



Both novice and expert? How apprentices develop vocational competence in workplaces where technology is continuously changing: Examples from the Norwegian media graphics programme

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Abstract

This article explores how young apprentices develop vocational competence through apprenticeship in workplaces where technology is continuously changing. The article draws on results from a longitudinal study that followed seven apprentices enrolled in the media graphics programme in Norway through their two-year apprenticeships.

The results showed how the apprentices developed vocational competence in the community of practice in the workplaces by taking an active part in the daily production, experimenting with different solutions, reflection, and by advice and discussions with their instructors and co-workers. However, the apprentices also had to deal with work tasks where the solutions were not yet known in the workplace. The article shows how the apprentices combined learning from colleagues with learning from other resources such as software courses and use of the internet. The results showed how the apprentices' competence development can be a resource for the co-workers and can facilitate the development of the enterprise. Furthermore, these results provide new perspectives on competence development in the community of practice. The study showed that the apprenticeship has an innovative potential and is an essential way for young people to develop vocational competence in a world of work where technology is continuously changing.

Keywords: vocational education and training, apprenticeship, workplace learning, technology, media production



Introduction

Throughout human history, apprenticeship learning in the workplace has been an essential way of developing vocational competence (Billett, 2013). The apprentices develop competence as they engage in authentic work tasks and interaction in the 'natural' setting of a workplace, and there is no distinction between learning and participating in practice (Billett, 2010; Lave & Wenger, 1991).

In the 21st century, practice-based learning through apprenticeship is acknowledged as essential for young peoples' development of vocational competence (e.g. Billett, 2010; Fuller & Unwin, 2011; Nielsen & Pedersen, 2011). In today's labour market, workers are required to continuously develop their competence in order to meet the rapidly changing requirements in the workplaces (Billett, 2013; Poortman, Illeris & Nieuwenhuis, 2011). Instead of a set of narrowly defined forms of knowledge, there is a need for a comprehensive competence (Moreno Herrera, 2016); thus, workplace learning should provide possibilities for the apprentices to become broad rather than narrow experts (Fuller & Unwin, 2004).

The traditional apprenticeship model was developed under conditions where the technology, and thus the expertise in the workplaces, was more stable. Even though there is renewed interest in workplace learning (Billett, 2013), there has been little research investigating how apprentices develop vocational competence in vocations where technology is continuously changing and when the best way of carrying out specific work tasks is not yet known to the experts in the workplace. This article contributes to the existing literature by investigating how young apprentices enrolled in the media graphics programme in Norway developed vocational competence through their two-year apprenticeships.

This apprenticeship programme is interesting due to the continuously changing technology in the workplaces. Furthermore, no previous studies have investigated how apprentices in this trade develop vocational competence under such circumstances. In this trade, rapid changes in technology mean that there are continuous changes in the software and ways of performing work tasks. Furthermore, there is rapid development both of new devices and software for the production of media material for these devices. Thus, there is a requirement in the workplaces for tradespersons to stay updated about the possibilities that changes in technology provide.

The article draws on the results of a longitudinal study that followed seven apprentices enrolled in the media graphics programme in Norway through their two-year apprenticeships. Six of the apprentices secured a two-year apprenticeship contract after two or three years of school-based education in the vocational education programme for media and communication in upper secondary school, and one after finishing a bachelor programme in graphic design at a university.

The research question for this article is: *How do young apprentices in the media graphics programme develop vocational competence in workplaces where technology is continuously changing?*

To answer this question, the article draws on workplace observations and in-depth interviews with the apprentices, their instructors in these enterprises, and three instructors in the apprenticeship training office during different stages of the apprenticeship period.

In the literature, there is different use of the concepts of skills, knowledge, qualifications, competencies and competence. In this article, I have chosen to use the concept of vocational competence in order to emphasise the multidimensionality and complexity of what is expected of a tradesperson. Even if the concept of competence is used differently, there seems to be agreement that competence is an integrated set of skills, attitudes, and forms of knowledge that becomes visible through successful behaviour in specific situations (Koenen, Dochy & Berghmans, 2015; NOU 2018:2).

The Norwegian apprenticeship programme for media graphics

The standard vocational education and training (VET) model in Norwegian upper secondary education consists of two years of school-based training followed by two years of apprenticeship training at an approved training enterprise. There are nine different and broad programmes in the school-based part of VET. (e.g. programmes in social and health care, electricity work, building construction, etc.). Each programme prepares students for many different, but related vocations. The programmes consist of academic subjects (Norwegian, English, mathematics, etc.) and vocational subjects specific to the programme. The students are also given the opportunity to undergo placement periods in enterprises during the school-based part of VET (Norwegian Directorate for Education and Training, 2016). However, few students from media and communication have had this opportunity (Aakernes, 2018).

Media graphics provides opportunities for apprenticeships in traditional press enterprises, advertising agencies, web or digital media firms, and film production companies (Opplæringscenteret for visuell kommunikasjon, 2019). The work tasks can include design and production of advertising materials, brochures, magazines and websites, editing of still or motion pictures, and practical work on film sets (Norwegian Directorate for Education and Training, 2008). The national curriculum outlines the requirements for the two years of enterprise-based training. Important objectives are 'idea generation, composition and design of different media products'; 'development of skills in the use of tools, technology'; and 'promotion of ability to always stay updated and keep developing one's own competence, and the ability to adapt to changes in the occupation' (Norwegian Directorate for Education and Training, 2008, pp. 1-2).

In the Norwegian VET system, the training of apprentices is a shared responsibility between the company where learning takes place, and the apprenticeship training office (Lahn & Nore, 2018). The training office for media graphics is trade-specific and is owned and operated by a community of companies. The task of the office is to recruit apprentices and training enterprises and network with enterprises, schools, and branch organisations, and to follow up apprentices. The apprentices attend several courses in the training office during their training period (Opplæringscenteret for visuell kommunikasjon, 2019). After the apprenticeship period, apprentices take a final practical examination, usually carried out over five working days, to earn the Journeyman's Certificate in the trade (Norwegian Directorate for Education and Training, 2008).

Previous research

Previous research on apprenticeships has established that the most common way of developing vocational competence is by taking part in everyday tasks in the workplace, interacting with more experienced colleagues (e.g. Aarkrog, 2005; Fuller & Unwin, 2003; Lensjø, 2016). The researchers found that the apprentices worked alongside their more experienced colleagues, and especially as newcomers, watched and listened to their colleagues. However, it is through the opportunity for active participation that the apprentices become tradespersons. Even if there might be some brief instructions, Aarkrog found that 'the predominant way of learning is to plunge into performing the tasks' (2005, p. 142).

Guidance and assessment by their co-workers is an integral part of the apprentices' work and competence development (Pedersen & Elmholdt, 2008). From this feedback, the apprentice is guided towards the quality standards and 'the required level of proficiency' (p. 101). A significant type of assessment is to let the apprentice take part in work tasks that demand greater responsibility (Nielsen & Kvale, 2006, p. 130). Most of the previous research on apprenticeships has investigated how apprentices develop vocational competence in workplaces where the apprentice is the novice, and the more experienced colleagues are the experts (Lave & Wenger, 1991). However, to meet the requirements of contemporary workplaces, the apprentices must develop the ability to keep updating their own competence so they can master both known and challenging new situations.

Messmann and Mulder's study of apprenticeship in the German dual system underlined 'the importance of designing complex work environments which challenge apprentices to learn' (2015, p. 592). To be able to deal with challenging situations and tasks, the study points to the importance of work environments that provide the apprentices with autonomy so they can make their own plans and decisions (p. 592). However, the apprentices also needed to receive support and competence-related feedback from their colleagues and superiors.

Nore (2015) found that due to the continuous development of technology and qualification needs, VET students entered into a 'more hybrid learning arena'. They developed vocational competence from schools, workplaces, courses and E-learning and became co-designers of their own VET. The courses offered by specialised course providers can be a way of meeting 'schools' and companies' lack of updated or specialised knowledge and skills' (p. 188).

Fenwick and Nerland (2014, p. 25), point out that in today's society, 'knowledge is generated from a multitude of sources and circulated rapidly across organisational boundaries'. They call this phenomenon 'knowledge on its travels'. It is necessary for practitioners to learn how to relate general instructions found on the internet to their specific work task. Similarly, Elmholdt's (2001) study of a web development company showed extensive use of the internet as a learning resource. Due to the continuously changing technology, there is a need to combine local knowledge sources (i.e. the knowledge of colleagues) and global sources which can be easily accessed via the internet, and to understand how they can be mutually supportive.

Young people are born and grow up in a society where competence in the use of media and ICT are daily necessities. They learn the use of digital technology both in schools and in their broader social life (Erstad & Silseth, 2019). The growing use of digital technology in different contexts results in young people gaining confidence and expertise in the use of these tools (Forkosh Baruch & Erstad, 2018). They are not only consumers of professional productions, as from an early age they learn how to produce and upload their own media material (Bond, 2014). Extensive use of digital technology, both as a hobby and at work, can blur the boundaries between work and leisure time. Elmholdt (2001) shows in his study how one of the employees found out how to use a specific digital technology during his leisure time. He shared his experience in the workplace, and this resulted in an improvement of production.

Fuller and Unwin (2003, 2004) have developed the 'expansive-restrictive framework' to analyse approaches to apprenticeship. An expansive learning environment concerns the opportunity to gain broad experience across the organisation; a gradual transition to full participation; and having a recognised status as a learner. Furthermore, these authors challenge the assumption that an apprenticeship is a 'linear journey from novice to expert' (2004, p. 32). They found that apprentices were sharing their expertise, spending a 'significant amount of time helping colleagues to learn in the workplace' (p. 38). Their expertise was developed both from previous competence development at school and also from their broader life experience. Restrictive learning environments are the opposite of expansive and they imply that the learners will gain mastery over a 'limited range of tasks, skills and knowledge', and are more likely to become 'narrow experts' (Fuller & Unwin, 2004, p. 35).

In summary, previous research has established that apprentices develop vocational competence through active participation in authentic work tasks with their colleagues in workplaces. Due to the continuous changes in qualification needs, the apprentices should be given the opportunity to autonomously make their own plans and decisions. This work autonomy must be combined with guidance and support from their colleagues. The research also points to the need to combine workplace learning with learning in courses and global knowledge sources such as the internet. However, there is a need for further in-depth studies to throw light on apprentices' competence development in workplaces where the technology and qualification requirements are continuously changing, and where the experts might lack the expertise in how to carry out specific work tasks. Furthermore, it is interesting to investigate the extent to which apprenticeship can develop to meet the rapidly changing needs for qualifications in workplaces.

Theoretical framework

Lave and Wenger's (1991) theory of learning explains how the apprentice develops vocational competence by participating in the 'community of practice' in the workplace. Apprentices develop competence without formal teaching through engagement in authentic vocational tasks together with their more experienced co-workers. Lave & Wenger's concept of 'legitimate peripheral participation' refers to how apprentices are given access to the community and the community's expertise. The apprentices start with simple tasks, where mistakes can be tolerated, and move on to more demanding tasks as they develop competence. During their competence development, they move towards 'full participation' in the community.

Lave and Wenger's concept is developed mainly from studies of craft apprenticeship in traditional societies. Thus, some scholars point to limitations in the theory regarding explaining how apprentices develop vocational competence in modern workplaces in advanced industrial societies (for example Fuller, 2007; Fuller, Hodkinson, Hodkinson & Unwin, 2005). Of particular interest for this study is the questioning of the innovative capacities of communities of practice due to the emphasis on transmission of existing practices; oversimplification of relationships between novices and experts; and insufficient recognition of the importance of multiple settings and networks for learning processes. However, the same scholars who point to limitations in Lave & Wenger's model also argue that the model 'continues to provide an important source of theoretical insight for research into learning at work' (Fuller et al., 2005, p. 50). Further development of the model is needed, along with research into how the model can be used to explain the complexity of competence development related to work activities in modern workplaces (Hughes, Jewson & Unwin, 2007). The major strength of the model is the emphasis on competence development through participation in a

vocational community, even though this model alone cannot explain how apprentices develop vocational competence in workplaces where technology is continuously changing.

Building on Lave and Wenger's earlier concept (1991) Wenger presents human activity and competence development as a duality of participation and reification (1998, p. 62). While participation is local and refers to the interaction within a purposive community, reification is global and refers to representation of practice as tools and documents. Also, computer software, web sites and instruction videos are kinds of reification, within which professional knowledge is embedded. Thus, competence development in the workplace must be analysed as a combination of participation in the local practice and the use of global knowledge sources. A large part of the reification involved in work practice in a digital workplace is global; however, this reification must be accommodated to the local practice and specific work tasks (p. 60). The right balance between participation and reification is essential for the development of the local practice, and for an enterprise to be a 'learning community' (p. 214).

The development of technology changes the activity in vocations, and the competence the tradespersons have to develop (Säljö, 2001). For example, the introduction of a new desktop publishing software in an enterprise changes the nature of the activity and the competence requirements. Specific technology is developed by humans for particular purposes and holds the same possibilities and limitations, regardless of who is using it (Leonardi, 2010). When using professional photo editing software like Photoshop, the user can choose a variety of different functions. While some functions are essential for the media graphics artist, others are essential for the photographer or the illustrator. Thus, the technology in use will differ between vocations and local practices, and technology becomes useful through purposeful human interaction (Orlikowski, 2000, 2007).

The study is also inspired by other scholars who regard vocational competence as holistic and multidimensional (Billett, 2001; Dreyfus & Dreyfus, 1988; Schön, 1995). These scholars regard vocational competence as an integration of practical skills, theoretical knowledge, embodied knowledge, tacit dimensions and social competencies such as accountability towards customers.

In order to develop vocational competence, the apprentices must be given the opportunity to engage in varied work tasks which gradually increase in difficulty and responsibility (Dreyfus & Dreyfus, 1988). Competence development also requires opportunities for both performance of routine tasks and using the competence in new situations (Billett, 2001; Dreyfus & Dreyfus, 1988). Expertise indicates that the practitioners should both be able to deal with known tasks and should have developed the competence necessary to meet new, challenging tasks. Furthermore, competence is understood as developed 'through a combination of engagement in work tasks of increasingly accountability, the close

guidance of other workers and experts, and the more indirect ongoing guidance by the settings' (Billett, 1999, p. 155).

It is common to say that a designer has 'an eye for it' or has a 'sense of aesthetics'. Her experience of whether the design is functional is more to do with what Ingold (2013) calls 'sensory awareness' than about whether she has used the principles for design in a prescribed way. An important part of the development of design competence is the development of this 'sensory awareness'. 'To have an eye for it' means that the professional sees in a special way and has developed 'skilled vision' (Grasseni, 2007). A community of practice or a professional community share aesthetic sensibilities and ways of seeing, and an important part of becoming a member of the professional community is to develop this community's specific skilled vision (p. 216). According to Grasseni, skilled vision is a result of 'education of attention, which requires repeated training and discernment' (p. 217).

Due to digitalisation, there are no strict boundaries between working with design and production in media enterprises. Thus, the apprentice can be given the opportunity to try out different solutions for design while she tries to find the different tools and panels in the software. 'The ongoing guidance by the settings' (Billett, 1999, p. 155) can happen when the apprentice tries out different solutions and sees what happens (Ingold, 2013, p. 7). Schön says that the 'situation talks back' and the practitioner engages in 'a conversation with the situation' as she 'reflects in action' on different solutions for the design (1995, p. 79). In this process, the apprentice can also reflect with the instructor or other colleagues through 'reflective conversations' (Schön, 1995).

The theories presented above throw light on how apprentices can develop vocational competence through active participation in authentic and varied work tasks of gradually increasing difficulty, and by being given room for reflection. The theories, however, do not sufficiently explain the consequences of continuously changing technology for the development of vocational competence. Earlier mentioned concepts such as hybrid and expansive learning environments, reification and digital confidence may contribute to this explanation.

Methods

To acquire an in-depth understanding of the research question, a qualitative design approach was used (Creswell, 2013). Seven apprentices in the media graphics programme were followed through their two-year apprenticeships. The sampling of media enterprises was purposeful (Patton, 2015), to ensure that the selected workplaces covered the apprentices' different training possibilities. Thus, the seven workplaces covered film production, traditional pre-press, advertising agencies and production both for print and digital platforms. To get a comprehensive understanding of the research question, the study included

apprentices, the instructors in the apprentices' workplaces, and instructors in the apprenticeship training office. The study follows the Norwegian guidelines regarding matters such as consent, confidentiality, information provided to participants, and the use of data (Norwegian Centre for Research Data, 2019).

Due to the study's longitudinal design, data were collected several times during the two-year apprenticeships, and the data collection methods were workplace observations (Creswell, 2013) and semi-structured interviews (Brinkmann & Kvale, 2015).

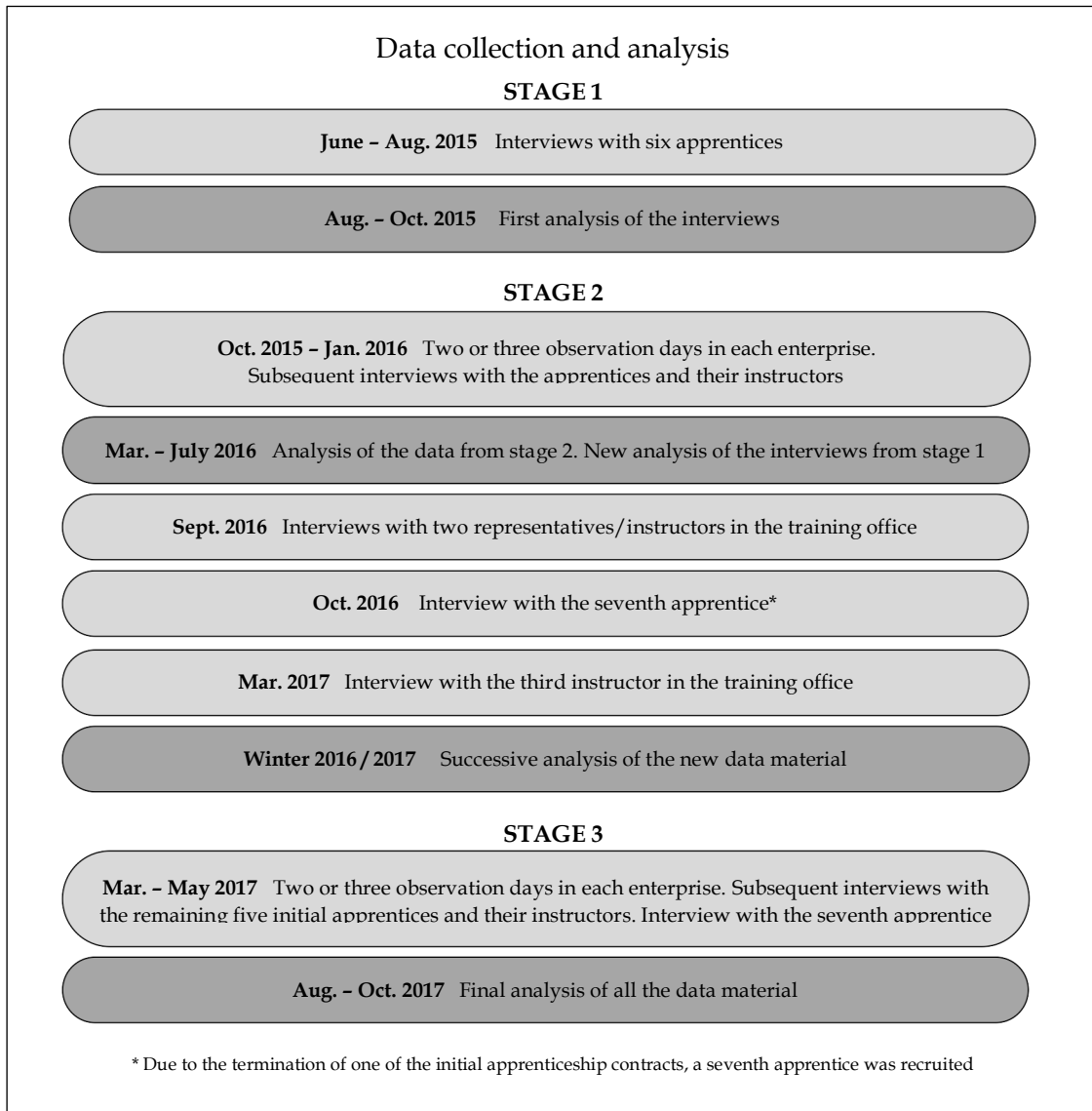


Figure 1. Overview of the process of collecting and analysing the data.

All the data collection was carried out by the author, and the interviews were recorded digitally and then fully transcribed. The combination of the methods made it possible both, through my own presence, to gain insight into the work and learning arrangements, and through in-depth interviews, to gain insight into the experiences and opinions of the different participants. The alternation between interviews and observations enhanced the possibility for continuous adjustment of the investigation's focus based on preliminary analysis of the results from one of the methods. Furthermore, triangulation of both methods and data was essential to enhance the study's validity (Merriam & Tisdell, 2016).

To cause as few disturbances as possible during the observation days, I chose the 'observer as participant' stance as an observer (Creswell, 2013, p. 167). However, I conducted conversations with the apprentices, instructors and other employees and asked questions about the work tasks when it was possible without disturbing their work. The theoretical framework and previous research informed the focus of the observations. Of specific interest was: the apprentices' role in the community in the workplace; variation in work tasks; reflection and development of skilled vision; autonomy, feedback and guidance; whether the environment was expansive or restrictive; and the use of global resources such as the internet and tutorials. I used an observational protocol during the observation days and included both descriptive and reflective notes (Creswell, 2013, p. 167).

Semi-structured interview guides were designed for all the interviews (Brinkmann & Kvale, 2015), and previous research in the field and the theoretical framework of the study were used as a framework for the interview guides. In addition to the themes from the observations, themes of specific interest were: competence requirements in the vocation; the local competence vs. the competence requirements; progression during the training period; the courses in the training office; the apprentices' digital competence.

The first cycle of data coding was carried out in accordance with the open coding principles (Merriam & Tisdell, 2016) by use of the software HyperRESEARCH. Emergent analysis of the data from the previous stage before conducting the next stage of data collection made it possible to follow up on things that seemed important on the observation days, and include preliminary results in the new interview guides. During analysis of the new data, the initial codes were changed to be more analytic and deductive, and the codes were organised into categories (Gibbs, 2018).

During the analysis, it became apparent that an essential part of the apprentices' competence development occurred through their participation in authentic vocational tasks in the enterprises. Furthermore, the participants emphasised design and use of technology as the two most significant aspects of vocational competence. Thus, these three main categories were identified: 1) Development of holistic vocational competence through active engagement in authentic

vocational tasks; 2) Development of stable competence in design; 3) Development of competence in the use of continuously changing technology.

The following sub-categories are used in the presentation of the results in the second main category: design competence as the basis for the vocation; development of skilled vision through reflection, feedback and discussions. The results in the third main category are presented in these sub-categories: use of the internet and apprentices' digital expertise; change in technology and development of enterprises; courses in the apprenticeship training office; change of the production; expansive vs. restrictive approaches towards apprenticeship. While defining the sub-categories, I used a combination of 'top down' (by using sub-categories from previous research and the theoretical framework of the study), and 'bottom up' (by developing analytic sub-categories from the data) approaches (LeCompte & Schensul, 2012). To ensure participant anonymity, the pronoun 'she' is used for all the participants.

Development of holistic vocational competence through active engagement in authentic vocational tasks

The results showed a strong understanding in the workplaces that apprentices' participation in the production work from the start of their apprenticeship period was essential for their development of vocational competence. Instructor 4 said: 'They take part in a production milieu where they work with real productions from day one.' Apprentice 7 spoke about how she developed vocational competence from taking part in the work:

This is the way I learn best; to be given a production task. Then I try to perform it the way I think it should be and ask somebody if I have some questions. I have found out that I learn quite fast this way, faster than if somebody tells me about something, because then I will not remember it the same way as when I have done it myself.

There were no strict boundaries between the apprentices' work with design and production. They tried out different solutions for the design during the production work and developed competence in the use of technology and various types of software by taking part in the production. Instructor 4 said: 'At the beginning, most of the tasks are simple and the primary focus is on quality assurance.' Apprentice 7 said: 'I like to test out the different tools and possibilities in the software, and actually learn mostly by myself.' Apprentice 4 said: 'I can learn through trial and error because there is always an undo button.' When the apprentices could not discover how to carry out a specific function, they asked their colleagues. Apprentice 1 said: 'I might ask about the best way to perform non-destructive editing of a picture, or how large a file should be.'

It was from their own active engagement with the performance of the work tasks that the apprentices experienced development of vocational competence. Sometimes they received a brief instruction, but the main impression from the observation days was that the apprentices started by experimenting on their own, and consulted their colleagues if they found it necessary.

The results showed that there was usually a significant progression in the complexity of the apprentices' design work and that they were given the opportunity to work with various productions. Instructor 4 said: 'In fact, the apprentices are, except for the production manager and me, the persons that work with the most different productions.' Apprentice 7 confirmed that it was the same in her workplace: 'I feel that my learning really is given priority. Sometimes I am the one who gets a creative job rather than somebody else that might want it.'

In the daily work in the enterprises, design competence and competence in the use of technology were interwoven parts of a holistic vocational competence. However, during the analysis, these aspects of competence appeared to be significantly different. While principles for graphic design are quite stable, technology is continuously changing. Due to this distinction, the analysis also showed differences in how the apprentices developed these competences.

Development of stable competence in design

Design competence as the basis for the vocation

The instructors emphasised the importance of the development of design competence. Instructor 2 called this competence 'the basis for the vocation'. She continued: 'Good design is based on the existence of a framework, and principles and concepts for good design do not change [...] you have to work according to the traditions as you follow the trends'. Even if graphic design changes and develops according to different trends, the basic principles for design were considered stable. As Instructor 4 said: 'principles for composition will never change'. It was also acknowledged that it takes a long time to become proficient. Instructor 2 said: 'A part of learning design is connected to psychology, to understand how different people respond to colour or typography [...] and you really have to work a while to understand this relationship.'

Development of skilled vision through reflection, feedback and discussions

I saw many examples of how the apprentices tried out different solutions for the design during the production work. Apprentice 1 was tasked with making an advertisement for sports equipment. She used her vision and feeling for design while continually making adjustments and trying different solutions concerning both the placement and sizes of the various elements. Later she explained how she reflected during the process:

It is about putting it all together in a way that results in less space between the different clothes and shoes and so forth. At the same time there should be some space that makes it look like there is a certain flow [...] I have to think about how big the socks should be compared to a sweater and a pair of trousers. You see, the trousers are long while the sweater is more quadratic in form, and I have to find a solution that makes it all fit together.

The participants in the study used different expressions to describe design competence. Instructor 1 called it 'see it with your eye', while others spoke about 'understanding' or 'feeling'. During the process of trying out different solutions for design, the apprentices could ask some of their colleagues for advice or for their opinions. They also asked for others' opinions when they had made a finished draft. The apprentices said that listening to their colleagues' different opinions about design was a part of their competence development. Apprentice 4 said:

I have experienced that when I ask a colleague for her opinion, then the others hear what we say, and then suddenly we have a kind of briefing for the whole group. And this is rather good, I think, because the one you asked has her opinion, and then somebody else says: No, I think it will be better this way. Then I understand that there are different opinions regardless of how long you have worked in the trade, and that design is not about right or wrong.

Competence development in design is not concerned with what is right or wrong but with developing a feeling or understanding of why specific solutions might be more suitable than others. The apprentices experienced that feedback from colleagues contributed to their development of a better understanding of design. Apprentice 1 said: 'It might concern the sizes of the different elements, and then it doesn't take much before I understand why small adjustments should be made'. Apprentice 2 said:

I find that I learn more from this feedback that is professionally reasoned than I do from the feedback from the customers. They usually do not see things the same way, and may just say: I do not like it this way.

Summary

To sum up, the results showed that the apprentices developed design competence by taking part in the everyday production tasks in the community of practice in their workplaces. There was a high vocational competence in design in the workplaces; a competence commonly understood as developed through many years of work in the trade. The apprentices performed independent design tasks and developed competence as they tried out different solutions, using feedback from colleagues, and discussions about design as ways of sharing ideas and developing understanding for design.

Development of competence in the use of continuously changing technology

While design competence was understood as the basis for the vocation, competence in the use of technology was understood as necessary for the actual performance of the design. Instructor 2 said: 'It should not be lack of competence in how to use technology that limits the possibility to be creative.'

Use of the internet and apprentices' digital expertise

Due to continuous changes in technology, the apprentices sometimes encountered tasks that nobody in the workplace knew how to carry out. Both the apprentices and the instructors pointed to the internet as an important resource for finding solutions. Apprentice 4 said: 'It is rather easy to make searches on the internet when you have a specific problem. Then you might find a YouTube video showing how you perform the task.' Apprentice 2 said that an essential part of the competence development was to understand which websites were professional and trustworthy.

There are of course the sites from the software providers, where there are forums for discussions and questions are answered by professionals. Then there is YouTube, and after you have done some searching, you know what seems trustworthy, and what seems not so professional.

Several of the instructors pointed to the apprentices' digital expertise as a competence they benefitted from in the enterprises. Instructor 6 said: 'Young people already have a lot of digital competence; they have grown up with PCs, with computer games, they have a totally different understanding. They are what I would call unafraid.' Being unafraid is understood for example as not being afraid of trying out possible solutions for solving tasks when they work with various types of software. Apprentice 3 experienced that there was a difference between her and her elder colleagues concerning digital competence: 'There are some things I can do that they cannot because they have not grown up with technology the same way that I have.' Some of the apprentices drew on software competence they had developed on their own by using the software as a hobby. Apprentice 6 explained how she had learned to use specific software for 3D modelling this way: 'Actually, I am self-taught. I have learned by watching YouTube videos. I had the opportunity to use it in some of my school assignments, but it was not a part of the education, and nobody has taught me about the software.'

Change in technology and development of enterprises

The instructors considered the changes in technology as the driving force for the changes in competence requirements in the enterprises. However, it was regarded as a challenge to find the time necessary to develop the required

competence. Instructor 1 said: 'There are new updates in the software that provide the opportunity to work more efficiently, but we might not know about them'. Apprentice 7 pointed to the internet as a source for joint competence development in the workplace by explaining how colleagues tried to find the solution together: 'Sometimes nobody knows the answer, and then we conduct searches on Google or YouTube, and then we often find the answer quickly.' This answer was then shared and discussed among the colleagues.

In some of the workplaces, there were regular in-house vocational development courses as a way of improving specific expertise and staying updated. Instructor 6 said that these in-house courses were a way of sharing expertise in the workplace. 'Some are real racers in InDesign regarding how to work efficiently, and we try to benefit from their expertise by using them as teachers on the courses. The apprentices always take part in these courses.'

Courses in the apprenticeship training office

During their apprenticeship period, the apprentices attended several courses in the apprenticeship training office as part of their formalised training. Instructor 9 in the apprenticeship training office said that they planned the courses in accordance with their experiences of the requirements in the enterprises. She said: 'We set up the courses to match what they are first exposed to in the enterprises, so we start with InDesign and typography, and we build on that.' She also explained that they aimed to ensure that the courses matched the curriculum for the apprenticeship period, but also that they covered

... things such as digital advertising, social media, and so forth, things that will not be assessed when they sit for the journeyman's examination. We think that they should know what is going on in the trade to become proficient tradespersons.

When Instructor 10 talked about how she organised the course activities, she emphasised that the apprentices should develop competence in how to use the software in different situations and for various tasks, rather than follow specific instructions for a set task.: 'I seldom show them something that they will repeat. I show them how things can be done because I want them to understand the functionality of the software. Afterwards they must use the same functions for a different work task.'

Especially due to the rapid changes in the software, the instructors in the workplaces pointed to apprentices attending these courses as a resource for the entire enterprise. Instructor 2 said: 'When they come back from the courses, they usually have something new to contribute. We always tend to have a little briefing about what they have learned. Do we already know it, or is there something they can teach us?' Apprentice 2 said that she enjoyed teaching her instructor.

It is a long time since she attended courses in software, and when we sit together working, I say: You know that there is a short command for this function, or that

you can carry out this operation differently? And she is very grateful and is really open to getting such input. And that is fun, to be able to teach your teacher something!

The results also showed how apprentices could take on the role of instructors for their co-workers.

Change of the production

In the last stage of the study, it became apparent that in two of the workplaces changes were made in the product and services due to the apprentices' competence development. In one workplace, there was a change from working with printed material to 'more involvement in the development of websites and web advertising, and the advantage is that we do not need to buy this service from elsewhere anymore' (Instructor 2). Apprentice 2 spoke about the changes this way:

There is more web production now, and the reason is that we have taken the initiative, and said we were willing to try it out. We have found out how to carry out the production, and we have agreed to take on this kind of work.

The 'we' in this context refers to her, the instructor and one co-worker. It seemed, however, that Apprentice 2 underplayed her role in these changes because Instructor 2 said:

The reason we now produce more for the web is that the apprentice is interested in learning new production methods. She has had to learn this on her own, either by attending courses in the apprenticeship training office or by finding her way here in the workplace. We would like her to use the time necessary to learn the methods, and then we can learn from her.

According to Instructor 2, the apprentice was seen as a resource in the development of production, and also for the competence development of the community in the department. In the other workplace, the apprentice was given the responsibility for digital 3D modelling of designs for exhibition stands.

She was one of the first apprentices to be more focused on digital than on paper-based design, and she had made 3D design earlier. She had the software on her personal computer, and we decided that we should try it out. We gave her the opportunity to make a 3D model for a small exhibition stand. And then she got it right away, and the model turned out to be really good, and it has snowballed from there. (Instructor 6)

Until it was discovered that the apprentice had this competence, the 3D modelling services were bought from another company, since no one in the enterprise had the necessary software competency. Instructor 6 continued:

We have recently purchased new 3D software that the apprentice is testing out. There is a need for more of us to learn this software, and this is something we actually have requested for some time now, [...] but it has been challenging to find the time to be able to sit down and learn the software.

This quote also points to the contradiction that was experienced in the workplaces between production requirements and the opportunities for the employees to update their competence.

Expansive vs restrictive approaches to apprenticeship

In most of the workplaces in the study, the apprentices were given the opportunity to develop competence in multiple settings, and their competence development was given priority. An example is apprentice 6, who was given the opportunity to work with 3D modelling due to the need for the enterprise to have qualified staff. However, Instructor 6 also emphasised that this opportunity was important for the apprentice's competence development.

For her, it is important that she is allowed to continue on this track, that we do not stop her, even if she is within a department that mainly produces material for print. [...] because competence in digital production is, and will be, very important.

Furthermore, their digital competence was acknowledged, and considered as a resource for updating the way of working with the software in the enterprises. However, in one of the workplaces, Apprentice 1 did not experience the same open-mindedness regarding change to the way of working.

There are certain details regarding, for example, the use of templates, and I have said, maybe we can do this another way, or I have learned another way in a course. But they do not want to do it that way; they want to do it the way we do it here.

In another workplace, the main part of the apprentice's job was to operate the digital printing machine, something not in accordance with the competence aims in the curriculum for the apprenticeship training period. Apprentice 5 said that she felt she was taken advantage of because the wages she had as an apprentice were lower than the other workers'. Furthermore, she experienced that she was not given the opportunity to take part in work tasks where she had the opportunity to develop the competence required to sit for the journeyman's examination. The solution to this situation was that the apprentice decided she wanted to terminate the apprenticeship contract. These two examples showed how restrictive approaches to apprenticeship are incongruent both with the apprentices' competence development and also with the development of the enterprise.

Summary

To sum up, the results showed that due to the continuous changes in technology, the apprentices also developed vocational competence from other sources than the community of practice in the workplaces. From the courses given by the apprenticeship training office they developed competence in efficient use of various types of software. Furthermore, they also used learning resources found on the internet, mainly when the way of dealing with the work task was not yet known

in the workplace. In some of the workplaces, the competence development of the apprentices became a resource for the other colleagues and for development of the enterprise.

Discussion

The results show that theories of apprenticeship learning in craft societies are still useful for explaining some aspects of competence development in modern workplaces. Participation in authentic vocational tasks in the enterprises was essential for the development of competence in design and the use of technology as a whole (Lave & Wenger, 1991). Even if the technology is continuously changing, this part of vocational competence also has some basic aspects that are learned through taking part in the community of practice in the workplaces.

In a vocation with rapid changes in competence requirements, competence in design is emphasised as a core competence. Even if graphic design changes according to trends in society, principles for typography, colour contrast and composition do not change. Moreover, changes in design trends happen far more slowly than changes in technology.

In order to develop design competence, the apprentices had to develop 'skilled vision' by training their aesthetic sensibility (Grasseni, 2007). They developed this competence by experimenting with different solutions for the design, by reflection (Schön, 1995), and by receiving guidance from their colleagues (Pedersen & Elmholdt, 2008). They were guided by co-workers with long experience in the trade and found that they learned from tradespersons that shared a specific way of seeing (Grasseni, 2007), and not from customers that did not see and talk about design in the same way. The results point to quite a linear journey from novice to expert in how the apprentices developed vocational design competence (Dreyfus & Dreyfus, 1988).

However, the study also shows the limitations in Lave and Wenger's theory regarding how to explain the whole picture of competence development in contemporary workplaces. Due to the continuously changing technology, the apprentices sometimes had to deal with work tasks for which the solutions were not known in the workplace. Schön's theory (1995), which was used to describe how the apprentices reflected on design solutions when the way of using the technology was known, does not explain what is going on when the apprentices face the unknown.

The primary information source in such cases was the internet, and the use of computers as the primary tool in the trade gave easy access to this source of information (Elmholdt, 2001). However, the apprentices had to relate the information they found, for example in an instruction video on the internet, to the specific work task they were dealing with (Fenwick & Nerland, 2014). Thus, the apprentices' development of vocational competence was situated and related to

challenges in concrete situations. In such cases, the apprentices' digital competence and previous experience in the use of technology were essential (Forkosh Baruch & Erstad, 2018). Furthermore, it was important that they were given the opportunity to autonomously make plans and decisions regarding their work, and also experienced support from their colleagues (Messmann & Mulder, 2015). However, the results do not fully explain how the apprentices developed the necessary critical approach towards the different web resources available.

Due to the apprentices' attendance on courses in the apprenticeship training office and their previous experience with the use of technology at school and for leisure, they were sometimes the experts in the workplaces regarding how to use the technology (Fuller & Unwin, 2004). The apprentices took on the role of teachers in the workplace, a role that is traditionally associated with the experienced participants in the community of practice (Lave & Wenger, 1991). The results showed a new relationship between the apprentice and the more experienced colleagues, and that the young apprentices were respected for their expertise. This new relationship challenges the role of the novice and the expert in the workplace. Furthermore, the results showed that the apprentices do not proceed on a linear journey from novice to expert in all the aspects of vocational competence (Fuller & Unwin, 2004). Moreover, it seems that these apprentices, due to the continuously changing technology, received complex work tasks and became 'full participants' earlier than both the Dreyfus model (1988) and Lave and Wenger (1991) describe.

The results suggest that reification and participation are complementary, and show the necessity for a proportional relationship between them to compensate for their respective shortcomings (Wenger, 1998). The workplace where there was resistance towards a change of the use of software based on the apprentice's suggestions, is an example of how participation in established, but not always updated practices prevailed. As a result, the co-workers in the enterprise missed an opportunity to change the practice and thus become a 'learning community' (p. 214).

In other workplaces, the apprentice's competence development and the colleagues' acknowledgement of their expertise, resulted in changes in practice, and competence development for the community (Wenger, 1998). These workplaces show similarities to 'expansive approaches' to apprenticeship (Fuller & Unwin, 2003). The apprentices were acknowledged as learners and became co-designers of their own VET (Fuller & Unwin, 2003; Nore, 2015). They were given the opportunity to develop vocational competence by a combination of participation in the everyday tasks in the workplaces, participation in courses, and by use of sources on the internet. The apprentices brought in new, updated competence in how to use the software, and thus also became co-constructors of the competence in the community of practice.

The results also point to engagement among the tradespersons in the enterprises regarding updating their own competence through cooperation and in-house courses. These results show that workplaces go beyond the traditional communities of practice where there is no distinction between learning and participating (Lave & Wenger, 1991). These workplaces bear a resemblance to 'learning communities' (Wenger, 1998) and show how participation in the local practice is insufficient for updating vocational competence.

Lave and Wenger's theory can be criticised for underplaying power relations and contradictions between production requirements and considerations about the apprentices' opportunities for competence development (e.g. Fuller, 2007, p. 20). In the use of the term 'community', the understanding of harmony and common interests among the different groups in a workplace is implicit. This study is also vulnerable to the same criticism. Even if there is an example of termination of an apprenticeship contract, the conditions in the workplaces appear harmonious with few conflicts. One possible reason is that I did not have enough focus on power relationships and contradictions during observations and interviews. Another reason is likely to be the instructors' attitude towards apprenticeship. Most of the instructors spoke highly about apprenticeship as a way for young people to develop the vocational competence required in the future job market. Furthermore, they regarded the enterprises taking on apprentices both as crucial for the development of the trade and as fulfilling a social responsibility. These factors can explain the results of the study; most of the enterprises offered an 'expansive approach' to apprenticeship (Fuller & Unwin, 2003).

Conclusion

This study has shown examples of how young people, through apprenticeship, can develop the vocational competence necessary to meet the challenging competence requirements in contemporary workplaces. The study attempted to answer the following research question: How do young apprentices in the media graphics programme in Norway develop vocational competence in workplaces where technology is continuously changing? The results showed that the apprentices developed vocational competence in multiple settings and from different sources. Engagement in authentic vocational tasks in the workplaces was still essential for their competence development. However, due to the continuously changing technology, this engagement was insufficient for the development of the required vocational competence. Thus, the apprentices combined participation in the community of practice in the workplace (Lave & Wenger, 1991), participating in courses in the apprenticeship training office, and use of sources on the internet (Nore, 2015).

The courses in the apprenticeship training office were essential for the media graphics apprentices' competence development. The training office provided

systematic education that reinforced the apprentices' ability to meet the continuously changing technology in the workplaces. The combination of production work in the enterprises and regular courses seems to be a good model for facilitating apprentices' competence development. The results showed that the training offices could be a crucial factor in the Norwegian VET system, by linking formalised school-based education and workplace learning. Further investigations of the training offices in different trades could represent an essential contribution to knowledge about possibilities for developing VET systems according to contemporary requirements.

Furthermore, the study has shown that the apprentices can take part in and be important for the construction of competence in workplaces. Thus, it is essential to acknowledge the apprentices' expertise and their possible role in the development of the workplace. The study points to the innovative potential of apprenticeship if an 'expansive approach' is adopted in the workplace (Fuller & Unwin, 2003). Thus, apprenticeship can continue to be an essential way for young people to develop vocational competence in a world of work where technology is continuously changing. This study has shown the complexity of vocational competence development in one specific trade in the Norwegian VET system. In order to continually develop VET to meet the changing competence requirements in modern workplaces, there is a need for further in-depth studies that investigate different trades and VET systems.

Note on contributor

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