

DOES THE INTRODUCTION OF LEARNING MANAGEMENT SYSTEMS IN VOCATIONAL EDUCATION AND TRAINING AFFECT LEARNING? A NORWEGIAN EXPERIENCE

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Abstract: *Recently, learning management systems have been introduced in the Norwegian school system, including vocational schools. Some vocational teachers have been sceptical about using learning management systems in vocational education and training. This study examined if the vocational teachers' use of a learning management system facilitated the students' opportunities to prepare for the tasks that will be part of their future as an apprentice. The research question was How does the introduction of learning management systems in vocational education and training affect learning? In vocational education and training, the transfer of tacit knowledge from master to apprentice has traditionally played an important role in the teaching. This transference of knowledge takes place in a face-to-face setting and in an interaction between master and apprentice which is based on acting, showing, explaining, and commenting. Documentation requirements through learning management systems appear to strengthen the vocational students' understanding of work tasks they will encounter as apprentices in the workplace. Learning management systems allows for the transference of tacit knowledge, and the documentation also appear to strengthen the communication between students and teacher.*

Keywords: tacit knowledge, vocational education and training (VET), learning management systems, OLKWEB (apprentice training documentation tool)

Introduction

The main approach to Norwegian vocational education and training is the 2 + 2-model. In the first half of the model the students in vocational programmes attend high school for two years, then in the second half, they have a two-year workplace apprenticeship. The training is regulated by the Norwegian Education Act and follows national subject curricula that apply to both the education that is taken at school and the training in the apprenticeship company. Most vocational subjects follow this model (Norwegian Directorate for Education and Training, 2016).

The result of the latest reforms in Norway, *Reform 94* and the *Knowledge Promotion Reform* (Norwegian Ministry of Education and Research, 2006), has been that a larger part of vocational education and training (VET) has been detached from the context where the competence will later be used. Where earlier courses were tailor-made for specific subjects and professions, today's courses have broad programme areas and subjects that do not correspond to specific vocations and trade areas in the workplace. When students today start the first year in upper secondary education (Vg1), the education and training is outlined by the

education programme, not by the individual subject or trade. The second year (Vg2) also has programme subjects that are common to several subjects and trades (Nyen & Tønder, 2014). To remedy this situation, a special school subject was introduced in 2011, now called vocational specialisation (YFF), where the aim is to give students the opportunity to gain experience of content, tasks, and methods that characterise the various vocations within the education programmes and to acquire relevant knowledge for general education subjects (Norwegian Directorate for Education and Training, 2016). In vocational education and training, the transfer of tacit knowledge from master to student and apprentice has traditionally played an important role in the teaching. This transference of knowledge takes place in a face-to-face setting and in an interaction between master and apprentice which is based on acting, showing, explaining, asking, and commenting.

Tacit Knowledge

Knowledge can be divided into two main categories: explicit and tacit knowledge. Explicit knowledge can be formulated relatively easily using words, numbers, and symbols and can thus be reliably transferred to others. Tacit knowledge, on the other hand, is

more difficult to articulate and communicate. The distinction between explicit and tacit knowledge largely depends on knowing and being able to do a particular action (Johannessen & Olsen, 2008). Tacit knowledge is a concept formulated by Polanyi (1966). His two key points were that tacit knowledge can often, but not always, be explicitly formulated in an assertive form, and that explicit knowledge must rest upon and presuppose tacit knowledge (Collins, 2010; Grimen, 1991; Polanyi, 2000; Rafoss & Witsø, 2014).

Polanyi's (2000) point of departure for the concept of tacit knowledge is that the individual knows more than he or she can communicate verbally to others. The development of professional awareness and discernment is only possible by acting; that is, performing tasks and reflecting on what is being done before it is being done, while it is being done, and after it has been done. In high school, knowledge is usually transferred in a situation where teachers and students are in a face-to-face setting and where the teachers both demonstrate and explain. Vocational subjects are about transferring skills that are associated with work operations. The student will then try to succeed at working with the skill while the teacher is present and can guide along the way through demonstrating and explaining. The student practises the skills until they are mastered so that the teacher can record that they have been acquired.

Apprenticeship Training Agencies

When the Norwegian model was created in the 1990s establishing an apprenticeship training agency (Opplæringskontor), it was a means of making the apprenticeships more relevant by strengthening the cooperation between companies and between schools and companies (Nyen & Tønder, 2014). Many apprenticeship training agencies have helped to facilitate training in the YFF subject in the participating companies. The apprenticeship training agencies have also facilitated training by offering electronic follow-up tools where goals in the curriculum are linked to work tasks in the company that will be documented as having been carried out and understood (Michaelsen & Høst, 2015). One of these follow-up tools is OLKWEB (Apprenticeship Training Agencies' Web Based Documentation Tool), which is

primarily described as an online follow-up platform for vocational students, apprentices, upper secondary schools, training companies, and apprenticeship training agencies (<http://www1.olkweb.no>). This tool has been used in vocational upper secondary schools in the YFF subject.

Purpose

In this study, I examine if the vocational teacher using OLKWEB facilitates the students' opportunities to prepare for the tasks that will be part of their future as an apprentice. This study will be of interest and have relevance because the use of such a learning management system as OLKWEB is a new phenomenon in this branch of the Norwegian high school system, and there has been almost no research into this topic in the vocational education and training field until now.

My research sought to answer this overall question: How does the introduction of learning management systems in vocational education and training affect learning? Two further questions helped to guide the research:

1. Does the vocational teachers' use of OLKWEB enhance the communication between teacher and student and enhance the students' reflections and mastery of vocational knowledge compared to traditional paper-based communication?
2. Does the use of the learning management system in vocational education and training help to raise awareness of the tacit knowledge that forms an important part of the transfer of knowledge from vocational teacher to vocational student?

In YFF, the teacher is at a high school and the student is working in a company. They are not in a face-to-face setting. In such a situation, is it possible for the teacher to then convey tacit knowledge? Can the teacher assess whether the student has acquired a certain type of verbal knowledge? OLKWEB is designed to instruct the students and evaluate whether they have acquired particular knowledge of their own. Is this possible using OLKWEB?

Methodology

I collected data by observing and interviewing teachers and students in their use of OLKWEB in their normal school activities. The data are based on interviews with and observations of teachers and students at two vocational high schools (School 1 and School 2) situated in two cities in two different counties in southern Norway. This collection has resulted in three sets of data:

1. At School 1, I conducted a qualitative interview with two vocational teachers in two trades: building and construction and automotive vocational area. This interview was recorded and then transcribed.
2. At School 1, I also observed and interviewed students and a teacher in a carpentry class that showed me how they documented work that they had performed in YFF in OLKWEB. This interview and the interaction between the teacher and students were recorded and then transcribed.
3. At School 2, I observed and interviewed a teacher and students when they used OLKWEB as part of their ordinary teaching activities. I documented this activity by obtaining screen dumps of what they were doing and noting what they were saying.

The extracts from the interviews with the students and teachers have been rendered anonymous so none of the interviewees can be identified. These were unstructured group interviews where my interest was in discovering the meaning of the topics that arose in the interview conversations (Johannessen, Tufte, & Kristoffersen, 2004). The meanings of the text were analysed by condensing meaning. The focus of this approach is on exploring and describing people and their experience and understanding of a phenomenon (Creswell, 2009; Johannessen et al., 2004).

The first stage in the analysis of the interview material was to form an overall impression and provide a summary of the meaning (Johannessen et al., 2004). I identified the main themes in the interview and observation material. The first analysis focused on identifying the themes, statements, patterns, and relationships that appeared in the text.

Coding resulted in five categories, arranged according to course initiation: (a) assignment and description of the task(s), (b) performance of the task(s), (c) documentation of the executed task(s), (d) teacher feedback and evaluation, and (e) plenary review in the classrooms. With the further analysis of the data material, I extracted the most essential descriptive statements under each category to shed light on the facts. I will address, in each category, the descriptive statements by linking them to the three aspects of tacit knowledge: action, reflection, and interaction (Johannessen & Olsen, 2008).

Findings

Assignment and Description of Tasks

Students in the various programs are connected to OLKWEB through their own laptop. In the automotive vocational area, the teachers have made their own subject curricula for practical work in Auto Repair Level 2. This means that the objectives from the national curriculum are specified and presented as tasks that the students will then plan, execute, and document. The teachers say that they are very satisfied with the online tool:

It's very nice. They're not particularly fond of OLKWEB, let's be clear on that. They need some help, and they need to have some time for it. They have to be encouraged. and have to be pushed a little. But the planning development time, it's easier now than before when we did it on paper, so that we're quite happy with it.

In the YFF, the students use learning objectives from Level 3 and work through the curriculum directly in OLKWEB. They must check OLKWEB to see if anything is missing. The teacher explains that in this way, the students are involved in planning their own learning. Time is set aside in the classroom to create individual specific curricula, which the students take with them to the firm where they will ask for help in satisfying the learning objectives they themselves have set up with the support and guidance of the teacher.

In the program for building and construction, the tasks were described in two ways. When it comes to work assignments given to the students while they are in school, the teacher is

involved and may influence the work processes. Here he uses OLKWEB as a tool to specify objectives and competence on the project level. Each construction project, for example the construction of a new house or renovation of a cultural heritage site, requires completely different approaches. In OLKWEB, the teacher must describe the tasks the students are to perform in their training. He cannot demonstrate this, he must formulate it linguistically. That is, he must turn some tacit knowledge into explicit knowledge. The student must then interpret what he or she reads in OLKWEB and translate this into action.

When the students have on-the-job training in a company, they, not the teacher, must instantiate the learning objectives for the work tasks because they are out in the firms working on tasks that are so different from each other that it is not possible for the teacher to have an overview of all of them. The student must therefore make the same type of reflection on the relationship between explicit and tacit knowledge as the teacher does when describing the work tasks. In the program for technical and industrial production, where most of the students chose the industrial mechanic subject as their YFF apprenticeship, the teacher was positive about the students' opportunities to find curriculum goals related to the tasks they performed in the company.

The building and construction teacher was focused on facilitating the students' professional development by planning how he could describe tasks that were again linked to the competence objectives in the relevant subject. That is what he describes as "specification at the project level". His students had the YFF subject at Level 1, and he thought they were too young to see the significance of building a wall or ceiling. He felt that they needed to be given an illustration of the entire construction process through a project description or an outline describing it from beginning to end. It is interesting that this teacher thinks that students at Level 1 are unable to transfer the knowledge from the curriculum to work tasks as the students at Levels 2 and 3 are able to do. I find that this response is due to the difference in practical craftsmanship (and thereby tacit knowledge of the craft), reflecting the different levels they are on in their vocational education.

Task Performance

The students have practical work either at Level 1 in the YFF subject, or they have it in a company as part of their on-the-job training at Level 2. The teacher is responsible for the students and is the one who grades the subject. Practical work is a very important arena for the students' development in the trade or vocation. Some of the students are alone with a professional or another person who is responsible for following up and giving assignments to them in the apprenticeship company. The following quote from the building and construction teacher points out the importance of OLKWEB's role in transferring vocational and tacit knowledge:

This is where I think that in the development of our subject we do not basically have a fixed template for things. I see that the students are having difficulty zooming in on the vocational aspect. In our industry, in practice, we go out, it's like having to take each job project by project, and it basically requires good knowledge of how things appear to be. I look at OLKWEB as a tool for specification at the project level. So, I need to have, after all is said and done, a lot of learning plans. A curriculum for each project.

The building and construction teacher stated he has good opportunities to transfer knowledge about the trade in projects where he himself helped and worked together with the students. He referred, for example, to the project where the school had been commissioned to restore a historical building. Here he could be hands-on in planning, execution, and a plenary review. At the site he could both demonstrate and explain to the students how to perform their craft and thereby transfer tacit knowledge to them. However, only a few students could be involved in this practical work on this specific construction project. The other students were on other construction sites and were given their work tasks by the apprenticeship company. The teacher was unable to predict what kind of work the students would encounter there. He could not be present at these work sites and therefore had no chance to demonstrate the work process to them. In these cases, other craftsmen were guiding the students and were the ones to

transfer the tacit knowledge of the craft to them. The teacher believed that the documentation system in OLKWEB could help strengthen the student's understanding of the task in future professional exercises. This understanding, according to the building and construction teacher, would be further strengthened by specifying each construction project with all its related sub-tasks, which again points back to goals in the national curriculum.

Documentation of Task with Teacher Feedback and Evaluation

In the following I will provide some examples of the documentation carried out by students in the program for technical and industrial production and of the teachers' feedback in OLKWEB as entered in the work performance rubrics and in connection with the learning objectives, as well as teacher comments and approval. First are three examples of student documentation in OLKWEB and the teacher's feedback given as information and guidance:

Example 1:

Student: Today I spent time with someone who showed me how to use an automatic planer. When I had learned how to use it, I logged what he and I had done and what he had shown me.

Teacher: Great, Kristian! But take some pictures next time and see if you can't find some learning objectives that are focused on documentation and quality. This applies to all tasks health, environment, and safety (HES) routines, etc.

Example 2: (a different student in a different company)

Student: Cut and prepared fittings for connection. Moved 9.6 meters of 3" pipe down to 3 C (production department, my comments), aligned for connecting and full welding of acid-resistant steel. [He refers to several different learning objectives.]

Teacher: Good, Johan, but explain the company's organisational structure and the department's position and function in the company. You have to expand on this for me.

Example 3:

Student: We've gone through the HES routines. I'm very interested in health and

safety because of the stories I've heard about how quickly things can go wrong and a little because of my own experience about how fast things actually go wrong.

Teacher: It's good that you've got something out of this, but you are lacking a description of the work, feel free to take pictures of the work and any schedules. The pictures can be entered here.

In example 1, the teacher prompted the student to formulate learning objectives that related to the tasks. By doing so, he encouraged the student to think about the wider context of her work, thereby pointing to the relational tacit knowledge according to which the task should be understood. In example 2, the teacher asked the student to reflect on the context within which the task should be seen and understood. In example 3, the teacher instructed the student to reflect further on what she did and to explain the tacit knowledge that is related to her work. In these three examples, the teacher initiates a dialogue with the students that encourages them to make the tacit knowledge they have practised explicit.

The data show both precise and completed forms and less precise and partially completed forms. These examples illustrate how electronic documentation of performed work can contribute to greater professional awareness, both among the students and teachers. This is because actions become evident in the text and images, and on top of this, the student and the teacher converse physically in the classroom as to whether the work has been done, documented, commented on and rated. The aspects of tacit knowledge that have been expressed here are action, reflection, and interaction.

Joint Review in Plenary in Classrooms

In the data, I found several classroom observations that show how the teacher used the projector to show the whole class a student's solution to a task in OLKWEB and used this example as a starting point for a discussion on the task. This method can promote learning and development both for the student, who was given the assignment, and the other students in the classroom. Several students asked for feedback and received elaborate comments that

teachers had given on similar tasks. They also asked more questions concerning tasks where they had been in the same workplace with fellow on-the-job-training students.

Discussion

Research Question 1

The teachers and students who were interviewed and observed were quick to report on tasks they had carried out, and they received a quick response from their teacher. This response can initiate a dialogue that could be used to elaborate on the issue at hand and further the student's reflection on the subject in question. It was easy for the student to report from home or from the workplace. Pictures could be used easily since all the students had a mobile phone with a camera and knew how to operate it well. Writing on a keyboard is easier for most of these students than using pencil and paper. It is also much easier to store and access reports in OLKWEB than paper reports. All teachers know how easy it is for a student to lose or forget papers. I found that the teachers' use of OLKWEB enhances the communication between the teacher and students compared to traditional paper-based communication.

When OLKWEB improves communication between teacher and student, it is fair to assume that it also enhances the students' reflections and mastering of vocational knowledge compared to traditional paper-based communication. However, the data do not provide any direct statements from the students or the teachers about this aspect of the research, so I cannot answer this part of the first research question.

Research Question 2

What characterises a learning management system like OLKWEB is that communication between teacher and student is formalised and explicit; whereas elements of experience and action knowledge will be tacit in the sense that they cannot be verbalised. The teacher gave the assignments in writing and linked them to a curriculum goal. The students then performed the task/work and reported on what they have done in writing or with the help of photographs.

Schön (1983) believed that learners develop

greater skills through example learning in training. Example learning is based on the idea that the learner ascertains how the teacher performs work operations and then performs those operations under the teacher's supervision and guidance while receiving feedback from the teacher. Tacit knowledge is transmitted through acting. My data and observations show that it is possible to transfer tacit knowledge in many ways. The data show that the students must verbalise what they have done when writing a report in OLKWEB about what the work assignment was and how it was performed. This verbalization in writing means that the students must conceptualise what they have done and reflect on it. The contextual, functional and phenomenal structure of the work also must be explained (Johannessen & Olsen, 2008). This structure helps to make tacit knowledge explicit. The requirement for formalisation and making things explicit encouraged the students to convert their tacit knowledge into explicit knowledge. In the context, the transfer and integration of tacit knowledge is based on the development of relationships between teacher and student, based on trust and the teachers' basic helping attitude. Such a trusting relationship was present between the students and teachers that I observed.

Summary

Two questions were formulated. The first one was partially answered by the data that indicated that the use of OLKWEB enhances the communication between teacher and student; whereas, I found no data that could assert that the use of OLKWEB enhances the students' reflection on and the mastering of vocational knowledge compared to traditional paper-based communication, nor, for that matter, that it does not enhance it. The second question was answered affirmatively by the data and observations. This finding was counterintuitive as traditionally, tacit learning is transferred when the vocational learner ascertains how the teacher actually performs work operations and then performs them under the teacher's supervision and guidance with immediate feedback from the teacher. My observations and data show that a learning management system such as OLKWEB allows for the transference of tacit knowledge.

My findings indicate that documentation requirements through OLKWEB appear to strengthen the students' understanding of work tasks they will encounter as apprentices in the workplace. OLKWEB can serve as a relevant tool for enhancing students' learning. Documentation systems seem to strengthen the students' understanding of the task as a future professional skill and, in addition, also appear to strengthen the communication between students and teacher. In this communication where the vocational teacher transfers knowledge and facilitates the development and integration of experience-based and tacit knowledge through the learning management system, action, reflection, and emotional commitment are required from both the teacher and student. Tacit knowledge plays an important role in the transfer, and all three aspects – action, reflection and emotional commitment – must be present.

At the two high schools where I collected my data, I interviewed and observed three teachers and 18 vocational students. This is not a very large sample of research subjects, so my results cannot be said to be representative of vocational education in Norway. On the one hand, this is one limited study with a limited number of participants. On the other hand, however, a strength of the study is that it includes both students and teachers at different schools who have experience of using OLKWEB. This study indicates that the use of learning management systems represents progress in education. However, more comprehensive studies are needed, for example, one that compares different documentation systems to one another, while ensuring a greater breadth in both the number of participants and more and different vocations and trades included in the sample composition. Hopefully this study will inspire further and more comprehensive research into this field.

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[Where necessary, English translations of the references are in brackets. The translations were provided by the author of the article.]

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