have been seen. The one that both low and high achievers learn more in mixed groups than in groups with uniformed knowledge. The one where low achievers learn more and high achievers learn less than in uniformed groups and the one where both the low and high achievers are disfavoured of working in mixed groups compared to uniformed groups (Cheng et al., 2008).

Webb (1982) is one of those who have found that both low and high achievers benefit from mixed groups. She studied students working in small groups. The students were divided into three sections, the ones with low ability, medium ability and high ability. Mixed groups, with people from all sections, and uniformed groups, with people from one of the groups, were formed. Her result was, as said, that both high and low achievers, gain profit from working in mixed groups. Slavin (1991) argues for the same statement, that both high and low achievers benefit from working in mixed groups. Stevens and Slavin (1995) also did a two-year long study regarding student cooperation. The conclusion was that both high achievers and low achievers get more achievement when working in mixed groups.

However, there are other studies that are showing different results. Mulryan (1992) observed small groups of students when studied math. His findings were that it is common that low achievers get passive in the discussions and not participate as much as the high achievers in the work. This often depends on the other group

members' unwillingness to let in the low achievers in the conversations. This may harm the low achievers' learning. Allan and Feldhusen (1991) argues that high achievers show positive academic effects from working in uniformed groups. She means that working with others on the same high level benefits the learning.

Lou et al. (1996) published a meta-analysis about students learning in group practice. They compared heterogeneous groups with homogeneous groups and found that low achievers performed better in heterogeneous groups. But in contrast to Webb, this study found that high achievers performed equally well in homogeneous and heterogeneous groups.

Cheng et al. (2008) studied learning in groups, but instead of just looking at mixed and uniformed groups they studied how functional the team was. Their conclusion was that low achievers performed better in mixed groups and high achievers performed worse. But if the group was well-functioning, with for example, assigned roles and individual accountability, also the high achievers benefited from working in mixed groups.

In summary, the researches about low and high achievers' performance in heterogeneous groups are not consistent. But, with Lou et al. (1996)'s meta-analysis heavily weighted, a great amount leaning towards low achievers benefits of mixed groups and high achievers are performing as well in mixed groups as in uniformed groups.

A study about mixed team surgeon team compared completely junior and senior team with a mixed junior-senior team (Zheng et al., 2011). They showed that the mixed team outperformed the junior team, but performed a little bit worse than senior team. If instead looking at the individual performances the junior team members performed a lot better in mixed team than in the junior team. The senior team members' performance decreased in mixed teams, due to the need to provide support to the junior team member, but the decrease was so small that it was not statistically significant. There were much more verbal communication in the mixed group where the senior surgeon gave feedback, correct errors, gave short instructions and positive encouragement to the junior surgeon. Zheng et al. (2011) imply that this communication lead to the increase of the junior surgeons' performance.

The most effective teams have, according to Wheelan (2016), three to six members. If the team is bigger than this, subgroups within the team are formed. To make bigger teams stay effective it is important that the subgroup is viewed upon as contributing to the team instead of as a threat to the rest of the team (Wheelan, 2016). However, Katzenbach and Smith (2003) have found effective teams with two to 25 members, if the team gets bigger than this the team most likely breaks into sub teams. As one can see, there is no consistent theory on an exact number of members in an effective team, but the size of the team is affecting the performance.

2.3   Success factors for learning

Hattie (2012) has done a meta-study and analysed over 900 studies to find out what makes a teacher successful and thereby what is important to make students learn in a good way. In the business sector, there are no teachers and students, but NGEs who need to learn, and their colleagues, mentor and supervisor will teach them, consciously or unconsciously. In order to develop the introduction of NGEs in the business sector, it is interesting to look at the school, where the primary aim is to teach and learn and, especially, what makes a teacher successful. To use this as an input for the introduction could make companies more successful in teaching their NGEs to be able to produce value for the company.

There is not only one thing that is important to be a successful teacher, but many different aspects of skills as both a leader and an educator. First of all, the learning process needs to be visible, i.e. the student needs to know that he or she is learning and what the goal of the learning process is. By making the learning visible the student can be part of taking charge of his or her own education (Hattie, 2012).

Further the climate where the learning is taking place needs to be supportive to make sure that the student dare to make mistakes to learn from (Hattie, 2012). According to Rollag et al. (2005) this is even more important for new employees since they want to make a good impression and do not dare to, or do not think they have the time to, ask because of the possibility to appear unskilled, or unproductive. Therefore, it is central to make sure that the new employee feels that he or she can ask questions and make suggestions. The supportive climate also contributes to being able to give and receive profitable feedback to help the student develop and learn quicker (Hattie, 2012).

Rollag et al. (2005) says that some people think that an employee's first assignment should be easy to boost his or her self-confidence. He argues for the opposite, by implementing this, the new employee does not get to know many people at the company, but to be able to solve problems and feel attached to the company it is important to create a broad network within the company. Instead, it is important to make sure that the new employees can build relationships with his or her colleagues early (Rollag et al., 2005). Having a strong relationship between the student and the teacher is also something that Hattie (2012) emphasises.

It is important for the teacher to both showing the students the way forward and giving them the opportunity to try by themselves. The students need to be able to ask for help and thereby receive feedback, but also get challenging tasks to learn and develop more. To be able to do this the teacher needs to be able to identify the most important parts of a subject, how they can present it in a beneficial way and what the next step is for the student Hattie (2012). It is also important that the teacher believes that the student can be successful in challenging tasks to make the students try harder and therefore improve Hattie (2012).

A study (Felstead et al., 2005) has shown that employees improve the work performance both from acquisition, where the goal is clear and involve more classic teaching and information gathering, as well as from being a participator and learning by being involved in the regular work were the collaboration with colleagues is an important part. Each of the two types of learning is, in the study, divided into five more specific ways of learning and the participants were asked to rank how much they learned from each learning method. The ways of learning from acquisition are training courses, draw on skills learn while studying, use skills and abilities learned outside work, reading books or manuals, using the internet. The ways of learning as a participator are doing your job on regular basis, being shown by others, reflecting on the performance, watch and listen to others that are doing their work and use trial and error.

2.4 Specific aspects of development

In the experiential learning model the reflection is a big part and in sociocultural learning model interaction between people is the core, such as done in mentorship and feedback. This chapter decribes reflection, mentorship and feedback as tools for learning.

2.4.1 Reflection

The word reflection usually means consider, ponder or evaluate. A reflection can take place in a current situation, an ongoing exchange between the actions and the conclusion of what is happening (Granberg, 2009). This is not always conscious and the reflection can lead to an action and the opposite way. Another way a reflection can occur is before a situation or after a situation. These types of reflections, that not occur during a current situation, are more comprehensive than the ones during an on-going situation. The reflection before a situation can, for example, occur before a meeting when thinking about the meeting's purpose. The reflection after a situation is often an evaluation of the event. Reflection is important to get a broader perspective of a situation, structure the thoughts, form new ideas and eventually learn (Granberg, 2009). To be able to do a giving reflection there cannot exist an immediate pressure to act because there must be time to be able to think and dare to see the situation from another angle (Granberg, 2009).

Emsheimer, Koppfeldt, and Hansson (2005) are some of many that have conducted studies about active reflection and how it is used. The result was that the students in the study lacked methods for how to reflect and process experiences.

2.4.2 Feedback

To learn and develop one needs feedback on their work, how this can be done in a good way is discussed by Hattie and Timperley (2007). However, there are different ways to give feedback and depending on the situation they are differently effective. It can be hard to give developing feedback (Hattie & Timperley, 2007). In Hattie

(2012)'s meta-study, feedback was found to be one of the most important factors for learning and achievement in school, if done correctly. Being done correctly means that the teacher gives effective feedback to a specific student and that the student understands the feedback.

To be effective, the feedback needs to give an answer to the receiver on least one of these three different questions (Hattie & Timperley, 2007):

- Where am I going? (What are the goals?)
- How am I going? (What progress has been made toward the goal?)
- Where to next? (What activities need to be undertaken to make better progress?)

Feedback that is not answering these questions are not feedback that are developing. Besides answering different questions the feedback can also be directed towards different aspects of the work such as the result, the process or the person's self-regulation. The fourth type of feedback that exist is on the person, but is rarely effective for development (Hattie & Timperley, 2007).

Apart from what type of feedback that is given, it is also important at which time the feedback is given. Hattie and Timperley (2007) have found that feedback works best when it is given as soon as possible when it is related to the result of a task. When it comes to processes, it is important that the person that is receiving the feedback has the opportunity to try by oneself and think about different ways of solving the problem. Both of these, however, need to be more or less daily elements of the work to create the most value for the development.

2.4.3 Mentorship

Mentoring is a form of supervision and guidance. Shea (2002, p. 8) defines the mentor as:

> *"A mentor is one who offers knowledge, insight, perspective, or wisdom that is especially useful to the other person".*

The most significant part is that the mentor should be a person with more experience than the adept (Mathisen, 2009). Otherwise, how the mentorship is organised can vary a lot. It can contain just a few meetings or a lifelong relationship, it can be structured or unstructured, formal or informal. Mathisen (2009) defines two types of mentoring. The first one is the career focused mentorship, that include encouraging to new challenging, job changing, and making a career plan. The other type is when the mentor should help to improve the psychosocial ability of the adept, that means to develop the self-confidence and the self-perception in the work role or function. In this master thesis, the focus will be on the second type of mentorship. To clarify this type of mentors will be called buddies.

Clutterbuck (2004) has specified the mentorship, or buddy-structure, and what makes it successful. He defines it as:

> *"Mentoring is off-line help by one person to another in making significant*

transitions in knowledge, work or thinking". (p 13)

In this case off-line means that the buddy should not have a power postion to the adept. This, because it can be hard to have an open discussion with a person that have influence over the wage and distribution of tasks. The word help has a broad meaning, it includes everything from listening, discussing and giving advices. The ability to help is based on the willingness and ability to understand the adept's point of view. The structure with a buddy should be a one-to-one contact because it is easier to build a trustful and open environment. To be able to achieve significant transitions of knowledge, work and thinking the purpose of having a buddy need to be predefined and clear (Clutterbuck, 2004).

The benefits of having a buddy, both to the company and to the adept, are that it secures that the adept will have the right knowledge and skills for the current work situation and become assimilated to the work routines (Mathisen, 2009). It can be a good complement to the normal introduction. The buddy can help the new employer to get insight into his or her strengths and weaknesses and a good way to get feedback. For the buddy, the relationship can bring new perspective from the NGE (Mathisen, 2009).

The only time it is not a benefit to the have a buddy is when the structures do not work. In that case it only takes time and creates a frustration without creating value (Mathisen, 2009). This can occur when the buddy doesn't have sufficient good communication skills to be able to give feedback to, listen to, challenge and support the adept. It can also occur if the work as a buddy is not prioritised or if the expectations are unrealistic (Mathisen, 2009).

3

METHOD

This master thesis consists of two types of primary data collection. The first one was a qualitative survey where the NGEs' perception of their learning was investigated. The second one was an interview study, where the experience of NGE's in teams and their, as well as how other members in the teams, performance were investigated. The interview respondents were section managers how compose teams. The results from the survey were analysed by both an inductive and a deductive analysis method. During the deductive analysis the findings were compared to the part of the theoretical framework about the two learning models. The results from the interview were only analysed by an inductive analysis method. In the last step of the inductive analysis the results from the survey and the interview were analysed together. From the analysis several activities were composed, whose purpose was to develop the NGEs. The activities were evaluated by an attribute analysis where all activities were rated on how well they fulfilled the desirable outcomes of the activities.

3.1 Survey

A digital survey, about the development during a consultant's first project, was constructed. The survey was optional and the respondents were informed about the non-compulsary participation, the purpose of this master thesis and that all answers would be anonymised, according to ethical guidelines, when the survey was sent out (Kvale & Brinkmann, 2014). The survey was sent out to all employees at ÅF in Gothenburg that have worked at ÅF less than three years and were under 30 years old. The limits were set so the respondents should remember how it was to be an NGE and new at ÅF. The average age of graduating from Chalmers is 25.8 years for master in engineering and 25.2 years for bachelor in engineering [1]. Based on this and Sudman, Bradburn, and Schwarz (1996)'s study about how much information you can recall from a memory depend on the elapsed time from the event the limits were set. The study showed that if the event occurred more than three years ago you will remember less than 50% of the details and that would not be enough for this research. The survey was a qualitative survey to provide knowledge about learning experience and how it had been perceived by the NGEs rather than gain knowledge about how many that have had a certain type of experience, as a quantitative survey would provide. The survey was provided in Swedish and English. The survey was sent to 302 respondents and 158 of them answered.

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[1] Oral reference: Ladok administrationen, Chalmers, 2018-02-12

An advantage of using a survey is that it is easier to reach more people at different locations, which is one of the main reasons a survey was chosen over interviews (Esaiasson, Gilljam, Oscarsson, Towns, & Wängnerud, 2017). Since ÅF is a consultancy company, many of the employees were not located in the ÅF buildings, but at customers' office, therefore a survey was suitable to reach more employees' opinions. Another advantage of a survey is that when the survey is send out the respondents get the opportunity to think about the questions as long as they want, that could lead to more accurate answers (Ejlertsson, 2014). A third advantage is that the survey can be completely anonymous, which make it is easier to be honest in a survey compare to an interview and the that is done in order to get more valid data (Fowler, 2014).

When using a survey there is a risk that the response rate is low since the respondents simply can ignore the survey, especially if the questions are poorly conducted and for people with troubles writing and reading in general or in the specific language (Ejlertsson, 2014). It is also easy to misinterpret written questions (Fowler, 2014) and therefore it is hard to ask complex questions (Esaiasson et al., 2017). To counteract these risks the survey was tried to be well executed, short and relevant, all according to Esaiasson et al. (2017) and the questions to be formulated in a clear way without judgement (Fowler, 2014). To secure that this was the case, several discussions with the supervisor were done. Another drawback with surveys is that the answers can be hard to analyse since no follow-up questions can be asked to clarify the meaning of the answer or the question (Fowler, 2014), but in this study the benefit of reaching a lot of people was more important than that drawback.

Most of the questions in the survey were open-ended questions. The aim of these questions was to let the respondents answer with their own words in order to get their view of the subject. In this way, any predetermined alternatives would not have made an impact of the answers (Iarossi, 2006). The disadvantages with open-ended questions are that it takes more time and effort to both answer and analysis them (Iarossi, 2006). However, the possibility to be able to catch the learning experience from the respondents at different locations at ÅF and that the participants got the possibility to reflect a longer time over the questions made a survey with open-ended questions preferable for this study. The survey's structure is presented in Figure 3.1.

One of the questions in the survey was a multiple-choice question. The respondents tend to choose the answers that come first rather than the ones further down in the list (Iarossi, 2006). Therefore, the order of the different factors the respondents had to choose between could have influenced the result. To not be influenced of our preconception of the factors, the factors were presented alphabetically.

To increase the accuracy of the survey, the follow-up questions, about how the NGE learned, were written to be as similar as possible. This because the formulation of the questions should not impact the respondents' answer and to avoid possible confusions about definitions (Iarossi, 2006).

Demography and Intro

During your first time at ÅF, what have you enjoyed the most?

How have you developed since you started at ÅF?

Have you developed as much as you wish?

Was there anything you missed, that would have gained your development?

Most and least important factors

Which factors have contributed the most to your development?

Which factors have contributed the least to your development?

Factors

Independent work

A mentor/ buddy

Feedback

Colleagues who show or explain

Observation of colleagues

Reflection

Ask questions and discuss with colleagues

Challenging tasks

Regular work

Deepening questions

Follow-up questions, most contributing factors

Follow-up questions, least contributing factors

Figure 3.1: The survey started with demographic questions to be able to distinguish answers from, for example, different divisions within ÅF. After this the respondents answered an easier "warm-up" question to get in the right mood before entering the main part of the survey. The first main question of the survey was designed to provide a general view of how the respondents had developed during their first time at ÅF. The respondents did thereafter choose what three and two factors that provided the most and the least development for them during their first project at ÅF and were asked specific questions about these factors.

The factors the respondents could choose from were based on literature about learning in both an educational and professional environment which is described in Chapter 2.3 *Success factors for learning*. The factors were:

- obtaining feedback (Hattie, 2012; Boud & Garrick, 1999)
- the possibility to ask questions and discuss with colleagues (Hattie, 2012; Felstead et al., 2005; Boud & Garrick, 1999)
- being pushed to develop more and gain support by a supervisor or buddy (Hattie, 2012; Boud & Garrick, 1999)
- obtaining challenging tasks (Hattie, 2012; Boud & Garrick, 1999)
- having colleagues who show or explain (Felstead et al., 2005; Boud & Garrick, 1999)
- work independently (Felstead et al., 2005; Boud & Garrick, 1999)
- observing colleagues (Felstead et al., 2005; Boud & Garrick, 1999)
- reflecting (Felstead et al., 2005; Dewey, 1996)
- working with regular tasks (Felstead et al., 2005; Boud & Garrick, 1999)

The survey questions are to be found in Appendix A.

3.1.1 Response analysis

The response rate of the survey was 52%. Men and women as well as the different divisions at ÅF were quite equally represented compared to the sample group, which can be seen in Table 3.1. These two parameters were the only ones available for doing a response analysis. It was not possible to do a response analysis of, for example, the parameter *years of work experience* since there do not existed any information about that parameter in the sample group data. Because the loss of respondents was equally distributed the respondents are a representative selection of the sample group.

Table 3.1: The loss of respondents in the survey divided into what division they belong to and their gender.

Division	Loss of respondents
Industry	51%
Infrastructure	42%
Digital solutions	51%
Energy	61%

Gender	Loss of respondents
Men	50%
Women	48%

3.2 Interview

Based on the result of the survey, a semi-structured qualitative interview template was constructed for interviewing section managers. A semi-structured interview can,

for example, be used to examine an unexplored field, how people perceive their world and to develop or test a theory (Esaiasson et al., 2017). This study was testing and further developing theories about NGE's in teams and their performance as well as examine how people perceive their world. It is all purposes that preferably are examined with a semi-structured interview to get reliable results. In contrast to questionnaire based interviews the semi-structured interview gives the opportunity to make a deeper investigation into why people answered as they did since the questions are not completely predetermined which they are in a questionnaire (Esaiasson et al., 2017). A deeper investigation was to prefer to get a detailed picture of the section managers' opinions about NGEs in teams.

Five section managers were interviewed. The amount of the interviewed was set to be enough to able to generalise the result, but not too big, so the interpretation of the results is possible (Kvale & Brinkmann, 2014). The interviews were approximately 45 minutes long.

The persons that were selected for the interviews had broad experience of in-house projects and team composition. Persons from all different divisions at ÅF were selected. The selection of the interviewed persons was made to get an empirical view of how the experienced team composers are perceiving NGEs, rather than mapping an overview of the current situation at ÅF or to get a representative set of data in a statistical point of view. The interviews were optional and this was told to the respondents when the meetings were booked. Before the interviews the respondents were also provided with information about the aim of this master thesis and that the interview will be presented anonymised, all according to ethical guidelines (Kvale & Brinkmann, 2014).

The interviews were transcribed to avoid any interpretations being made during the interview. By avoiding this the reliability of the interviews increased. Transcription also allows the interviewer to fully focus on the interview and therefore pay more attention to when follow up questions needs to be asked to clarify a statement or get a more detailed description (Svensson & Starrin, 1996). The respondents were anonymised while processing and analysing the interviews.

When constructing the interview guide it is important to make sure it is dynamic with a natural flow. The respondent should easily understand the questions and feel intrigued to answer them in detail. It can be hard for the respondent to talk about the question subject in detail right away, therefore the interview started with some simpler questions, otherwise the answers may have been less detailed than they could have been (Kvale & Brinkmann, 2014). From the simpler questions about projects and teams in general the interview continued towards the team and more specifically the NGE in the team. From this the questions were focused on the learning experience and development of the NGE. This structure of the guide made the questions more and more specified towards the subject in question throughout the interview. This is illustrated in Figure 3.2.
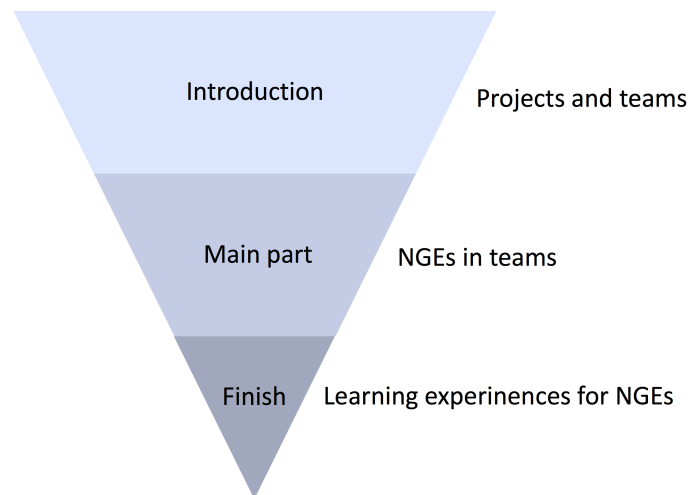
Figure 3.2: Illustration of the flow of the interviews where the questions started broad and became more and more specified.

To make the respondent feel intrigued to answer the questions, the questions were tried to be open and not leading (Eriksson & Wiedersheim-Paul, 2011). To be able to understand the deeper meaning of the answers the interviewer asked follow up-questions to keep the respondent talking and explaining more about the subject (Hedin, 2011). Time to think was given to the respondent before and during the interview by being more silent than one may usually be, to encourage the respondent to express all his thoughts (Kvale & Brinkmann, 2014). The interview template can be found in Appendix B.

3.3   Inductive and deductive analysis

To process and analyse the data from both the survey and the interviews, a combined inductive and deductive analysis was conducted. The outcome of the general inductive approach is categories with the most relevant objectives identified in the data and the outcome of a deductive analysis is to test if the data are consistent with the two learning models (Thomas, 2006). The data from the survey was tested against the learning models in the deductive analysis while the data from the interviews only affect the creation of the model and were therefore only analysed in an inductive way. The two analysises of the survey data and the interview data was done separately and combined in the final step of the analysis, where it also was compared with the theoretical framework.

The first five steps and the last, eighth, step in the analysing processes were a part of the inductive analysis (Braun & Clarke, 2006) and step six to seven were the deductive analysis (Fereday & Muir-Cochrane, 2006) and therefore only for the survey, see Figure 3.3. The combination of the inductive and deductive part was made to increase the reliability and not bias the identification of relevant text by search for things that match with the models, which can be a risk if developing the deductive code manual first and then try to fit the themes into the code manual

(Hsieh & Shannon, 2005). A scheme of the analysis can be seen in Figure 3.3.

Figure 3.3: A schematic view over the analysing process. The purple arrows with white text are only done for the data from the survey. The rest of the arrows, blue with black text, are done for all data.

1. **Familiarized with the data**, were made by reading it all and gain understanding of the general content of the text.

2. **Provided initial keywords**, marked all the interesting data with one or several keywords which compresses the answers to concise formulations, so called memos. The compression was done to be able to easier analyse the result, but not lose the core in the answers (Esaiasson et al., 2017).

3. **Searched for themes**, by gathering relevant data with similar keywords and meaning. This part of the analytical method is called the mapping method. The mapping was used to organise the answers and have the possibility to find dividing lines between different opinions (Esaiasson et al., 2017). It may have decreased the reliability since it involved interpreting the answers, to minimize this risk of this the concept of triangulation was used, where interpretations were discussed to avoid misinterpretations (Hedin, 2011). One part of the data was sorted into multiple themes and some part of the data were not sorted into any theme due to irrelevance (Thomas, 2006). The themes can be found in Chapter 4 *Result*.

4. **Reviewed themes**, made sure that all relevant data fitted in a theme.

5. **Defined and named themes**, wrote down a definition and name that caught the core of the themes.

6. **Developed the code manual** *(only for data from the survey)*, the code manual consisted of a code name, a definition and a description of how to know when this category exists. The code manual can be found in Table 3.2 and was based on the two learning models in the first research questions which are described in Chapter 2.1. It was used to compare the themes with the research questions by finding similarities and differences. From the experiential learning model the four elements: concrete experience, reflective observation, abstract conceptualisation and active experimentation were used as codes. From the sociocultural model, discussion, listening, imitation and help from others were used as codes.

7. **Connected codes and themes** *(only with data from the survey)*, the themes were clustered into the codes to relate the data to the research questions. In each code, all themes that concerned the code were placed and then clustered

Table 3.2: From the pedagogical models in the theoretical framework, codes were developed. Each code consisted of a name, a definition and a description.

Code	Definition	Description
Concrete experience	Having a sense impression.	The person has had a sense impression or feeling.
Abstract conceptualisation	Understanding something with one's thoughts or forming an idea to a lesson or action.	The person has shaped an idea to a lesson or action.
Reflective observation	Actively notice and think by searching for knowledge or a solution.	The person has actively search for the solution to a problem or answer to a question.
Active experimentation	Actively do, try or test something in practice.	The person has actively produced something.
Discussion	Interaction with people where the NGE is active.	The person has discussed with others.
Listen	Hear other people explaining or showing things, including get answers on short, easy questions that not requires a dialog.	The person has listened to others.
Imitate	Do the same thing as someone do or has done.	The person has imitated someone else or something someone else has produced.
Help from others	Get guidance and support from others and/or the team improve one's performance.	The person has gained guidance or support.

in similarities and differences compared to the code.

8. **Compiled the analysis**, the final analysis was made where the results were compared to the theoretical framework. A thematic map (Braun & Clarke, 2006) was made in order to verify that all relationships between themes have been found. The first research question was investigated. Preparation was done to be able to create a model.

To ensure the reliability of the analysis, consistency tests were done after step 3, 6 and 7. Two authers took the same test data and individually sort them into a theme or code given only the themes and codes descriptions, then the two results were compared (Fereday & Muir-Cochrane, 2006). In this case, the result matched and no changes were needed.

3.4 Attribute analysis

Ten activities that develop the NGEs were composed based on the analysis of the data through a brainstorming workshop. This form the basis of a model of how to develop NGEs. The activities were then checked to contain all output from the analysis. The only output not present in the activities was regarding team composition. Team composition was not considered an activity and was therefore not analysed further, but summarised to complement the activities in the model.

To put together all output from analysis related to the activities an attribute analysis was made (Maylor, 2010). The main step in the attribute analysis was to break down the goal, in this case a model of how to develop NGEs and how it is affecting the team, to small desirable outcomes. The desirable outcomes of the goal are seen in Table 3.3. Every activity was then rated on how well they will fulfil all these outcomes, scale 1-5. Where 1 was *strongly disagree* and 5 was *strongly agree*. The lowest alternative, *1 - strongly disagree*, had a small variation of meaning for each outcome. From left to right in Table 3.3, it meant that the development of the NGE is really small, the performance of the team is worsening a lot, the NGE needs a lot of additional time, the other team members need a lot of additional time, the implementation demands a lot of effort, the theory does not support this activity at all. The highest alternative, *5 - strongly agree*, was given when the goals were fulfilled.

The two first outcomes, *The NGE develops a lot* and *The performance of the team is improving a lot*, were seen as more vital than the others to fulfil the goal. Therefore, they were given an increased weighting. The outcome *The NGE develops a lot* was given a weight of the score times three and *The performance of the team is improving a lot* was given a weight of the score times two. The second one was given a lighter weight because the two outcomes that were connected to time were seen as very similar to the one about team performance, all three of them affect the project. It was done to make team performance and the development of the NGE similar

Table 3.3: The template for the attribute analysis. The first row is the desirable outcomes. In the first column, A, B, C ... are the activities to make the NGEs develop. For every activity, every outcome was rated from *1 - strongly disagree* to *5 - strongly agree.*

	The NGE develops a lot (weight 3)	The performance of the team is improving a lot (weight 2)	Much time is saved for the NGE	Much time is saved for other team members	The implementation is very easy	The activity is based in the theory
A						
B						
C						
...						

important in the model.

The attribute analysis makes it easy to go back and see how the prioritization of the model was done. It is simple to construct and make discussions on each outcome possible. The discussions also enable relatively objective measures (Maylor, 2010).

3.5 Discussion of method

The construction of the survey was affected by the assumption that all NGEs at ÅF have developed during their first project at ÅF. If some NGE have not developed, this type of questions may force answers about development, that are not representable. However, there were a few respondents that stated, in the survey, that they have not developed, even if the questions did not ask for that information. It was presumably because they could not answer the question about the development. Since these answers have raised without any specific investigation about the presence of development it is likely that the assumption has not affected the survey's answers to any great extent.

To evaluate if the experiential learning model can explain learning, not only the existence of the learning elements need to be investigated, but also if all of them are required to learn. The data that were compared to the model was collected in the survey. The survey was not formulated to explicitly examine if all the elements were present in every learning sequence, but letting the NGE generally describe their experiences of learning. The survey was designed to have multiple purposes

since the survey was meant to evaluate both the learning models as well as give input to the creation of a model for how to best develop the NGEs. The conclusion of that is that the survey was not optimal to evaluate that all the elements in the experiential learning model existed at the same time and could thereby not prove it. The survey could only evaluate that, overall, all the elements existed. However, it could strengthen or weaken the credibility of the model. To be able to deeply evaluate this model, observations or deeper interviews may be needed to explore all elements and different situations. The survey was better fitted to evaluate the sociocultural model since it only demands a social context of an individual situation.

Five interviews can be perceived as few to draw general conclusions. However, in qualitative studies, it is important to choose the respondent carefully (Esaiasson et al., 2017), which has been done from different divisions and with broad experience. The interviews were also done until the theoretical saturation was reached. Theoretical saturation is fulfilled when the interviews do not provide any new information for the study (Esaiasson et al., 2017). This state was reached within the five interviews, hence the decision to not do any additional interviews.

The second research question asks about the team performance. To gain input in this matter only the section managers have been interviewed and not any team members. If the team members have been interviewed too, a more comprehensive coverage of the team performance could have been done. But the answers could have been more subjective and more self-centred. The reason that the section managers were chosen was that they have a more objective view on the matter, since they follow the teams and projects at a distance compared to the team members. Also, the opinions about how NGE affects the team are diverse and the section managers could provide a clear picture of this diversity.

When conducting a qualitative analysis, interpreting the result is a big part of the work. To not take ones' own opinions into consideration the interpretations were discussed and made sure to be well established in the result. If this had not been done, the conclusions may have been deflected. Even though these arrangements were made, interpretations are still made and could affect the result in an undesirable way.

To construct the model, the analysis method attribute analysis was used. The attribute analysis consists of a part where qualitative responses are quantified. Just like when interpreting the data, the quantification of the result was discussed and checked. However, it is a difficult process to quantify which makes it a significant source of error. However, the benefit of this method is that once the quantification is done, the result of it becomes objective and how the result is formed can easily be traced from the different quantified aspects.

4

RESULT

Below, the result of the survey and interviews are presented. They are both divided into several themes to make the result more presentable, see step one to five in the analysing process in Figure 3.3.

4.1 Survey

Early in the survey, there was a question about what could have increased the NGEs' development. The most significant aspects, apart from specific technical knowledge, were to get more support from colleagues or managers, to have a buddy and to obtain more challenging tasks. These factors sum up the rest of the results from the survey that is presented below. No differences have been found in the answers from different divisions, except for buddies, where one division has not been working with buddies and therefore, buddies have not contributed to the development at that division. All opinions from the survey are presented, regardless of the frequency of the opinion.

4.1.1 Support from colleagues

The NGEs see a link between learning and colleagues with more experience.
"Colleagues' experience is the best way to learn, since they used to be in my shoes and know which traps to avoid and what to do to get a good result."[1]
(freely translated)

Support and guidance from their colleagues let the NGEs learn about effective work, gain a better understanding of the work, improve their problem-solving ability and become more independent. An open environment were people help each other is important to make this possible. Support and guidance is important for the NGEs and can be obtained both from more experienced colleagues but also from other NGEs. Lacking support and guidance is an obstacle for the development of the NGEs. The lack of support and guidance is a result of lack of structures, time or people who can or are willing to provide support or guidance.

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[1]"Kollegors erfarenhet är det bästa sättet att lära sig på då de tidigare varit i mina skor och vet vilka fällor man skall undvika och vad man kan göra för att få ett bra resultat."

4.1.1.1   Active interaction

Interaction with people at the office, colleagues, managers or clients, where the NGEs are active.

Discussions lead to deeper understanding, more efficient work and a possibility to come up with better solutions. The discussions take place when working together with colleagues, when running into difficulties or when tasks are examined. Also, the ability to ask questions lead to development, you could take part of others experiences and points of view. Challenging tasks force people to ask questions and learn from them. Also, easy questions are asked because of the fast answering. Overall fast answers are provided and that lead to rapid improvement. An open environment and overall prestigeless people make discussions and asking questions possible.

> *"By asking senior consultants and getting answers to questions that you have had as well as getting answers to questions that you have not even thought of is very instructive."*[2] (freely translated)

If one lacks active interaction, the personal and professional development decrease. It happens, for example, when working alone, not able to interact with colleagues, when the knowledge is missing at the office or when people don't have the time to help.

> *"It feels important for my development to work together with others, it is easy to get stuck when you work by yourself."*[3] (freely translated)

4.1.1.2   Passive interaction

Colleagues explaining or showing something without any active interaction from the NGE or colleagues giving access to information about previous projects.

Passive interaction, such as listening or being shown, is a big part of the introduction where the NGEs learn good and more efficient methods of working, gain new technical knowledge or just get access to information. The NGEs take advantage of their colleague's experiences to learn more and have things explained to them in a way that support their development. However, NGEs sometimes feel that it is hard to learn just by listening to or observing colleagues and that they need to try and test by themselves to really learn - with or without instructions. Sometimes there is no one to observe or ask because no one has similar tasks.

> *"As a novice, it was very rewarding to see how the more experienced engineers worked, so that I could more easily know how to do different tasks."*[4] (freely translated)

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[2]"Genom att fråga seniora konsulter och få svar på frågor som man har haft samt få svar på frågor som man inte ens hunnit tänka på ännu är väldigt lärorikt."

[3]"För mig känns det viktigt för min utveckling att kunna jobba tillsammans, det blir lätt att det står still/man kommer ingen vart när man jobbar själv."

[4]"Som ny var det väldigt givande att kunna se hur de mer erfarna arbetade, för att på så vis lättare kunna veta hur jag själv skulle gå tillväga i olika uppgifter."

4.1.1.3 Feedback

Feedback given to the NGE, both structured and sporadic.

Both positive and negative feedback are developing for the NGE. The feedback can be given on thoughts or work, for example code or reports. Feedback is received from colleagues, managers and clients. The feedback leads to a faster improvement and more efficient work.

"I received instant feedback and learned faster."[5] (freely translated)

When feedback doesn't exist, it is perceived as the least developing factor, when it exists it is developing. A desire among those who are not getting feedback is to get more feedback. One reason for the lack of feedback is lack of time. The feedback is today working better in in-house project than in projects at customers.

"I did not get the feedback I was looking for, I wanted to know what I could improved."[6] (freely translated)

4.1.1.4 Teamwork

The culture of working together as a team to solve problems and learn from each other.

Work as a team and share experiences are perceived as something positive and are missed by some of those who do not have a team that work together. They miss the opportunity to learn from others. The persons that are learning from their team say that they have a functioning team where it is an open environment, the team members prioritise the team's performance rather than one self's. Colleagues take time for each other and both more and less experienced colleagues learn from each other's expertise.

"Everyone always wants the section's best. In our section we work more like a team than individuals."[7] (freely translated)

"... nor got any support in developing the skills I used in the project - I mostly sat alone and googled."[8] (freely translated)

4.1.1.5 Buddy

Having a person dedicated to the NGE's personal or professional development.

There are buddies that guide, support, give feedback and can discuss problems or thoughts. There are also buddies that teach tools, programs and work procedures, then the NGE observes and listens to the buddy. A buddy can do some or all of these things. The buddy can either be a colleague or a manager. A good buddy is available.

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[5]"Jag fick på så sätt direkt feedback och lärde mig då snabbare."

[6]"Jag fick inte feedback jag sökte, ville veta vad jag kan jobba på."

[7]"Alla vill alltid sektionens bästa. I vår sektion arbetar vi mer som ett lag än som individer."

[8]"... och fick inte heller något stöd i att utvecklas i den kompetens jag använde i uppdraget - jag satt mest ensam och googlade."

"The buddy has led me in the right direction so I know what to focus on and what parts are more and less important."[9] (freely translated)

There are two groups where a buddy is the least valuable part of the development. The first one is when you don't have a buddy. The hypothetical buddy, that is wished for, is able to guide and support the NGE and available for questions. The other one is when persons have a buddy, but the buddy is uninterested, unavailable or lacks competence.

"The buddy I received was lacking knowledge of the project I was going to working in."[10] (freely translated)

4.1.2 Type of work and ways of working

Apart from describing their colleagues' role in their development, the NGEs also described how different types of work or ways of working are affecting their development. Tasks that are vague or feel meaningless, do not contributing to development.

4.1.2.1 Challenging work

Working with tasks that exceeds one's regular knowledge or ability.

From challenging work new knowledge is obtained, sometimes it is knowledge that is unexpected. Working with tasks that exceed the NGE's knowledge and/or ability, pushes them to develop, but also motivates them to become better and gain more confidence. Challenging work also provides an opportunity to reflect and discuss with others.

"By tackling challenging tasks, I force myself to achieve more than I, or others, think I can handle. It makes my development much faster."[11] (freely translated)

However, too hard challenges can be destructive since the NGE can feel left alone and does not know how to pursue the work. Not all NGEs have experienced challenging work and they miss it since they feel that they cannot develop as much as they want and they also suffer from decreasing motivation.

"When it's too challenging, it's way too hard to grab and understand why you have to do it in a certain way."[12] (freely translated)

"I just feel that I needed bigger challenges to get the development I'm looking for."[13] (freely translated)

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[9]"Mentorn har lett mig i rätt riktigt så jag vet vad jag ska fokusera på och vilka delar som är viktiga/mindre viktiga."

[10]"Den fadder som jag tilldelades saknade kunskap kring det projekt som jag under min första tid skulle arbeta i."

[11]"Genom att ta mig an utmanande uppgifter 'tvingar' jag mig själv att klara av mer än vad jag eller andra tror att jag klarar. Det gör att min utveckling går mycket snabbare."

[12]"När det är för utmanande är det alldeles för svårt för att greppa och och förstå varför man ska göra på ett visst sätt."

[13]"Jag känner bara att jag hade behövt större utamningar för att få den utveklingen jag söker."

4.1.2.2 Regular work

Doing everyday tasks.

On one hand, doing everyday tasks, let the NGEs improve by developing work procedures and learn more about the work subject. On the other hand, the structures of the work are perceived as slow and do not provide sufficient challenge for the NGEs to gain a constant development. From these experiences, it is important to have tasks on the appropriate level of difficulty.

> *"Regular work is something that is not challenging enough."*

4.1.2.3 Independent work

Working independently by one self.

Independent work can make reflecting and analysing possible. To be able to try by oneself, search for information and take the time one need to solve a problem, makes it easier to learn. One also learns to trust one's own decisions and gets a deeper learning that is hard to get by, for example, just listening. However, independent work can make it hard to develop. When not getting any support, or being left by oneself it is difficult to know what to do and how to do it. It is hard to get progress. When working alone, one just does what they already have learned.

> *"[By independent work] I was able to figure out the best solution by myself."*[14]
> (freely translated)

4.1.2.4 Reflection

By oneself actively reflect over one's development or performance.

Reflection is not something that is consciously done continuously. But, when describing what is done when working independently or with challenging tasks, trace of reflection can be seen. Some people reflect about their own performance, their own development and how they affect others but also about the product itself. By doing this they gained a better understanding of their experiences and the product as well as personal development. However, some people find it hard to reflect without input from others or think that it isn't an effective way to develop. Also, you need to have enough knowledge to be able to reflect, which an NGE often lacks. Some people don't find the time to reflect and therefore it isn't contributing to their development.

> *"There is no time for that [reflection] when 'how' and 'what' are missing."*[15]
> (freely translated)

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[14] "[Genom självständigt arbete] Jag fick fundera ut vad som var bästa lösningen själv."
[15] "Det finns inte tid till [reflektion] när 'hur' och 'vad' saknas."

4.2   Interview

Not all sections have special procedures to introduce NGE compared to other newly employed persons. The structures that that exist and come up during the interviews with the section managers is presented below.

4.2.1   General development and ways to learn

Overall development of the NGEs and different ways to learn.

Generally, the NGEs develop by learning new technical tools and new work processes. For example, you can notice the improvement when the person starts to ask relevant questions to the pertinent persons. The speed of the development varies from person to person and depends on their personal drive and the shape of the current project.

> *"You can see that they ask questions, they start to ask relevant questions to the pertinent persons."*[16] (freely translated)

There are different structures that will help the NGEs development: getting support from a senior colleague, have the expectations of the project clarified, which makes it easier to accomplish the tasks, reading old project documentation and get practical experience by being shown the end products and how they will be used. To give responsibility to the NGE can also make them develop.

In the consultancy business, all worked hours are paid for by the client, therefore it is not possible to let an NGE observe a senior worker during a long time, without doing any tasks of their own.

4.2.2   Distribute tasks

One of the responsibilities of the manager is to distribute tasks among the employees and this affects the development of the NGE.

The manager tries to distribute tasks to NGEs depending on their interests as well as their knowledge level. An appropriate task is often a smaller, delimited task within a project. This can be done by both the manager or a more experienced colleague. After a while the tasks become more and more difficult as the NGE learns more. Sometimes, however, the tasks are too difficult and/or unclear or too easy and/or monotone. It can be hard to find appropriate tasks within a project if the project is too small or in the wrong phase. The beginning of the project often requires more experience than when the project is up and running and a new employee can join when the project has been defined already. Also, the NGEs have different knowledge and skills, even from the same education, which makes it difficult for the managers to give them appropriate tasks.

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[16]"Man ser hur de ställer frågor, börjar ställa rätt frågor och gå till rätt folk."

"They get something easier and can grow into the role when you see that it works."[17] (freely translated)

"[When you are new at work] It is hard to find tasks at an appropriate level."[18] (freely translated)

4.2.3 Feedback

Feedback as part of the development of an NGE.

There is a lack of structured feedback in general. Feedback between colleagues and from the manager are mostly sporadic, but can occur during for example status meetings. The only structured occasion for feedback is the yearly personal development talks.

"[About feedback] We don't have any system for that, we are pretty bad at it."[19] (freely translated)

4.2.4 Buddy

Having a dedicated person to encourage the NGE's personal or professional development or someone that takes extra care of the NGE.

How the work with a buddy is organised varies from section to section. Some sections always assign a buddy to a new employer, some sections never do it and in some sections it varies from time to time. The buddy can introduce the NGE to the office and the colleagues and also guiding and teaching the NGE throughout the project. The buddy can be a manager or a senior colleague.

"Our routine is that everyone should have a mentor, it can either be the manager or an experienced person that guides the new one."[20] (freely translated)

The sections that don't work with buddies think that it is hard to find someone with sufficient broad knowledge. Some sections also assigned people that the NGE should talk to about different areas to learn more about the sector. The buddy-structure usually fulfil the purpose, but it does not when the buddy does not have time for their buddy-tasks.

"[If they are using buddies] We are pretty bad at that."[21] (freely translated)

4.2.5 Advantages of newly graduated engineers

How the company can benefit from having NGEs.

There are advantages of having NGEs in the teams. They can be ambitious and

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[17]"Man får något enklare och växa efterhand att man ser att det fungerar."

[18]"[När man är ny på jobbet] Då är det svårt att hitta rätt uppgifter."

[19]"[Om feedback] Vi har inget system för det, vi är rätt kassa på det."

[20]"Vi har som rutin att vi skall ha en mentor, kan antingen vara chefen eller någon annan erfaren som vägleder den nyerfarna."

[21]"[Om de använder sig av buddies] Det är vi också ganska dåliga på."

work rapidly. They have knowledge about, and can quickly learn, new technical tools. They want to find the most efficient work processes and can question the old ones. Thereby, they come up with new innovative approaches. The NGEs also have a lower wage than their senior colleagues which means that the company can earn more money on a project with NGEs. NGEs are also necessary for the regrowth in the company.

"Many people from the university can quickly adapt to new information and learn rapidly."[22] (freely translated)

4.2.6 Disadvantages of newly graduated engineers

How the company can be disadvantaged by having NGEs.

There are disadvantages of having NGEs in the teams. They lack understanding of work processes and end products. They can both lack drive and have too much of it. The later one results in a feeling of stress due to that they need to show what they can do, which lead to a bad performance when they do not dare to ask for help. An NGE works a bit slower than an experience person and demands more guidance and review. It is a higher risk that something goes wrong and that, together with the fact that they need more support, can be costly.

"It takes more time, more hours to accomplish a task."[23] (freely translated)

4.2.7 Advantages to senior team members

How senior team members can benefit from having NGEs as colleagues.

To have NGEs in the team can be positive for the senior members. The senior members can develop by helping and teaching others. This can also be satisfying for the senior members. By getting new points of view and be pushed to reflect over the work processes, the senior's performance can improve.

"It is also funny, so it can be positive to the individuals that have been working a long time."[24] (freely translated)

4.2.8 Disadvantages to senior team members

How senior team members can be disadvantaged from having NGEs as colleagues.

To have NGEs in the team can be negative for the senior members. It can be harder to remain on budget and deliver at stated time which can create stress. It also takes time and energy to instruct an NGE and not everybody is interested in doing that. It can lead to frustration, especially when done repeated times.

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[22]"Många som kommer från skolan har ett högt tempo på att ta in inforamtion och lära sig snabbt."

[23]"Det går mer tid, mer timmar på att utföra en uppgift."

[24]"Det är också roligt så det kan ju också vara positivt för individer som har varit med länge."

"The budget, which they need to stay below in different activities, creates a pressure."[25] (freely translated)

4.2.9 Team composition

How the team and its composition affects the development and performance of the NGE.

The sections want to place NGEs in a team that makes them develop, both with help by the construction of the tasks and by the colleagues. It is important that the team members understand and remember what is difficult in the beginning to be able to help the NGEs. With different levels of experience in the team, instead of only very experienced and the NGEs, the gap between the NGE and the other members of the team gets smaller and the understanding is easier to achieve.

The project leader and the type of the project have a big impact on the NGE's development. The NGE has a faster development if the project leader is a good teacher, has time to help and can give inspiring, challenging tasks.

The best for the NGE and for the performance of the team is to either have a small team with two or three members, or to have a big team (over 15 members) where there are more people to ask and more tasks that are suitable for an NGE, according to the interviews. Also, the NGE is not alone with his or her responsibility which can be the case in medium sized teams (7-10 members). Therefore, it is most difficult for the NGE to develop and to perform in medium sized teams. In a small team, with two to three members, the cooperation gets closer and it is easier for the senior member to understand what needs to be explained and which tasks that are suitable for the NGE, according to the interviews.

"[About putting NGEs in teams] There have to be several senior members in the project that they can learn from [...] and have the opportunity to ask a lot of questions."[26] (freely translated)

"It [to put NGEs in teams] will work if you have a small project, with a competent project leader, with only two persons."[27] (freely translated)

The amount of NGEs in each team depends on the project's tasks. If it is expensive to do wrong, the number of NGEs need to be low, for example generally when working with hardware. However, if an error can be fixed quite easily the number of NGEs can increase, for example generally when working with software.

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[25]"De blir stressade över att vi har ju en budget att förhålla oss till för olika aktiviteter."

[26]"[Om att sätta in nyutexaminerade i team] Det måste ju vara att det finns några mer seniora i projektet då som de kan lära sig av [...] och har en chans att fråga mycket."

[27]"Har man ett litet uppdrag med en duktig uppdragsledare med kanske bara 2 personer som skall jobba så funkar det [att sätta nyutexaminerade i team]."

4.2.10 Securing quality of the project

Processes that insure that the project's quality are not affected by the work of NGEs.

NGEs generally demand more check-ups throughout the project than experienced engineers. It varies if this is something done systematically or sporadically. In some business areas, the industry itself provides structures for quality assurance that helps the project team to make sure they deliver a good enough product. If the project has very high demands on quality it is hard to have several NGEs in the project, this is however sometimes difficult to achieve due to the increase lack of experienced engineers.

"[About NGEs] You have to spend more time on reviewing, quality checks and things like that."[28] (freely translated)

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[28]*"[Om nyutexaminerade] Man får lägga mer tid på granskning, kvalitatssätkring och den typen av saker."*

5

DISCUSSION

5.1 The newly graduated engineers' perception of learning

Almost every part of the survey that say something about the NGEs' learning can be deduced to the experiential learning model and/or the sociocultural learning model which strengthen the hypothesis that these models complement each other. Many parts also fit in both models. The most striking fact from the survey was the emphasis on learning from colleagues supporting the sociocultural model, while the streak of the experienced based learning is not that clear, but all elements can be found when inspect the survey. All quotes are from the survey answers.

5.1.1 The experiential learning model

From the survey, one cannot state if the NGEs learn from just doing one of the four elements in the experiential learning model or if all four elements are required, the survey was, however, not constructed singularly for this purpose. There are answers that include all four elements, such as the quote below. Most answers, however, only highlight one or two of the elements, leaving the other elements to not have existed, existed but not in direct relation to each other or existed but have been forgotten or have been seen to natural to be explained in the survey.

"Gained access to material they gave me that I read through and learned from. They showed the instruments and got to try by myself how you should do."
(freely translated)[1]

The grasping dimension, including concrete experience and abstract conceptualisation, can most likely be concealed as an obvious element of learning since they are the elements where one discovers or understands the subject and not actively tries to learn it. All four elements have, however, been described in various answers, this is shown in Table 5.1.

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[1] *"Fick tillgång till material som de gav mig som jag läste igenom och lärde mig av. De visade instrumenten och fick testa själv hur man skulle göra."*

[2] *"Som ny var det väldigt givande att kunna se hur de mer erfarna arbetade."*

[3] *"Genom att bearbeta information och erfarenheter jag fått ta del av från kollegor kunde jag använda det i självständigt arbete."*

[4] *"Utvecklades mycket i att söka efter information och försöka hitta förklaringar innan man kanske gör något dumt."*

[5] *"Genom att jag genomfört de arbetsuppgifter som jag ska lära mig - trial and error - så tvingas*

Table 5.1: Summary of the answers in the survey related to the four different elements in the experiential learning model.

	Element	Definition	Example from survey
G R A S P	Concrete experience	Having a sense impression.	Receiving feedback, observe or listen to a buddy or colleague. *"As new it was very giving to be able to see how the more experienced worked."* (freely translated)[2]
	Abstract conceptualisation	Understanding something with one's thoughts or forming an idea to a lesson or action.	Discussions that lead to deeper understanding, feedback that lead to a faster improvement, obtain knowledge from challenging work, reflecting and analysing independently, learn to trust one's decision and gaining a better understanding. *"By processing information and experiences from colleagues I could use this in the independent work."* (freely translated)[3]
T R A N S F O R M	Reflective observation	Actively notice and think by searching for knowledge or a solution.	Asking questions, observing others to learn or search for information independently. *"Developed much by searching for information and try to find explanation before perhaps doing something stupid."* (freely translated)[4]
	Active experimentation	Actively do, try or test something in practice.	To learn from trying by oneself when producing and take part of others experiences in one's work. *"By doing tasks that I should learn - trial and error - I force myself to understand what I am doing."* (freely translated)[5]

Other answers that strengthen the experiential learning model are that regular work or no sufficient challenge sometimes does not develop the NGEs, due to that it does not provide any new sensory impacts which is a necessity for learning. It is also hard to learn just from listening without trying oneself. It supports the experiential learning model that says that learning contains of more than one element and that one need to both grasp and transform to be able to learn. However, this does only involve two of the four elements.

There are, however, obstacles with each of these elements, connected to the need for interaction with colleagues which is not a part of the experiential learning model. For example, the following problems cannot be explained or helped by the model. It is hard to gain a impression without knowledgeable colleagues, form an idea into a lesson or action by oneself and without sufficient amount of knowledge and also find someone to observe or ask that have the knowledge and is available. One can also feel alone when left to only try by themselves and sometimes one need to discuss with others to overcome problems.

Only traces of active reflection can be seen in the results. It is not a big part of the results and it seems like most people are not doing it, at least not consciously. The constructivist perspective is based on the theory that people build their knowledge by reflecting about their experiences (Kolb, 1984). The result that people are not actively reflecting is not in line with the experiential learning model's basic thoughts. Instead, it seems like the NGE do the abstract observation by discussing with others and, when receive feedback and learn by working but then it is not conscious. To sum up, all elements can be found, but then the reflecting part is not always conscious, but rather performed by discussions.

5.1.2 Sociocultural learning model

According to the survey the NGEs learn through all different aspects of the sociocultural model, an example of this can be found in Table 5.2. They discuss, listen, imitate and get help from others, i.e. the communication is very important. Due to this, the knowledge gets deeper, the work processes get more efficient and the work gets more independent.

Feedback is one way to get help from others and one way to see Vygotsky's theory ZPD in reality. Not everyone has had the opportunity to receive feedback and several of them have requested it which strengthens the impression that one need input from others to develop. The NGEs talk a lot about how senior colleagues can

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jag förstå vad jag håller på med och får en djupinlärning."

[6] *"Genom att diskutera med erfarna kollegor har jag fått med mig otroligt mycket av deras kunskap."*

[7] *"Dom kunde berätta hur dom hade gjort och öppna upp för andra sorters lösning än vad jag själv hade tänkt på."*

[8] *"Ser arbetsmetodik hos andra och kan anamma denna."*

[9] *"Vägledning genom nya teknikområden och arbetsuppgifter gjorde att jag kunde ta mig förbi svårigheter där jag annars hade fastnat och inte utvecklats."*

Table 5.2: Summary of the answers in the survey related to the four different codes of the sociocultural learning model.

Element	Definition	Example from survey
Discussion	Interaction with people where the NGEs are active.	Discussions lead to deeper understanding, more efficient work and the possibility to come up with better solutions. *"By discussing with more experienced colleagues, I have picked up an incredible amount of their knowledge."* (freely translated)[6]
Listen	Hear other people explaining or showing things, including get answers on short, easy questions that not requires a dialog.	The NGEs let their colleagues explain things for them and ask easy questions because of the fast answering. They have also been shown the end products and how them will be used. *"They could tell you how they had done and that opened up for other kinds of solutions than I had thought about."* (freely translated)[7]
Imitate	Do the same thing as someone do or has done.	The NGEs learn work methods by observing and read old project documentation. *"Observe working methodology of others and embrace it."* (freely translated)[8]
Help from others	Get guidance and support from others and/or the team improve one's performance.	Support and guidance lead to effective work, better understanding and more independent work. *"Guidance through new technical areas and tasks led me to overcome difficulties where I had otherwise been stuck and had not developed."* (freely translated)[9]

help by discussing, explaining and showing different methods or tools, this is also typical examples of where the ZPD theory can be identified at the NGEs' learning. The NGEs point out that when the interaction with other people is missing the learning decreases, which supports that interaction is important to learn.

The requirements for situated learning, described by Lave and Wenger (1991), are fulfilled when the apprentices can work with the same tasks as the others in the team. Shared work tasks can be hard to achieve because in some teams there is no one that has work tasks in the same area. When there are people with similar tasks, it is possible to see that the NGEs have imitated, improved and learned from them. When it does not exist clear, shared work tasks, the model is insufficient for explaining the general learning of the NGEs. Lave and Wenger (1991) have studied professions without the demand of education or special knowledge. Engineer is a profession that represents the opposite, long education and often a deep, special knowledge. Therefore, Lave and Wenger's theory may not fit perfectly at an engineer company, but the apprentice structure can be seen in situations where several people work with the same tasks.

It can be hard to learn from just listening or observing, which the sociocultural model does not state. The model rather explains both listening and observing as detached learning methods. From the survey, it can be stated that to learn, these methods need to be combined with other learning method. How one can learn without input from others is also one aspect that sociocultural model does not cover.

5.1.3 The combination of the two models

In some answers in the survey, it is possible to see both the experiential learning model and the sociocultural learning model. Only one of the theories cannot describe the whole learning process which makes it important to use both of the models to understand the overall learning. This is most obvious in the comments about reflecting, listening, observing and working by oneself. The relationships are supported by quotes from the survey.

Reflecting, i.e. processing information to understand it, can be hard without input from others. In this case the learning element, abstract conceptualisation, from the experiential learning model, needs to be combined with sociocultural model to work satisfactorily.

"Hard to get on by yourself without input from others." (freely translated)[10]

Learning from just listening and observing is described as hard even though the sociocultural model states those activities as how one learns. In this case they need to be combined with other learning elements as described in the experiential learning model.

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[10] *"Svårt att själv komma vidare om man inte får input ifrån andra."*

> *"It is not all about observing, you have to test and try to be able to absorb the knowledge."* (freely translated)[11]

According to the experiential learning model, there is nothing wrong with learning by oneself as long as one does all four learning elements. However, the survey answers states something different. They are not against independent work, but they stressed the importance of working together with others to learn more and more efficiently.

> *"It is important with independent work, but the breakthroughs appear when discussing with others."* (freely translated) [12]

There are also answers from the survey that can be explained with one of the theories but not the other. For example, there is nothing in sociocultural model that supports statements about working independently and therefore makes statements about the advantage with this no sense from a sociocultural perspective. The advantages, however, make perfect sense from the experiential learning model's perspective. To be able to search for information, analyse and try in one's own time refers to three of the four elements in the model. The fourth one is the concrete experience which has not been described connected to independent work.

> *"By doing the tasks that I should learn - trial and error - I'll be forced to understand what I'm doing and develop a deep understanding that is hard to get by, for example, observing others."* (freely translated) [13]

One example where the sociocultural learning model can be found, but not the experiential learning model, is the result about support and guidance. The NGEs learn about effective work and gain better understanding from support and guidance from colleagues and managers can't be directly associated with the experiential learning model, because nothing about cognitive learning can be identified. Instead, it fits in the sociocultural model in that way that a person or a team can help the novice to develop and learn more.

> *"Guidance through new technical areas and assignments made it possible for me to solve problems that I otherwise had gotten stuck on and not developed from."* (freely translated)[14]

In different situations, the two learning models are more or less present. For example, in a discussion with colleagues the sociocultural learning model is dominating, but when the NGE later, by oneself, without others, tries out his or her new knowledge from the discussion, the experiential learning model is the dominating one. However,

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[11] *"Det gäller att inte bara observera, man måste själva testa och prova för att kunna ta åt sig kunskapen bäst."*

[12] *"Det är viktigt med självständigt arbete men genombrotten kom genom att diskutera med andra."*

[13] *"Genom att jag genomfört de arbetsuppgifter som jag ska lära mig - trial and error - så tvingas jag förstå vad jag håller på med och får en djupinlärning som är svår att erhålla genom att ex. observera andra."*

[14] *"Vägledning genom nya teknikområden och arbetsuppgifter gjorde att jag kunde ta mig förbi svårigheter där jag annars hade fastnat och inte utvecklats."*

this thesis does not aim to describe learning in different situations, but how the general aspects of the NGEs' learning at ÅF take place.

There are no clear relations between a certain task and one of the two learning models. People from different divisions have the same pattern in their answers and different divisions and parts of divisions work in very different areas with different tasks. Also, no pattern can be seen when study all the answers individually. But, the survey does not explicitly ask for work tasks connected to the different ways to learn. Therefore, no evident conclusion can be drawn about if one learning model clearly can be connected to a specified task.

It is possible that the learning of the NGEs could have been described by some other learning models as well, but this is outside the scope and will not be discussed in this thesis.

5.1.4 Potential gaps between the learning models and the survey result

The comments about vague or meaningless tasks and that they are not contributing to the development, cannot, undoubtedly, be connected to one of the two models. The lack of explicit assignments can be seen as a part of the sociocultural learning model according to the fact that this theory says that the learning effects of the context and the environment. It can be a sign of lack of communication. It can also be that the tasks actually are vague and unclear, and if this is the case, the comments do not fit in any of the models. From the survey answers, it is impossible to say if the tasks are vague or if the communication has been broken. Maybe, a gap in the models is found. The part from the results that says that, if the tasks are meaningless they are not contributing to the development, are harder to even try to explain by the models. It can depend on that it is probable that the lack of development in this case is depending on the lack of motivation. Motivation theory is not included in the models. When using these models as an explanatory model for learning it is important to remember that the motivation factor is not taken into consideration.

The only other comments that cannot, undoubtedly, be connected to one of the two models are the comments about the need for an open climate within the team to be able to have discussions. This can be seen as a natural part of the sociocultural learning model since discussions do not occur otherwise, but is not explicitly described in the model. The model demands the open climate just like it demands a social context. However, an open climate does not exist just because people exist, in contrast to a social context. There needs to be structures, that make sure that there is an open climate. The model does not take this into consideration, which limits its usability.

5.2 Discussing the results

How the results are related to the theoretical framework and what the result implicates about an introduction of NGEs are discussed below. There were no clear stereotypes of NGEs to be found in the data. Instead, all NGEs have individual preferences in almost all aspects of how to develop as an engineer.

5.2.1 The time aspect of introduction

Discussion about the general time aspect of all the survey and interview result.

As already stated in Chapter 2.2. *How the team composition is affecting the team members' performance* it took time and effort from the surgeon team to introduce and help the NGEs at their new work (Zheng et al., 2011; Rollag et al., 2005). This aspect was confirmed during both the interviews and the survey, where time was a recurrent cause of not getting the opportunity to be introduced properly. Therefore, to make a good introduction, time needs to be set aside for this purpose, not only by the manager or buddy in charge of the introduction, but by the team that the NGE is working in. Time can be invested by having discussions, answering questions and giving feedback. According to the survey the time invested in the NGE will make him or her develop and thereby produce results faster, as well as contribute to the regrowth in the company. Without a sufficient amount of time spent on the NGE the interview result shows that he or she may not grow into his or her full potential. He or she may also make errors which can affect the quality of the project.

Another aspect that takes time from another person than the NGE is distributing appropriate tasks to the NGE. The person responsible must understand the NGEs previous knowledge and skills to know what the next step is (Hattie, 2012). If the NGE has a buddy, he or she in a similar way needs to take time to understand the NGE to be able to give successful support.

However, time is a limited resource that many are lacking. The projects are charged for by worked hours. Therefore, it can be difficult to take the time to introduce and help the NGE even though one knows the importance of it. If ÅF did not have to take the time, quality and cost of the projects into consideration when introducing and helping NGEs it would have been much easier. Now they sometimes stand against one another; On one hand the project needs to be delivered on time with great quality and on the other hand the NGE needs to get support and try solutions in projects. This is a drawback of working in project form. The benefits of creating a good introduction to the NGE may not affect the current project, but the next which needs to be taken into account.

5.2.2 Newly graduated engineers' interaction with colleagues

Discussion about the result in Chapter 4.1.1 Support from colleagues, 4.1.1.1 Active interaction, 4.1.1.2 Passive interaction, 4.1.1.4 Teamwork and 4.2.1 General development and ways to learn.

It is clear, according to both the results of the survey and the interviews that NGEs perform better when they can work together with, have the opportunity to learn from and can discuss with more experienced colleagues. This is also supported by Felstead et al. (2005), who states that one learns from both more classic teaching as well as by being involved and collaborate with colleagues. The later one is, however, most effective for learning. However, some NGEs also stressed the need for working alone and process the input they got from their colleagues and some did not stress this part at all. This may point towards different ways of processing new knowledge, such as trying by oneself or trying in discussion with others.

One big part of the passive interaction is observation. There are different opinions from the survey about how effective observation is. One reason for this could be that the observation concept fits different tasks different well. Some tasks are more suitable for observation, where it is possible to just see something and then repeat it. To learn other tasks the NGEs have to try by themselves before understanding the concept and learn how to do it. Another reason why the varying opinions about observing can be the teaching ability of the one showing the task. Hattie (2012)'s study about what makes a teacher successful, shows that the teacher's ability affects the students a lot. Maybe this can partly explain why the NGEs sometimes find it hard to learn by observing and listen and sometimes feel like it is a good way to learn.

Both according to Hattie (2012) and Rollag et al. (2005) a supportive climate amongst colleagues is important for learning and to be able to give and receive feedback. The results of the survey also point out that when people learn from others in a team there have often been an open and allowable climate. It is also important to be able to take advantage of one of NGEs most evident benefit, according to the interviews; being able to question ways of working and solve problems. A possible fear of asking questions among some NGEs was also described in the interviews with the section managers. Both Hattie (2012) and Rollag et al. (2005) also emphases relationship building between the NGE and the other employees. By building relationship it is easier to ask questions and relate to the company.

5.2.3 Newly graduated engineers' in teams

Discussion about the result in Chapter 4.1.1 Support from colleagues, 4.1.1.4 Teamwork, 4.2.5 Advantages of newly graduated engineers, 4.2.6 Disadvantages of newly graduated engineers, 4.2.7 Advantages to senior team members, 4.2.8 Disadvantages to senior team members and 4.2.9 Team composition.

According to the interviews the NGEs work with senior colleagues is seen as a

precondition of a sufficient performance and a development of the NGEs. This is both supported by the sociocultural learning model, see Chapter 2.1.2 *Sociocultural learning model*, where people in the environment contribute to the learning, and, for example, by Lou et al. (1996)'s meta-analysis and Zheng et al. (2011)'s study of surgeons, that say that low achievers or junior surgeons perform better in mixed teams. In the survey result, it is seen that colleagues sometimes have insufficient knowledge to be able to support the NGEs. However, the interview result shows that, sometimes, the colleagues have too much knowledge about the subject which makes it hard to give support at the right level. The conclusion of this is that giving support is not easy. It demands a good teaching ability, as Hattie (2012) describes. By understanding the NGE and his or her skills and knowledge the support can be better.

According to the theory about team composition there are different opinions about how high achievers perform in mixed-teams. It supports the picture you get from the interview results. Zheng et al. (2011) and Allan and Feldhusen (1991) imply that the senior team members' performance decrease when they have to help and teach the junior team member. It can also be seen in the interview results where it appears that it can be harder for the team to stay below budget and within time plan with NGEs in the team, and that this creates a stress and a frustration among the seniors. But also, the opposite appears in the interview results, that senior team members benefit from working with NGEs, since they have to get a new perspective. Both Webb (1982); Lou et al. (1996) have drawn the same conclusion, that high achievers get benefits from working in mixed teams. The seniors' performance seems to be affected by having NGEs in their teams, according to the results how it is affected, positive or negative, it depends on the senior's attitude to NGEs and how austere the budget and time plan are.

The section managers say that they want to place NGEs in teams where they can develop. This carries the risk that the team's performance is going to decrease if the senior members of the team are persons that are bothered with having an NGE in their team. If there are many NGEs at one section the only alternative is to place several of them in the same team. Both Zheng et al. (2011)'s study and the interview results points out that this is not an optimal solution since they then do not get sufficient support from more experienced team members. If there are only a few NGEs at the section, there is a choice of which team they should belong to.

There are aspects that need to be taken in consideration when choose teams for NGEs. Firstly, how the seniors' performance in the team is affected, e.g. if they gain energy from teaching NGE or get frustrated with it. Secondly, which tasks the NGE can manage in the project. Preferable they should be defined, varying and have the appropriate level for the NGE to learn and be productive. Thirdly, the size of the risks in the projects, e.g. how expensive it is to do wrong. If it is very expensive to do wrong, fewer NGE can be placed in the project since they require more check-ups. If it is not expensive to do wrong the NGE can try more by themselves. Fourthly, the size of the project team, which is discussed below.

5.2.4 The size of a team

Discussion about the result in Chapter 4.2.9 Team composition.

The section managers prefer to have NGEs in either small teams with two or three members or in large teams with over 15 members. This is the opposite of Wheelan (2016)'s opinion about team sizes and productivity, which advocate teams of three to six persons. However, the section managers based their preferences on when the NGE developed the most and not when the team was most effective. If Wheelan's opinion is accurate, it seems like there is no connection between the optimal team size for productivity and learning. However, Katzenbach and Smith (2003) have found effective team between two and 25 people which suggest that the preferred teams for NGE can still be effective.

One reason the NGEs' development in small teams can be that the NGE and the other team members work very close together and it is easy to ask for help and support, Hattie (2012) stresses the importance of relationship between the one learning and the one teaching. The NGE can also get tasks with more variety which helps the NGE to understand the whole process of a project. That the NGE benefits from a broader understanding of the processes in the project is clear according to the interviews.

One reason for that the large teams were perceived as successful may be that the NGEs then have shared work tasks, as described by Lave and Wenger (1991). When people have the same tasks as the NGEs, they can achieve more and more advanced tasks with the support of colleagues with the same kind of responsibility. According to Lave and Wenger (1991) a shared working community also have a better understanding of what they are doing and why they are doing the task. It could lead to a better performance. In a smaller teams the NGEs may not have any colleague with similar tasks. It means that the NGE has to take responsibility for the entire task at once. Thereby it hard to gradually take more responsibility for a task, which is one of the advantages of a shared working community (Lave & Wenger, 1991).

5.2.5 Different types of work

Discussion about the result in Chapter 4.1.2.1 Challenging work, 4.1.2.2 Regular work, 4.1.2.3 Independent work, 4.2.1 General development and ways to learn, 4.2.2 Distribute tasks and 4.2.6 Disadvantages of newly graduated engineers.

In the survey, three types of work are distinguished: independent, challenging and regular work, that each has their own strengths and weaknesses connected to the development of the NGEs. Independent work is a big part of the experiential learning model, see Chapter 2.1.1 *Constructivism and an experiential learning model*, since it requires processing new input. This is also reflected in the survey where the advantages of independent work, to be able to try by yourself and process the thoughts is stated. However, without proper support and guidance it is a large risk that the NGE feels left alone and cannot develop further due to lack of input. The

risk of doing wrong may also increase, since the NGEs have a higher probability to do wrong according to Rollag et al. (2005) and the interviews. Independent work is, therefore, important, but is not to be mistaken for being left alone. There need to be a balance between independent work and input from others to make the NGEs develop and decrease the risk of mistakes. According to Hattie (2012) the NGEs colleagues can help obtaining this balance by identifying the most important parts and how to move forward.

When an NGE receives a challenging and varied task, it can either create great development or no development at all, depending if the NGE gets support to get across difficulties and if the challenge is too hard or on an appropriate level. An appropriate level of challenge stretches beyond the NGE's comfort zone and therefore provide new knowledge. They can also contribute more to the project because they do not have too easy tasks and not too hard tasks where they just get stuck. For some people, even the work that is seen as regular can be challenging enough. That the tasks should be at an appropriate level is something that Hattie (2012) emphases, but also stresses that it is important to believe in the NGEs and that they can be successful since they then try harder. In the survey, some NGEs say that they have not got enough challenging tasks, this may indicate that the belief in the NGEs has not been high enough. It is, therefore, important for the person distributing the tasks to make sure that the challenging tasks are challenging enough but not too challenging. According to the interviews the tasks' degree of difficult also should increase in the same rate as the NGE develops.

The interviewed managers also experienced NGEs with more or less drive which could be connected to their desire to have more or less challenges. With the right structures the NGE with less drive may be supported to perform better than they would have if they are perceived as inalterable since the NGE tries harder and therefore develop more (Hattie, 2012).

To make a challenging task manageable and developing the possibility to receive support and the tasks' intelligibility is important, these results are found both in the survey and in the interviews. The importance of that the task, and thereby learning objective, is clear, i.e. visible, is concurrent with Hattie (2012)'s findings. With clear and defined tasks the NGEs can contribute more to the project because they do not have to figure out what the task means or what the target is, before they start working. It seems like there are no disadvantages for the NGEs connected to clear and defined tasks. The only drawback that could be found is connected to the distribution of clear tasks. Sometimes it can be hard to find appropriate, defined tasks in a project, according to the interviews. It is also difficult to find an appropriate task since it varies from person to person what an appropriate task is.

5.2.6 Reflection

Discussion about the result in Chapter 4.1.2.4 Reflection.

That reflection is not a big conscious part of the development and the work of an NGE today can make it difficult make it a big part in the future. Reflection is neither something that is requested. The advantages with reflection, that the perspective is broadened, thoughts get structured and new ideas are formed, see Chapter 2.4.1 *Reflection*, are necessary to both the development of the NGEs and to make the project successful. But, because reflection is not within the work procedures today, the NGE has to put a lot of time into learning to reflect. To learn to reflect, together with the time it takes to do the reflecting, the number of new work tasks to learn and overall all the new impressions during their first project can make the investment in imposing reflection too big. The imposing will take time from other, easier and more immediate, tasks. Therefore, a better solution can be to not specially highlight reflection for the NGEs and instead wait for a later project when the NGE has learned the basics of the job. By choosing this solution, it is hard to base the learning for the NGE in the experiential model for learning, because the active reflection is not in focus. To cover up for the lack of active reflection the active interaction gets more important, since the reflecting can occur unconsciously through discussions and conversations.

There are three possible explanation for the gap between the experiential learning model's opinion about reflection and the answers from the survey. The first one is that the experiential learning model is not totally suitable for the learning environment for NGEs at ÅF. The circumstances with short deadlines and little or none work experience do not encourage reflection. Therefore, other methods of learning are to prefer such as discussing where you can get input from others. The second is that the NGEs lack methods for reflecting, like the students in Emsheimer et al. (2005)'s study, and therefore do not reflect. The third explanation is that people actually are reflecting but that they not doing it consciously and therefore it cannot be seen in the results of the survey.

5.2.7 Feedback

Discussion about the result in Chapter 4.1.1.3 Feedback, 4.2.3 Feedback and 4.2.10 Securing quality of the project.

From the interviews, it is clear that the feedback structures, both the official and unofficial, do not work optimally, either because it has not existed or because it has not fulfilled its purpose. This is also confirmed in the survey where the opinions were similar without any strong individual differences; if it works, it is positive for the NGE, but if it is not working, it is missed. The importance of feedback is something that Hattie and Timperley (2007) stresses in their theory of feedback.

Since feedback is such an important part of the development it is important to ensure that feedback is constantly given and received, both within the team and between

the manager and the employees. It is a contrast from today's feedback structures where the feedback is given once a year at some sections. In an in-house project, ÅF has the possibility to influence the frequency of the feedback and how feedback is given and received in a greater extent than when a single consultant works at a customer and adapts to their way of working. It is important to take advantage of this opportunity to gain more benefits from in-house projects than they are doing today. From the result, it can be seen that feedback already today is working better in an in-house project than in projects at customers. Feedback does not require any large structures, but requires awareness and time to be given and received (Hattie & Timperley, 2007), see Chapter 2.4.2 *Feedback*.

Since an NGE has more to learn than a more senior colleague feedback is even more important for NGEs than other employees, even though it is important to continue to develop for senior employees as well. Feedback is also a way of making the quality of the project increase, since the team members quicker learns what to be done and not to be done. This quality checks can be implemented even when it is not ordered by the customer and can reduce the effects of having NGEs on the project who may decrease the quality without check-ups. On the other way around, quality checks are a way to naturally incorporate feedback and discussions to learn from each other into the work, if the climate in the team are supportive.

5.2.8 Buddy

Discussion about the result in Chapter 4.1.1.5 Buddy and 4.2.4 Buddy.

Just like feedback, having a buddy have not always been satisfactory even though it sometimes has been an important part of the NGE's development. Today, the buddy is a colleague or a manager. Clutterbuck (2004) strongly recommends that the buddy should not be a person that have authority over the other. But, there are examples from the survey where the buddy has been a manager and the relationship between the buddy and the NGE is seen as successful and developing. The explanation of this is probably that the open and trustful environment has been built even though the buddy and the adept have been on different hierarchy levels. This shows that it can be possible to have this type of buddy but it is really important that the buddy doesn't judge the NGE and that the NGEs are not afraid to ask and discuss questions with, as well as ask for support from, the buddy. The relation environment is important to make this type of buddy-relation working (Mathisen, 2009).

According to Mathisen (2009) the possible reasons for a not-working buddy-relation are lack of communication ability, low priority or unrealistic expectations. According to the survey, it seems like the low priority and lack of time is the most significant reason for the unsatisfactory with one's buddy. The low priority and lack of time makes the buddy unavailable.

Buddy-structures within ÅF has been difficult to achieve when a single consultant

works at a customer office and easier to achieve in in-house projects. However, it is not easy in in-house projects either. A successful relationship between a buddy and an NGE required a willingness and ability to help as well as clear expectations from both parts to be successful and help the NGE develop (Clutterbuck, 2004; Mathisen, 2009). Otherwise the relationship only takes time and energy from both parties without giving much back.

There are examples in the survey when the buddy-relationship has worked. They show that a working buddy-relationship lead to learning the right skills for the current working situation, just as Mathisen (2009) claimed. To be able to give sufficient support, it is important that the buddy has knowledge about the adept's working area, since one of the strongest benefits from having a buddy is that the NGEs can ask questions and learn about the specific work tasks. Mathisen (2009) says that the buddy is a good way to get feedback. By having a specific person to ask when a problem arises it may take less time from the NGE to search for whom to ask which make the NGE able to learn quicker. According to Mathisen (2009), the relationship between the buddy and the NGE can bring added value by giving new perspective from the NGE, to the buddy. That cannot be found in the results, but it is probably because neither the survey, nor the interviews were addressed to buddies so that question were never asked.

According to the interviews the teaching ability of the project leader affects the NGEs development. This makes it credible that even the buddies' teaching skills would affect the NGEs development since they both are in a teaching position towards the NGE.

6
MODEL

From the analysis and discussion of the result ten activities that are developing for the NGEs have been found:

- The team have time to give support and there is an open environment
- The NGE has someone to ask and discuss with
- The NGE has a buddy
- The NGE has time to try by oneself
- The NGE's challenges are at an appropriate level
- The team have structures for feedback
- The NGE's tasks are clear and defined
- The quality of the NGE's tasks is reviewed
- The NGE has someone to observe
- The NGE has time for reflection

Since all of them are developing for the NGEs, they are preferable to do. However, being able to do all of these activities are not always possible. This model is therefore a tool to understand what NGEs need to develop and make it easier to prioritize among the different activities. The prioritization can be made from how much the activity can affect the team's performance and how much effort it takes to implement or what activity is most developing. Some sections at ÅF does a lot of the activities all ready and can then choose some other to implement, while other sections may start from scratch. The model is useful in any of these cases. Examples on how the activities can be implemented are found in Appendix C.

The ten activities have been ordered from the one with the highest total score, which can be seen in Table 6.1. There is a column containing the sum of the rate of *The NGE develops a lot* and *The activity is based on theory.* There is also a column containing the sum of the rate of *The performance of the team is improving a lot*, *Much time is saved for the NGE*, *Much time is saved for other team members* and *The implementation is very easy.* In Figure 6.1 a visualisation of the score of each activity in these two columns are presented. The diagram is divided into four fields depending on how much the activity develops the NGE as well as if it has support in the theory and how the activity affects the team's performance as well as how easy it is to implement. The presentation of the activities, that follows in this chapter, is based on the division.

Table 6.1: The attribute analysis made on the activities discovered developing for the NGEs. Every outcome is rated from *1 - strongly disagree* to *5 - strongly agree* for every activity.

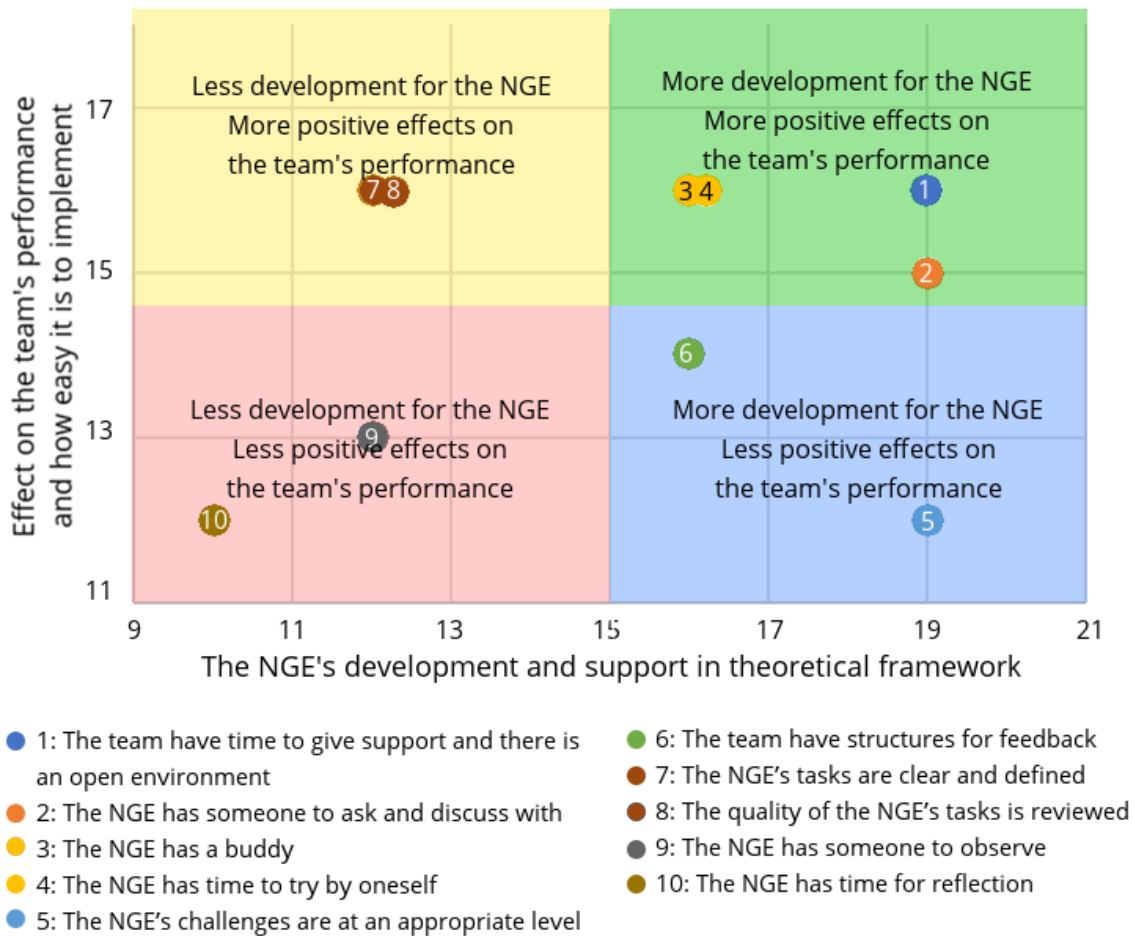|	The NGE develops a lot (weight 3)	The performance of the team is improving a lot (weight 2)	Much time is saved for the NGE	Much time is saved for other team members	The implementation is very easy	The activity is based in the theory	Sum of development and theory	Sum of team, time and implementation	Total
The team have time to give support and there is an open environment	5	4	4	2	2	4	19	16	35
The NGE has someone to ask and discuss with	5	3	3	2	4	4	19	15	34
The NGE has a buddy	4	4	4	2	2	4	16	16	32
The NGE has time to try by oneself	4	3	2	3	5	4	16	16	32
The NGE's challenges are at an appropriate level	5	3	3	1	2	4	19	12	31
The team have structures for feedback	4	4	2	2	2	4	16	14	30
The NGE's tasks are clear and defined	3	3	4	3	3	3	12	16	28
The quality of the NGE's tasks is reviewed	3	4	3	2	3	3	12	16	28
The NGE has someone to observe	3	3	2	3	2	3	12	13	25
The NGE has time for reflection	2	3	2	3	1	4	10	12	22

Figure 6.1: The ten activities that make the NGEs develop, dividing into four groups based on their rating in Table 6.1. The y-axis shows the aggregated score of the team's performance times two, the two time ratings and the implementation. The x-axis shows the aggregated score of the NGE's development times three and the support in the theoretical framework. The diagram can be divided into four fields that covers all the activities. The activities in the top right field are most developing for the NGEs and easiest to implement with none or low negative effects on the team's performance. The bottom left field represents the activities that are less developing for the NGEs and more difficult to implement with more negative effects on the team's performance. The two other fields are either most developing for the NGEs but most difficult to implement with negative effects on the team's performance or easiest to implement with none or low negative effects on the team's performance but least developing for the NGEs.

6.1 More development for the NGE and more positive effects on the team's performance

Here follows a description of the activities in the right-top field in Figure 6.1.

6.1.1 The team have time to give support and there is an open environment

How does the NGEs develop? The NGEs can get the support they need, to know what to do and how to do it. Also, the NGEs can learn about effective work, gain a better understanding of the work and become more independent. An open environment creates opportunities to ask questions without feeling insufficient.

How does the team's performance affect? There are two different effects. The first one is that the other team members can enjoy and improve by getting new points of view and be pushed to reflect over the working processes. The second one is that the other team members can be stressed and feel frustrated when having an NGE in the team that they need to support.

Time: The NGEs can execute the work quicker when getting support, but the support takes time from other members in the team.

Implementation: It is an activity where clear structures can be hard to define. It is also hard to give support if no one has knowledge in the area. It is, moreover, hard to give support if one has too much knowledge, so the person can distinguish what is obvious and what is not.

Theory: The effects of time to give support is well established in the sociocultural model (see Chapter 2.1.2 *Sociocultural learning model*). Hattie (2012) states that an open environment where mistakes and questions are allowed is a precondition of learning.

6.1.2 The NGE has someone to ask and discuss with

How does the NGEs develop? The NGEs can get answers on easy questions and more tricky ones. The knowledge gets deeper when discussing with others.

How does the team's performance affect? The rest of the team's performance is not directly affected by this activity, more than that the NGEs can contribute more to the team.

Time: The team members need to give time to discuss and talk to the NGEs.

Implementation: Already today, the NGEs are learning from asking and discussing with others. Therefore, there is not an effort to implement this activity. But, it is important to continue with this activity so it can continue being a great way to learn for the NGEs.

Theory: The activity is well established in the sociocultural model (see Chapter 2.1.2 *Sociocultural learning model*).

6.1.3   The NGE has a buddy

How does the NGEs develop? Persons assigned to help the NGEs makes it easier for the NGEs to ask, discuss, observe or get feedback, depending on the situation and what support the NGEs need.

How does the team's performance affect? The buddies get new perspective and new points of view that can improve the work.

Time: The NGEs have an assigned person to turn to, which makes it easier to quickly find the right person that can help if a problem arises. It takes time for the buddy to give support and be available.

Implementation: To make the implementation possible the buddy-structure must have a clear aim and the buddy should, preferable, do not be a manager. Time has to be set aside for the buddy to support and understand the NGE. The buddy's and NGE's working tasks have to fit together. If possible, the buddy should be a person with good communication and pedagogic skills.

Theory: The activity is well established by Mathisen (2009) and there is trace of it in the sociocultural model (see Chapter 2.1.2 *Sociocultural learning model*).

6.1.4   The NGE has time to try by oneself

How does the NGEs develop? When the NGEs get time to try by themselves, with or without having observed someone else first, their knowledge gets deeper.

How does the team's performance affect? If the NGEs have not observed anyone else before testing the risk of something going wrong is higher than otherwise. The NGE will learn and be able to perform better. The rest of the team is not affected by this activity.

Time: To try by oneself may take time, and someone may need to show the NGE how to perform the task before trying.

Implementation: This is nothing that requires any particular structures other than having time for the NGE to try the tasks, this is also something that is already done in many cases. To not make the NGE feel left alone, guidance should be available even when working alone.

Theory: In the experiential learning model trying out new knowledge in practice is one of the elements of learning (see Chapter 2.1.1 *Constructivism and an experiential learning model*). Having time to do this is therefore supported by the theory.

6.2   More development for the NGE and less positive effects on the team's performance

Here follows a description of the activities in the bottom right field in Figure 6.1.

6.2.1   The NGE's challenges are at an appropriate level

How does the NGEs develop? With challenging tasks the NGEs are forced to try and to go beyond their comfort zone, then they are going to provide new knowledge. With challenging tasks at an appropriate level, the tasks are not going to be

too hard, so the NGEs feel that it is possible to manage.

How does the team's performance affect? The rest of the team's performance is not directly affected by this activity, more than that the NGEs can contribute more to the team.

Time: To distribute tasks at an appropriate level to the NGEs, takes time from the person that has that assignment. More challenging tasks could also lead to more questions from the NGEs that can take time from the other team members.

Implementation: This activity demands a continuous dialogue between the distributor of tasks and the NGE. Otherwise it can be hard to put the tasks at the right level. It can also be hard to implement if the project does not have tasks at an appropriate level.

Theory: Hattie (2012) describes challenging tasks as one of the largest success factors in school.

6.2.2   The team have structures for feedback

How does the NGEs develop? The NGEs can get input on what has been a good performance and what can be improved, and thereby learn.

How does the team's performance affect? If the feedback system works the whole team's performance could improve because they have to pay attention to what is working and what can be improved.

Time: It takes time from both the NGEs and the other team members to receive and give feedback.

Implementation: It can be hard to learn to give and receive feedback. An open environment is a big advantage when working with feedback. If that is missing it is going to be harder to implement feedback structures.

Theory: Hattie and Timperley (2007) have shown that feedback is important for a person's development.

6.3   Less development for the NGE and more positive effects on the team's performance

Here follows a description of the activities in the upper left field in Figure 6.1.

6.3.1   The NGE's tasks are clear and defined

How does the NGEs develop? If the given tasks are clear and defined the NGE can focus on learning about the task and perform it instead of trying to figure out what it means or why it should be done.

How does the team's performance affect? The rest of the team's performance does not change, except for that the NGEs can contribute more when they understand the task and can accomplish it.

Time: For the NGEs it takes less time to conduct a clear and defined task since they do not have to figure out what the task means. This also reduces the amount of support needed from other team members who then can focus on their own tasks

or more developing discussions. However, the one distributing the tasks needs to be more thoughtful about the task which takes more time.

Implementation: To be able to provide clear and defined tasks the project needs to have these kinds of tasks. In the beginning of a project this can sometimes be hard.

Theory: Knowing what to do and what to be expected of oneself helps the learning process according to Hattie (2012).

6.3.2 The quality of the NGE's tasks is reviewed

How does the NGEs develop? From a quality review the NGEs learn what they have done right and wrong, which makes them perform better next time.

How does the team's performance affect? The rest of the team's performance does not change. A quality review decreases the risk of the NGEs, as well as the rest of the team, doing wrong, which increases the NGEs, and the whole team's, performance.

Time: Someone has to do the quality review, which takes time. It also demands time when the review is presented.

Implementation: There are several structures for reviewing quality at ÅF today, which makes it relatively easy to implement at sections lacking it. However, if the reviews are not demanded by the customer it can be harder to implement them due to lack of time.

Theory: There is no explicit theory about this area connected to this master thesis. However, quality reviews are a form of feedback which is strongly supported as a big contribute to development (Hattie & Timperley, 2007).

6.4 Less development for the NGE and less positive effects on the team's performance

Here follows a description of the activities in the bottom left field in Figure 6.1.

6.4.1 The NGE has someone to observe

How does the NGEs develop? The NGEs can get support and learn about how to perform their work tasks.

How does the team's performance affect? There are no effects on the team's performance other than the one being observed needs to be aware of how he or she is presenting the task. The NGE can perform better after observing because they have learned how to do a part of the work.

Time: Observations do not need to take time from the person being observed, but it demands time from the NGEs that is observing, which can be hard to afford in a consulting business.

Implementation: To be able to observe someone doing a task similar to NGEs tasks there need to be someone with similar responsibilities that also want to be observed. There is not always more than one doing the same type of task which

makes it hard to use observation as a learning method.

Theory: In the experiential learning model (see Chapter 2.1.1 *Constructivism and an experiential learning model*), getting an impression, from, for example, observe, is one learning element. Having someone to observe is therefore supported by the theory as an aspect of learning.

6.4.2 The NGE has time for reflection

How does the NGEs develop? The NGEs get the opportunity to reflect over what they have done and what they have learned.

How does the team's performance affect? The NGEs are the only ones involved in this activity and therefore there are no effects on the rest of the team's performance. The NGE will from reflecting perform better.

Time: The NGEs have to devote time to reflection in order for the activity to work.

Implementation: Today there is almost no respondent experiencing active reflection as a working method to learn. Reflection also needs a structure to be as productive as it can be, since it is hard to just think without a clear goal. You need a structure about what you should think about. The combination of no structure or will to do it today and the demand of a structure makes the implementation of reflection hard.

Theory: Even though the empirical results do not prefer reflection as a learning tool there are strong theoretical arguments about reflection as an important tool in the experiential learning model (see Chapter 2.1.1 *Constructivism and an experiential learning model*).

6.5 Team composition

Apart from the activities, the team composition is important to increase the preconditions of learning as much as possible. By optimizing the team composition, the possibility to learn from working together with others increases. There are two aspects that are most central to the team composition. The first one is the number of NGEs in every team and the second one is the size of the team. If there is only one NGE in a team the NGE is going to develop more because he or she can learn from several more experienced team members. It is hard to accomplish if there are more NGEs than projects at a section. Few NGEs in the same team is to aim for. If there are more teams than NGEs it is best to place the NGE in a very small team or in a large team, with more than 15 members. Other things that affect which team the NGE should be placed in are seniors' performance in the team is affected, which tasks the NGE can manage in the project and the size of the risks in the projects.

6.6 Future work

The combination of NGEs' introduction and learning is an unexplored field, there are many more aspects that could be examined in the future both at ÅF and in

general. For example, it would be interesting to investigate the introduction at another company to compare the strengths and weakness with ÅF to be able to develop the model. In a longer perspective, this could lead to different models in different situated contexts. It would also be interesting to actually measure the performance of each team member in different teams, teams contained of NGEs, teams contained of seniors and mixed teams, to see how their performances are affected.

To further improve the model the use of reflection should be investigated. A suggestion is to do deep interviews with NGEs and observation to determine if the inner, active reflection exist, but not is conscious or if it not exist at all. This could lead to a better model where the place of the reflection is clearer. By doing observations and deep interviews the question about if different work task can be described by a certain model can be clarified.

This thesis has not covered different personal learning styles and different personalities which may be important for the introduction and the team composition. This was brought up in the interviews, but was seen outside the aim of the thesis. Is this something that could help the introduction to improve even more?

7
CONCLUSION

7.1 First research question

Can the learning of newly graduated engineers be described through an experiential learning model combine with a sociocultural learning model, based on how the newly graduated engineers perceive their learning?

To conclude, the two models combined, describes the learning process for a newly graduated engineer at ÅF in a satisfactory way. In some cases, they need to be combined to explain a phenomenon, sometimes only one of them can explain the experienced learning and in some cases both models fit. However, depending on the reason of not learning from vague tasks and open environment, there might be a gap in the models, even when combining them. It is not possible to see if all learning elements of the experiential learning model have to exist, for learning to exist.

7.2 Second research question

How can ÅF make newly graduated engineers develop in an in-house project and how is this affecting the team's performance?

Ten activities that make the newly graduated engineers develop in an in-house project have been composed. The activities are: *The team have time to give support and there is an open environment, The NGE has someone to ask and discuss with, The NGE has a mentor, The NGE has time to try by oneself, The NGE's challenges are at an appropriate level, The team have structures for feedback, The NGE's tasks are clear and defined, The quality of the NGE's tasks is reviewed, The NGE has someone to observe* and *The NGE has time for reflection.*

The activities and their ranking in how much they develop the NGE and how it affects the team's performance can be seen in Figure 6.1. Every activity is affecting the team due to that the development of the newly graduated engineers makes them able to contribute more to the team. Another way the team is affected is that it can take more or less time for the new team member to learn, and for the rest of the team to support. Further the team members can improve and get new perspectives or feel stressed and frustrated about it. A few of the activities do not affect the team, except that the newly graduated engineer can contribute more to the team.

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A
SURVEY QUESTIONS

Demography

Work experience after graduation?
0-6 months, 6 months -1 year, 1-2 year, 2-3 year, more than 3 years

Gender:
Man, Women, Other option, Do not prefer to answer

Education:

My first project was:
at the customer, in-house

Belong to the division:
Industry, Infrastructure, Digital solutions, Energy

Introduction

During your first time at ÅF, what have you enjoyed the most?
How have you developed since you started at ÅF? Please give examples.

Since you started at ÅF, have you developed as much as you wished? Yes, No
Was there anything you missed, that would have gained your development? If yes,
please give examples.

Most contributing

Based on the factors below, what contributed the most to your development in your
first project? Choose maximum 3 factors.
*When the respondent chooses factors he or she gets questions about these factors
and not the other ones.*

A mentor/buddy
What role in the organization did your mentor/buddy have? Please give examples.
In what way did you develop thanks to your mentor/buddy? Please give examples.

Feedback
In what way did you receive feedback during your first project? Please give examples.
In what way did you develop by receiving feedback? Please give examples.

Colleagues who show or explain
In what way did you develop by having colleagues that explained or showed? Please give examples.

Observation of colleagues
What did you observe that made you develop? Please give examples.

Reflection
How did you reflect during your first project? Please give examples.
In what way did your reflections help you develop? Please give examples.

Independent work
In what way did you develop by working independently? Please give examples.

Ask questions and discuss with colleagues
In what way did you develop by asking questions and discussing with colleagues? Please give examples.
Did the team encouraged to learn from each other?
If Yes: In what way?

Challenging tasks
In what way did challenging tasks contribute to your development in your first project? Please give examples.

Regular work
In what way did you develop through regular work? Please give examples.

Other
You chose alternative "Other", what other factor has contributed to your development?
In what way did you develop through "other"? Please give examples.

Least contributing

Based on the factors below, what contributed the least to your development in your first project? Choose maximum 2 factors.
When the respondent chooses factors he or she gets questions about these factors and not the other ones.

A mentor/buddy
Did you have a mentor/buddy?
If Yes: What made a mentor/buddy a less important part of your development? Please give examples.
If No: Would you have liked someone who supported you more? Please give examples.

Feedback
What made feedback a less important part of your development? Please give examples.

Colleagues who show or explain
What made "colleagues who explain or show" a less important part of your development? Please give examples.

Observation of colleagues
What made observation of colleagues a less important part of your development? Please give examples.

Reflection
What made reflection a less important part of your development? Please give examples.

Independent work
What made independent work a less important part of your development? Please give examples.

Ask questions and discuss with colleagues
What made "ask questions and discuss with colleagues" a less important part of your development? Please give examples.

Challenging tasks
What made challenging tasks a less important part of your development? Please give examples.

Regular work
What made regular work a less important part of your development? Please give examples.

Other
You chose alternative "Other", what other factor was a less important part of your development?
What made "other" a less important part of your development? Please give examples.

B

INTERVIEW GUIDE

Introduction

Can you describe how you work with in-house project?
- At client, at ÅF? What do you deliver: Product, background?
- What duration has a project? How big is a team?

Newly graduated engineers in teams

Have you had newly graduated engineers working for you?
How do you think when you should place a newly graduated engineer in a team?
- Does the competences/persons in the rest of the team affect this procedure?
How is the other person's performance in the group affected of a newly graduated engineer in the team?
- Do you have any explicit experiences of when the performance has been worse? Why?
- Do you have any explicit experiences of when the performance has been better? Why?
What are the drawbacks of having a newly graduated engineer in the team?
What are the benefits of having a newly graduated engineer in the team?
Do you have any experiences of newly graduated engineers who have performed well in a team? What was the reason?
Do you have any experiences of newly graduated engineers who have performed badly in a team? What was the reason?

Learning

Do you use to see that the newly graduated engineers develop?
- In what way?
How do you work to make the newly graduated engineers develop?
- For example, transfer knowledge, learn new things, mentor/buddy, feedback?
How do you work with buddies/mentors for newly graduated engineers?
How do you work with feedback for newly graduated engineers?
How do you secure that the newly graduated engineers' tasks are at an appropriate level?
Do the newly graduated engineers develop as fast as you wish?

C

IMPLEMENTATION OF ACTIVITIES

This appendix describes examples on how to implement different activities that develop newly graduated engineers. In the figure below the activities are placed into four different categories depending on how much they develop the newly graduated engineer and how it affects the team's performance as well as how easy it is to implement. Since all of them are developing, they are preferable to do. However, being able to do all of these activities are not always possible. This figure is therefore a tool to understand what NGEs (newly graduated engineers) need to develop and make it easier to prioritize among the different activities. The prioritization can be made from how much the activity can affect the team's performance and how much effort it takes to implement or what activity is most developing. The model is useful both if a lot of the activities are already being done since one can then choose some other to implement, and also if one starts from scratch.
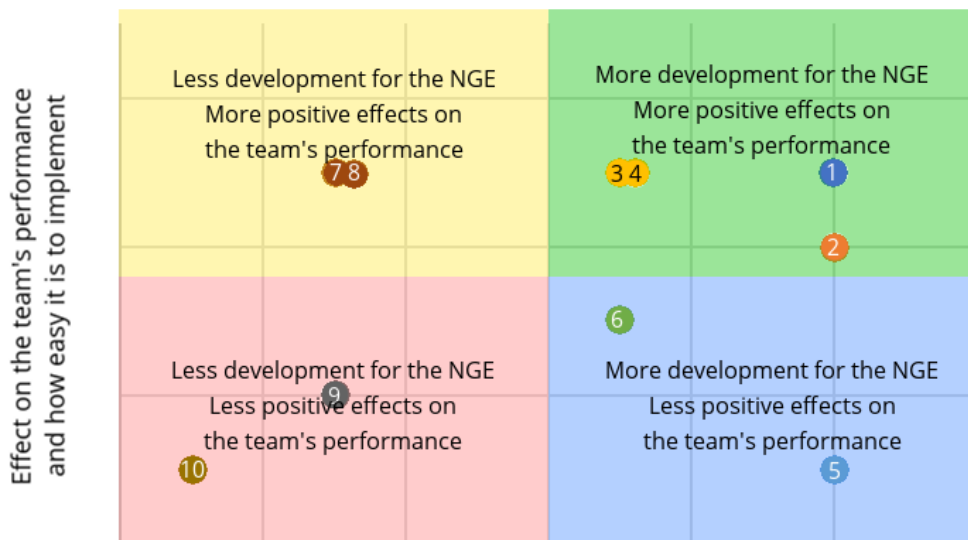
The NGE's development and support in theoretical framework

- 1: The team have time to give support and there is an open environment
- 2: The NGE has someone to ask and discuss with
- 3: The NGE has a buddy
- 4: The NGE has time to try by oneself
- 5: The NGE's challenges are at an appropriate level
- 6: The team have structures for feedback
- 7: The NGE's tasks are clear and defined
- 8: The quality of the NGE's tasks is reviewed
- 9: The NGE has someone to observe
- 10: The NGE has time for reflection

More development for the NGE and more positive effects on the team's performance

The team have time to give support and there is an open environment

Aim: The NGEs get the support they need, and can find out what to do and how to do it. Also, the NGEs can learn about effective work, gain a better understanding of the work and become more independent. The other team members can improve by getting new points of view and be pushed to reflect over the working processes. An open environment creates opportunities to ask questions without feeling insufficient which will lead to a better work climate.
Risk: The other team members can be stressed and feel frustrated when they need to support an NGE. The activity's structure is hard to define which make the implementation hard. Persons in the team can know too little or too much which make it hard to give relevant support.

Implementation

Make sure that the team is inviting and tries to build a relationship to the NGE as soon as possible. Try to create an understanding among the seniors why it is important to support and give them allowance to take time to support the NGE. Overall an open environment is important.

The NGE has someone to ask and discuss with

Aim: Help the NGEs to get answers on easy questions and more tricky ones. The knowledge gets deeper when discussing with others. The most important learning source right now.
Risk: The other team members need to take time to discuss and answer questions. The most important learning source will disappear if this activity is missing.

Implementation

Make sure that the team is inviting and tries to build a relationship to the NGE as soon as possible. It will make it easier to dare to ask questions. Overall an open environment is important.

The NGE has a buddy

Aim: Makes it easier for the NGEs to ask, discuss, observe or get feedback, depending on the situation and what support the NGEs need.
Risk: It takes time from the buddy to give support and be available. An unavailable buddy is worse than no buddy at all. The buddy's and NGE's working tasks have to fit together for the buddy to be able to help the NGE.

Implementation

Put together the NGE with a more experienced colleague in the same field. The buddy should, preferable, do not be a manager. The buddy-relationship must have a clear aim and time has to be set aside for it. The focus is on the daily contact where the NGE, for example, can get support or be delegated to the right person.

The NGE has time to try by oneself

Aim: When the NGEs get time to try by themselves, with or without having observed someone else first, their knowledge gets deeper.
Risk: If the NGEs have not observed anyone else before testing the risk of something going wrong is higher than otherwise. It can also take a lot of time.

Implementation

There is no structure that can make this happening, but it is important to encourage to it and plan for it after every learning sequence.

More development for the NGE and less positive effects on the team's performance

The NGE's challenges are at an appropriate level

Aim: The NGEs are forced to try and to go beyond their comfort zone, to provide new knowledge. The NGEs will feel that the tasks are manageable.
Risk: It takes time to find appropriate tasks and in some projects, it is not even possible. It could lead to more questions from the NGE.

Implementation

This activity demands a continuous dialogue between the distributor of tasks and the NGE for examples weekly, very short reconciliation meetings. The distributor needs to take time to understand the NGE's competencies. The distributor must dare to give challenging tasks, but also, understand that some tasks that are seen as easy for someone can be hard for another one.

The team have structures for feedback

Aim: The NGEs can get input on what has been a good performance and what can be improved, and thereby learn. The whole team's performance could improve when paying attention to what is working and what can be improved.
Risk: It takes time from both the NGEs and the other team members to receive and give feedback. It can be hard to learn to give and receive feedback.

Implementation

The feedback has to be planned and help to answer the questions about *What are the goals?, What progress has been made?* and *Where to go next?*. The reconciliation may be short but frequent, for example, one time a week. The feedback should include both positive and negative aspects regarding the questions above. At the end of the feedback session, get a confirmation from the NGE that he or she has understood.

Less development for the NGE and more positive effects on the team's performance

The NGE's tasks are clear and defined

Aim: The NGE can focus on learning about the task and perform it instead of trying to figure out what it means or why it should be done.
Risk: The one distributing the tasks needs to be more thoughtful about the task. Not all projects have suitable, defined tasks. Some tasks that are seen as easy for the distributor can be hard for an NGE.

Implementation

Identify clear and defined tasks within the project where the NGE is placed. Describe carefully the aim and the process to the NGE and get a confirmation from the NGE that he or she has understood.

The quality of the NGE's tasks is reviewed

Aim: From a quality review the NGEs learn what they have done right and wrong, which makes them perform better next time. A quality review decreases the risk of doing wrong, which increases the performance in the whole project.
Risk: Quality review takes time and if it is not demanded, it can be hard to implement due to lack of time.

Implementation

To make sure that reviewing quality is done and prioritized, make it a demand and plan for when it is going to be done early in the project. The quality reviews should be done frequently. It is also important that it is clear how it should be done. Many lines of business work with this type of reviews and can therefore help with implementation at other lines.

Less development for the NGE and less positive effects on the team's performance

The NGE has someone to observe

Aim: The NGEs can get support and learn about how to perform their work tasks.
Risk: Observing demands time from the NGEs and possibly from the one being observed. There needs to be someone with similar responsibilities that also want to be observed.

Implementation

Two things that simplify observation is firstly placing the NGEs close to others having the same kind of responsibility. Then the NGE can observe and intercept different ways of working. Secondly the NGEs can get a task to go to a person in the team that shows him or her their work and explains it.

The NGE has time for reflection

Aim: The NGEs get the opportunity to reflect over what they have done and what they have learned and therefore perform better.
Risk: The NGEs have to devote time to reflection in order for the activity to work. Today there is almost no one that is experiencing active reflection as a working method to learn which can make the implementation hard.

Implementation

Devote time for reflection and use a guide to know what to reflect about. An example is to write down something about the following six aspects (Winka & Ryegård, 2013); something positive, something negative, an insight, a question, the result and what changes that should be made until next time.