



MagiCAD for Revit deployment in a company:

Introducing a framework for a learning path, and elearning
as a part of training

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<p>Sammandrag: Inom VVS-branchen har MagiCAD for AutoCAD nått en betydande position bland olika projekteringsmjukvaror i Finland och nordn. Progman har länge erbjudit kontaktundervisning i MagiCAD, men i och med att ett annat VVS-tekniskt CAD-program, Revit, blir ett alltmer vanligare verktyg, har det också uppstått ett behov att arbeta fram ett nytt ramverk vad gäller användarutbildning, något som i detta examensarbete kallas för inläringstig. Med inläringstig avser man hela den process som ett kundföretag genomgår när det tar i drift en ny mjukvara. Progman kommer i framtiden att erbjuda nätbaserade kurser i MagiCAD i syfte att bättre kunna möta de behov som växande marknader ställer på olika håll i världen. Detta innebär att traditionell kontaktundervisning och nätkurser (elearning) kommer i framtiden att fungera ihop så att de tillsammans blir ett effektivare sätt att undervisa slutanvändare i programmet.</p> <p>Eftersom detta ramverk berör Progmans kunder direkt, skickades det ut en enkät till några utvalda kunder som redan deltagit i MagiCAD for Revit-kurser, för att få veta om deras synpunkter vad gäller MagiCAD for Revit-kurser och elearning. Utifrån deras svar och diskussioner kring ämnet med experter, samt med visst stöd av pedagogiska principer, lades det fram ett förslag om hur en inlärningsstig kunde se ut för kundföretagens anställda som innehar olika roller. Dessa roller är VVS-ingenjör, mallspecialist, BIM-projektör och projektchef. Inlärningsstigen består av åtta steg, av vilka sex berör de här fyra målgrupperna. De sex stegen är <i>Inledning</i>, <i>Grundkurs i Ventilation & Piping (VP)</i>, <i>Fördjupningskurs i VP</i>, <i>Konsultering, BIM och MagiCAD for Revit</i> och <i>Arbetsgrupp för mallutveckling</i>. Dessa stegen består av kontaktundervisning, möten, konsultering och elearning. Alla grupper behöver inte genomgå varje steg, utan bara de som är väsentliga ur de respektive gruppernas synvinkel. En anställd kan också ha flera av de här rollerna samtidigt.</p>	
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<p>Abstract: In the field of HVAC engineering, MagiCAD for AutoCAD has reached a solid position amongst design softwares in Finland and northern countries. Progman has, for a long time, provided classroom training for MagiCAD, but as another CAD program, Revit, is becoming a more popular tool, a need for devising a new kind of end-user training has also appeared, in the thesis called learning path. Learning path refers to the entire process a customer company has go through when deploying a new software. Progman will also offer online courses (elearning) for MagiCAD to meet the need from growing markets around the world. This means that traditional classroom training and elearning are combined in the future in a way that enables an effective end-user training of the program.</p> <p>Because this concept directly concerns Progman's customers, a questionnaire was sent to customer employees who already have attended MagiCAD for Revit courses, in order to derive information on their views and opinions on MagiCAD courses and elearning. Based on their responses and on discussions on the subject with experts, and based on theories on pedagogical principles, a suggestion was presented on how a path of learning could be build up for employees in customer companies who have different roles. These roles are HVAC engineer, template specialist, data model specialist and project manager. Learning path consists of eight steps, six out of which concern these four groups. The six steps are <i>Introduction, Basic course Ventilation & Piping (VP), Advanced course VP, Consultancy, BIM and MagiCAD for Revit and Template workshop</i>. These steps are organized as classroom trainings, meetings, consultancy and elearning. Everyone of these groups do not have to go through all the steps, but only those that are essential from respective group's perspective. One employee can also have several of these roles simultaneously.</p>	
Keywords:	Elearning, mjukvara, implementering, inlärningsstig, slutanvändarutbildning, MagiCAD, Revit
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GLOSSARY

Additional tools	MagiCAD tools that have no direct connection in creating systems. Such tools are symbols, annotative texts and legends, for example.
Aftersales	Team in Progman that takes care of end-user training and support
AutoCAD	Cad program that MagiCAD uses as platform
BIM	Building Information Modeling
CAD	Computer aided drawing
Classroom	Course premises provided by Progman or third part
Collision control	A function in MagiCAD that checks for possible structural collisions or that different systems do not collide with each other
Discipline	Group of tools in Revit for designing different systems such as Ventilation or Electrical
HVAC	Heating, Ventilation, Air Conditioning
IFC Export	Industry Foundation Classes. A tool to export a Revit model to be viewed with an IFC model viewer program
MagiCAD	Name for the whole software

MagiCAD Common	Includes tools related to project management
Meeting	Occasion for knowledge sharing
MEP	Mechanical, electric, plumbing
Template	Provides predefined settings for a project including settings for views, system structure, line weights, scales etc.
On-site	Customer company office
Productive tools	By using these tools a user directly contributes to creating a system. Such tools are duct drawing and device installation.
Provision for Builderswork Openings	Tool in Revit that allows to make openings in structures for ducts and pipes (in questionnaire: Provision for Voids)
Revit	Cad program that MagiCAD uses as platform
VP	Ventilation & Piping
Webinar	A live occasion online where an instructor gives a presentation for attendees
Training manual	Discipline-specific (e.g. MagiCAD for Revit Ventilation & Piping) user guide in paper format or as a pdf-file.

FOREWORD

I want to aim my gratitude to all the people who have contributed to my thesis in many different ways, both at Arcada and Progman, for offering me the setting and mentoring, and the representatives in the customer companies for a valuable customer perspective. Special thanks go to my supervisor at Progman, Petri Piittala, for important feedback during the writing process, and the head of Aftersales, Jyrki Seppä, who gave me the assignment and the idea for the thesis.

Helsinki, 21 May 2017

A handwritten signature in blue ink, appearing to read 'Hemmo Määttä', is written over a horizontal line.

Hemmo Määttä

1 INTRODUCTION

This thesis is based on my work as a technical support trainee in Aftersales team in a Finland based software company called Progman. Aftersales team provides end-user training and technical support for the company main sales item, a CAD program called MagiCAD. Progman has a long experience in training HVAC and electrical engineers using MagiCAD for AutoCAD. However, another CAD program, Revit, has started to gain more foothold in different market areas, creating a need for a new kind of training concept. This is because it means, from an end-user perspective, to some extent “unlearning” from the old software and acquiring the new one partly with the help of elearning courses offered in the future.

MagiCAD training has so far been carried out as traditional face-to-face classroom interaction. Additionally, there are also tutorial Youtube clips and webinars available on different topics. But as markets are growing, a variation in training with the help of an online learning environment is much needed.

In my thesis I am trying to create a framework for how engineering professionals, depending on their job assignment, acquire a new software by attending both courses in this new online environment mentioned earlier and classroom courses provided by Progman, and in this way reach a level of sufficient competence and ability to use the MagiCAD independently, in such ways that correspond their field of expertise. This framework I am going to call learning path.

An idea of a learning path as steps to be taken was originally introduced by Jyrki Seppä, the Aftersales team manager. I have tried to refine and complete his idea about the learning path, that is, customer company engineering professionals taking steps in order to learn a new software. My contribution to this path is a more detailed specification of different people who attend the courses, and of course agenda. Moreover, I have defined the role of elearning for each step. Additionally, the thesis could ideally work as a tool for Progman when planning

courses and selling trainings. Departments, such as sales, could use this data as a practical tool that directly shows available options in different cases.

In this report, I am going to go through the methods I have used to compose a plan for a MagiCAD for Revit path of learning. The main body of research material consists of a questionnaire and discussions. I am going to analyze the findings after the theoretical background and discuss the benefits of elearning for everyone, both the service provider and the customers. Later I am going to present a plan for how a learning path could be constructed in detail to meet the needs of various engineering professionals, such as HVAC engineers and data model and template specialists.

2 METHODOLOGY AND BACKGROUND

As the results of this thesis directly affect the customers, it is natural that they are involved in the process as much as possible. This is why I chose a questionnaire and personal communication as the methods to gather information.

The outcome of this thesis presents the eight-step path covered in chapter 5, put together according to the feedback from the survey. In section 5.5 I am going to present the steps from three to eight giving a suggestion on the exact content of each step, both when it comes to classroom training and elearning. Steps one and two, which have no direct connection with training, are covered only briefly. This said, I decided to include those steps in the tables to remind what precedes the actual trainings.

The main questions I wanted to get answers for with the questionnaire:

- What MagiCAD functions the users would consider to be beneficial to learn by elearning?
- Were the classroom courses ideal in terms of workload and content structure?

In other words, I wanted to know how customers see the whole process and if it could be made better. Besides the survey and discussions, I have included pedagogic views on learning and together all these three work as a foundation for my thesis.

2.1 Progman and MagiCAD for Revit

Progman Oy is a Finnish software company that provides a CAD program designed for HVAC and electrical engineering. The software is called MagiCAD and it is an add-in program installed on top of another CAD program. The first MagiCAD release was in 1998. The software is used in approximately 25 countries. (1)

There are two CAD programs that MagiCAD can be installed on: AutoCAD and Revit, both developed by Autodesk, an American CAD software corporation. The first release of

AutoCAD was in 1982, that for Revit was in 2000 (2). These programs can be used independently but a user can purchase a MagiCAD license and use it together with AutoCAD or Revit as an add-in tool, hence the name MagiCAD for AutoCAD and MagiCAD for Revit.

Within the field of Finnish HVAC engineering, MagiCAD for AutoCAD has had the time to establish a strong position. Trend at the moment, however, seems to be that Revit will gain more popularity in the future and that is why it is important to react to this development. In some market areas, like Norway, Revit already has a more solid standing when compared to the current situation in Finland for example. (3)

Revit is, like AutoCAD, a CAD program with different disciplines. In this context the term discipline refers to a certain system, for example ventilation. This means that in the user interface, the tools meant to be used for designing this system, are gathered under this specific discipline tab (see fig. 1).

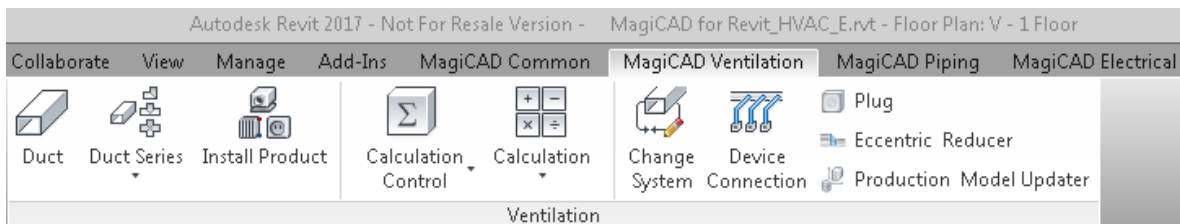


Figure 1. MagiCAD for Revit Ventilation tool ribbon.

In the picture above we can see the MagiCAD Ventilation tab active and the related tools displayed under it. MagiCAD tabs are displayed side-by-side with Revit tabs, as we can see in fig. 1, to the left from MagiCAD tabs there are for example Add-Ins, Manage, View and Collaborate.

One of the major differences between Revit and AutoCAD is that in Revit all the different systems (ventilation, piping etc.) exist in one single file whereas AutoCAD needs separate drawing-files for each floor that is connected to others with connection nodes. In Revit a user can look at different floors by choosing views.

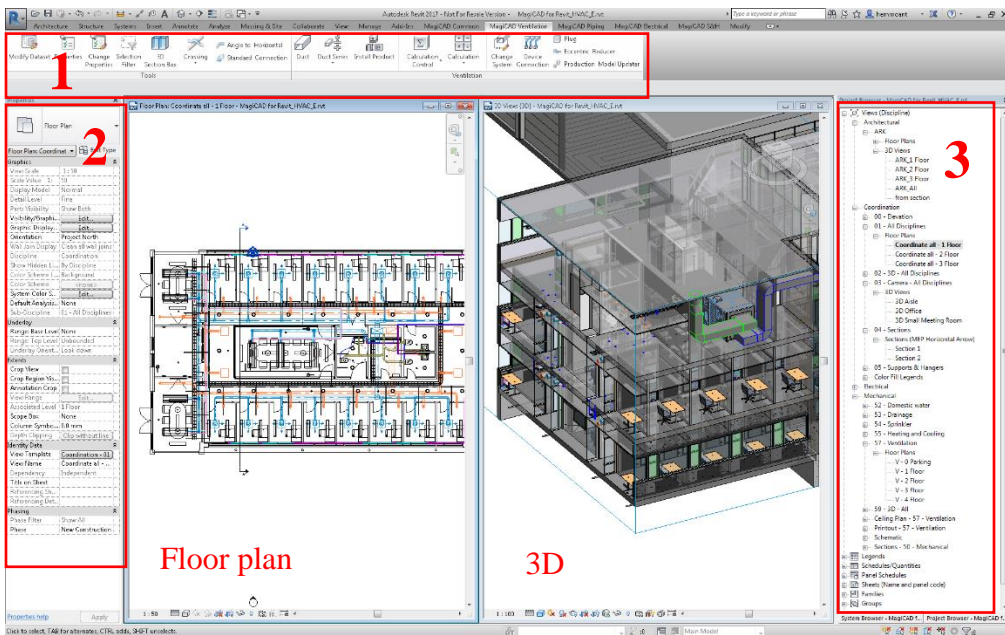


Figure 2. Revit display. A 3D-view on the right. A Floor plan view on the left.

In other words, all the systems exist in the same data model simultaneously but the user can decide which systems she/he wants to be visible and how, and which systems she/he wants to hide.

The picture above shows how a Revit interface can look like. On the right (frame no. 3) there is Project browser where one can choose between different views. On the top (frame no.1) there are tool ribbons and system tabs and on the left (frame no. 2) Properties. When for example to activate a device is activated, in Properties dialogue a user can see all the information in it. The views can be organized according to user's wishes. In fig. 2 the are two tiled views: a 3D overall view on the right, and on the left a view from above displaying a floor plan.

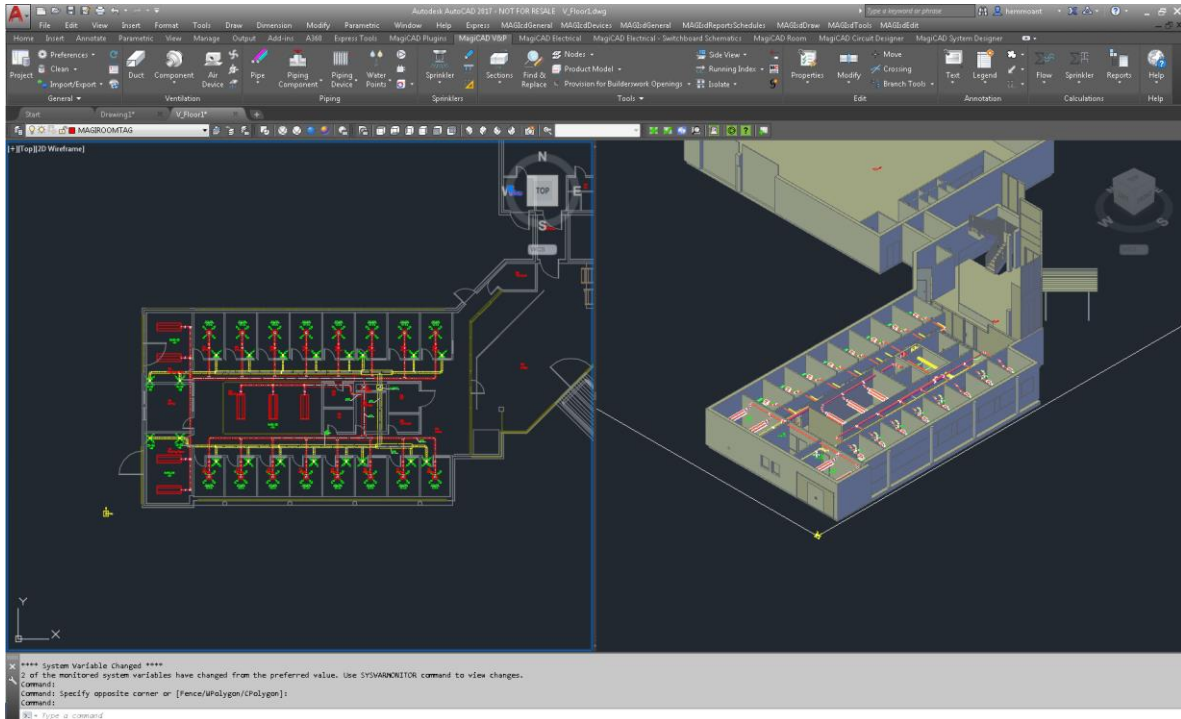


Figure 3. AutoCAD display.

In fig. 3 we can see a similar view on AutoCAD as it is displayed on Revit. The tiled picture on the right is the same view as the one on the left, but displayed in 3D. In AutoCAD examining different systems is more restricted and file-dependent than it is in Revit.

2.2 The respondents

There are three customer companies and their employees that participated in the survey. These companies have started to introduce and explore Revit and MagiCAD for Revit and possibilities to carry out projects with the software. Some projects have already been fully executed with MagiCAD for Revit. (3)

Among the company employees there are four different types of groups or roles that I have identified and that are involved in the eight-step process. There are people who have a better overall view on the deployment process, while others concentrate on daily engineering work. The four groups are HVAC designers, template specialists, data model specialists and project managers and they are explained in detail below:

- **HVAC engineers** is the group of engineers that execute the daily designing work. (3, 4)
- **Template specialists** work in collaboration with Progman's Revit specialists trying to create templates. The templates help the designers in their daily work as all the settings that steer drawing are strictly predefined. They are in a near collaboration with the Progman representatives and can therefore give important feedback. (3, 4)
- **Data model specialist** is a person who is needed when a new project is launched. Especially in an initial stage of a project they have to make many decisions concerning how different systems work together in the same data model. (3, 4)
- **Project managers** are people that do not necessarily use the software that much but they have to have an understanding on what the program is capable of. They are in the lead of projects that are carried out with MagiCAD for Revit. (3, 4)

I have made this grouping in order to contribute to a better understanding of customer companies and their needs. In chapter five I am going to go through the course objectives for each group.

All the respondents were familiar with the terminology used in the questionnaire because they had attended a basic course in Revit and the terminology is partly the same in MagiCAD for AutoCAD, a software they had used before.

2.3 The questionnaire

I chose to create a questionnaire because it is a good way to find out the respondents' potential thoughts and experiences about elearning or classroom courses something that is useful when creating content in elearning course modules. All the respondents have attended a classroom

course in MagiCAD for Revit. Therefore, the survey was also a possibility for them to give feedback on courses already held.

The questionnaire was emailed to seventeen customer employees in total, out of which seven responded. In addition to this, I had discussions with Revit experts, both with a professional from a customer company and one from Progman. They have experience on collaboration between Progman and the customer company along the whole process of Revit deployment.

The questionnaire consists of eight questions, with including sub-questions, which makes the amount of questions go up to fifteen in total. The questions were mainly open because of the complex nature of the topic. The small amount of respondents is to some extent compensated by the discussions with the professionals I had.

Questions one to three concerned classroom courses that the respondents had attended earlier, what expectations they had regarding them, how they felt about the workload and whether they found it easy to start using the software after the courses. Questions from four to eight was about what prior experience the respondents had on elearning and which Revit and MagiCAD for Revit functions or set of tools the respondents would find possible to learn by online courses. Questions seven and eight were about general feedback. The respondents could pass questions if they were not able to answer.

Accuracy and relevance could be brought up as important principles when devising a questionnaire. Survey questions have to generate appropriate information that supports the objective and the questions have to be comprehensible. A questionnaire shall not either refer to things occurred too far away in the past. (5, p. 27)

I tried to compile my survey in a way that the learning paths generated by it would reflect the responses in a best possible way, taking into consideration the situation before, during and after the classroom courses. I also wanted to keep the questionnaire rather short because the respondents would possibly answer it on their work time (see the questionnaire in appendices).

Through the discussions with the experts I wanted to know more about what kind of roles employees have in different stages of a project. That helped me define these four groups.

Also, I gained valuable information about company praxis concerning internal training, their thoughts about on-site consultancy and how the software deployment proceeds on a general level.

2.4 Delimitations

What I am not going to cover in this thesis is trial and Revit familiarization course. Trial version of a software is often a user's first connection to the software. When it comes to MagiCAD, it contains a short webinar presentation after which the attendee receives small exercises in pdf-form on the desired discipline. As for path suggestions, a trial could be considered to come first before anything else. Since this happens before a customer purchases the software, I am not going to cover it in this thesis. I am to go through all those processes that occur after the company has purchased the software. These two, trial and familiarization course, are mostly used for sales promotion.

Also I am not going to cover other disciplines than Ventilation and Piping which means that, for example, MagiCAD for Revit Electrical is not covered. Also, the outcome of this thesis concerns only the Finnish market area.

2.5 Theoretical background

My approach in creating a learning path relates to an idea of a so called blended learning. The idea is to merge online course modules with educator-led training sessions in order to gain benefit from both teaching methods. (7, p. 29)

Elearning means different things depending on how it is carried out. In this thesis It refers to modular training material that a learner accesses online. Its characteristics are self-paced and individualized progress and interaction with the course content. Tutorial videos guide the student step-by-step making up the core for the courses. These courses may consist of a varying amount of modules that are a product of single actions to achieve a desired outcome,

like device installation for instance. Modules may also provide students with different interactive exercises, not only learning by doing. (7, p. 89)

There are many reasons why elearning is potentially beneficial to customers in the Finnish market area, as well as for Progman. Some of these desirable benefits are:

- Elearning is time and place-independent. In an ideal situation this leads to economic savings for customer.
- Releases staff resources from training for other purposes.
- Takes into consideration individual learning styles and learner's prior knowledge
- More flexible and varied supply of course modules in different sizes and topics
- Takes away the excessive workload from classroom training making the content more easily digestible. (6)

The benefits of classroom trainings are among others the direct and effective live communication and interaction between the students and the instructor.

The software used to create online content is Lectora Publisher. It is an elearning development and content tool provided by Trivantis Corporation.

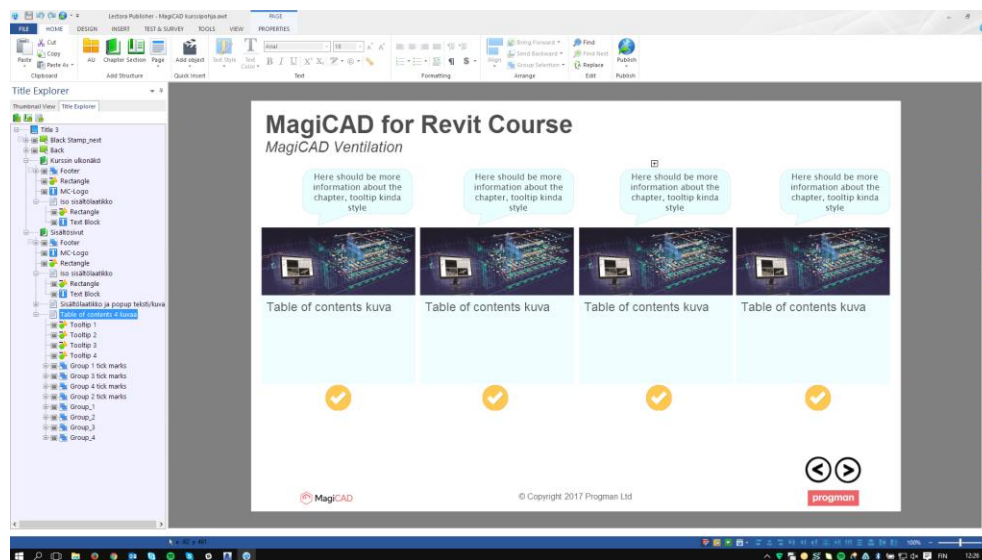


Figure 4. Lectora elearning tool.

In the picture above a Lectora desktop can be seen with tool ribbons and project tree menu on the left. Courses can be made responsive for different devices, like mobile phones and touchscreens. Modules consist of slides and they can be published for example in HTML form as a web page. There is a possibility to integrate interactive question patterns and exercises.

2.5.1 Guidelines behind execution of elearning courses

Constructing online education requires a conscious choice of a pedagogic strategy. An underlying principle, whenever education or learning is concerned is the so-called constructive alignment, a theory brought forth by John Biggs. He emphasizes “deeper understanding required rather than simply a list of topics to be covered” (9, p. 27). For example, when giving students a possibility to apply themselves in the software before the actual classroom training, they are more likely to gain deeper understanding on the topic rather than just learn by heart (9, p. 16). Constructive alignment is an outcomes-centered approach to teaching. Course objectives for students are defined in advance and, based on those objectives, the method of teaching is then designed in order to attain the set goals (8, p. 5).

Another element of constructive alignment is the so called 3P model. The three P’s are presage, process and product. Presage is what happens before learning. Process refers to what happens during it and Product is the learning outcome. The learning outcomes are a product of many things; student’s prior knowledge, how the goals of learning are set and interaction during learning, to name a few. (9, p. 18-19) These elements I have tried to take into consideration when developing the learning paths.

Another aspect of incorporating interactive elearning is intensifying learning. In an elearning environment a learner has the possibility to have influence over the pace at which a course is completed and at some extent even over the content and the flow of new information (7, p. 89).

Planning online course duration and workload is an important aspect in order to make participants feel motivated. Moreover, the more complex the material is that the learners are supposed to acquire, the more important it is that the environment is clear and does not cause distraction. Even though elearning enables presenting material in various ways, there lies a risk that this beneficial quality becomes a burden. The content must be carefully planned in order to maintain balance. (13 p. 15)

Even though the principles presented in this section concern primarily the way of constructing actual content for online modules, the same guidelines are useful on a higher level, that is, which pieces a course module consists of.

2.5.2 Elearning related issues to be solved

There are still many technical issues that have to be solved before full advantage can be derived from elearning. These issues have, for instance, to do with localization of course modules. Different market areas use different templates so one has to decide whether a market specified and tailor-made learning environment is possible and in which language this could be carried out. Different release versions cause problems as well. A customer does not necessarily have the particular release version of MagiCAD or AutoCAD that are used in an elearning module.

In an elearning environment, learners do not have possibility to a direct peer support or interaction with a teacher. This is because the implemented environment does not enable this at this stage. However, this might have an impact on their motivation why it is important to engage participants instead of just delivering a course. It is important also because online courses, in a way, delegate the responsibility of learning to the learner to a bigger extent than in a face-to-face situation. (13, p. 23)

The fact that a student cannot directly reach an instructor in an elearning environment has to be solved somehow if a problem situation occurs. These problems can be of a technical nature and they do not have to be learning-related. That is why a forum for students and instructors to meet is needed. One solution for this might be to offer a possibility for communication

between students and instructors in the same customer portal where elearning courses are supposed to be taken. Being available for the students in spite of the lack of direct interaction is crucial (6).

2.5.3 A step further in BIM thinking

BIM, or Building information modelling, describes a variety of activities that strive to represent building elements in a truthful, near real-life and intelligent way. BIM provides detailed information about MEP objects and systems, constructional elements and their mutual relations and visualization in different forms, all this in association with a life cycle analysis and collaboration between project contributors. (10, p. 1046.) In Revit collaboration occurs using a centralized model and so called worksets and these tools allow people to work on different parts of the same project simultaneously (11). A practical example of a BIM functionality is for example when a HVAC engineer clicks on an installed device in a data model receiving a lot of information on that device, such as a 3D model of the device, connection size, pressure drop, air flow volume, sound data etc. This instead of the engineer just being able to view a 2D visualization of the device in a drawing.

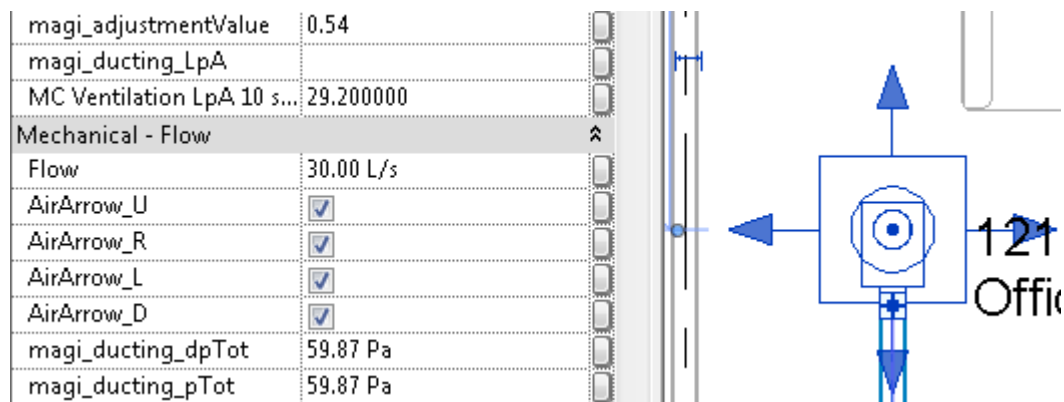


Figure 5. Air supply device and its properties.

In figure 5 we can see an air supply device and some product data on the left in Properties column. Once the user has activated a device in the drawing, she/he is provided with a lot of information on it.

When it comes to BIM functionality, in this thesis I concentrate on project management and operative collaboration. Revit allows other kinds of BIM related functions, such as building energy consumption or cost estimation, but they are not as connected to MagiCAD.

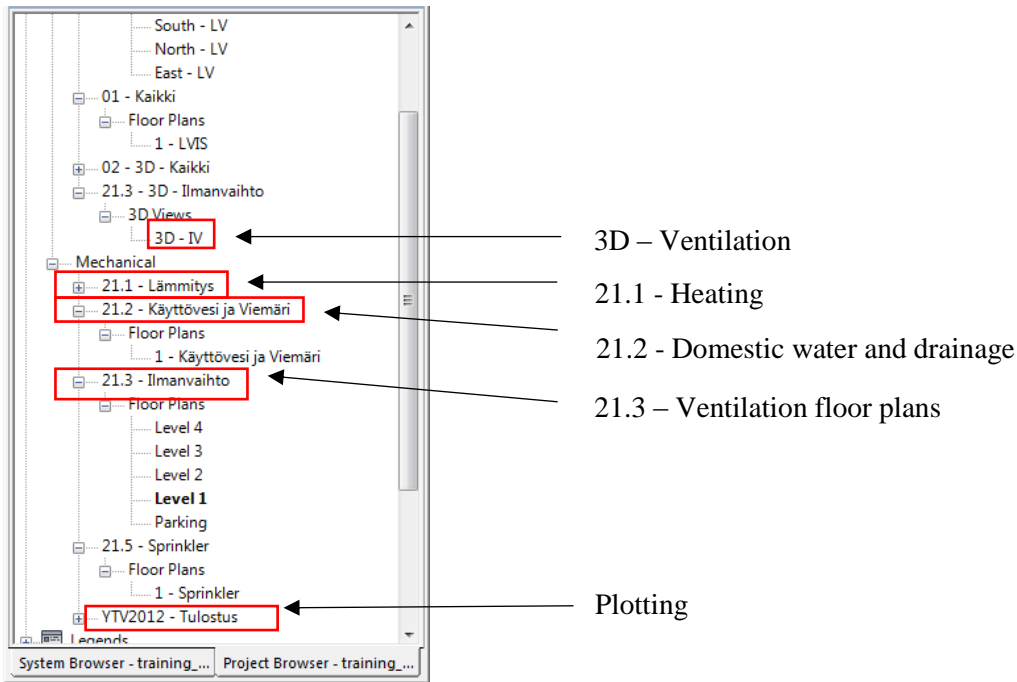


Figure 6. Revit Project Browser.

Figure 6 of a tree menu illustrates the idea of Revit project setup. All HVAC and electrical systems are in the same model and by clicking headlines and subheadings a user can open for example any system-related view (e.g. ventilation level 1) or a general 3D view. When a change is made in any of the views it does not need to be updated in other views because it is one single model.

In figure 6 we can also see how the template is categorized. The system numbering follows *LVI2010-nimikkeistö* directions on how HVAC systems ought to be marked according to a Finnish standard (12). Not only systems but also, when going deeper down in the hierarchy of separate parts or devices in a system, such as a fire damper, for instance, should be included in the standardized classification numbering system.

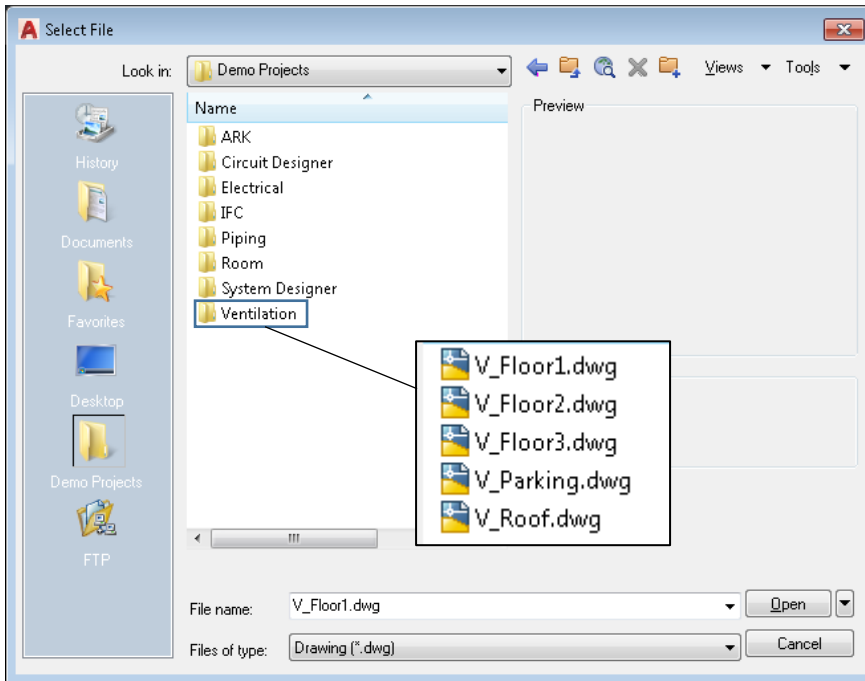


Figure 7. Project browsing in AutoCAD.

Project browsing and fetching desired drawings in AutoCAD happens through a traditional file selection, as presented in figure 7. When compared to Revit Project Browser (fig. 6) we can see that Revit allows a larger variety of different options in a single file.

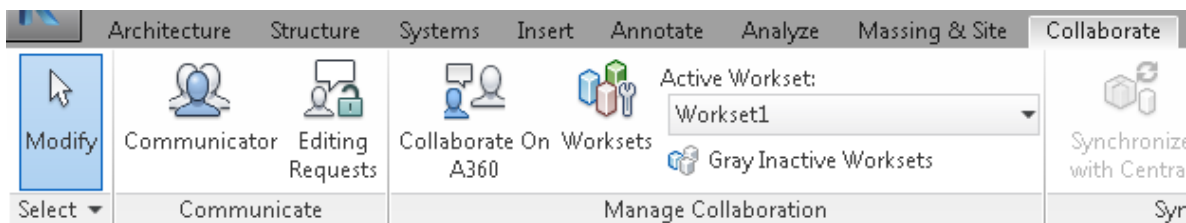


Figure 8. Revit collaboration tools.

In fig. 8 there is Revit collaboration management and other communication tools presented. A Revit project is divided into worksets (e.g. heating, electrical) that are handed out for the designer responsible for heating or the electrical systems, for example. They work on their respective worksets simultaneously and independently and they can update the central model on their own behalf when they choose. Project manager or data model specialist can view the central model where all the systems are presented in one model.

BIM related tools have no direct connection to basic drawing functionalities, but they have an essential role in engineering work with MagiCAD. Such tools are for example IFC and Navisworks Export, Collision control or Provision for Builderswork Openings. MagiCAD for Revit shares many of these tools with MagiCAD for AutoCAD.

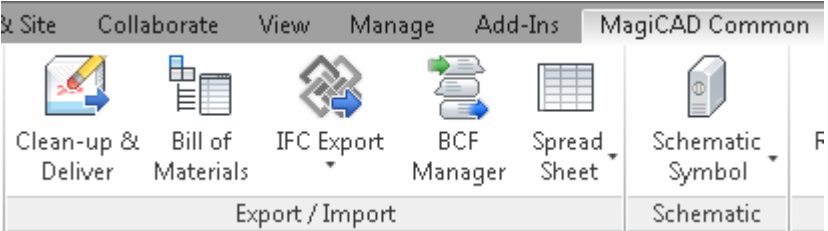


Figure 9. Export/Import tools in MagiCAD Common.

In the picture above we can see BIM related MagiCAD tools, such as Bill of Materials, IFC Export and BCF Manager that all are meant to be used for collaboration and communication between different project contributors. These tools have an important role from project management perspective because, for example, with the help of IFC Export, a model is transferred into IFC format and a third party is able to view the model outside the software, with specific IFC viewers.

3 CURRENT SITUATION

Progman organizes general trainings regularly a certain amount of times every year. There are 1-day and 2-day trainings. A learner can attend either a general MagiCAD for Revit course, or a company can buy a course that can be tailor-made. Engineers and other employees in smaller companies more often attend general trainings (3).

On a 1-day course – MagiCAD for Revit familiarization course – an attendee gets to learn the basic functionality in Revit and MagiCAD for Revit. But like trial, it is not meant to be an actual part of the path of learning. This is because trial and the familiarization courses are designed to make it easier for a potential customer to decide whether or not they want to purchase the software. They might even have Revit already and they consider on buying MagiCAD to make their work more effective. That is why I have not included it in my learning path.

Company-specific training can last up to three days. The agenda is based on general trainings but they can also be modified according to special wishes, so the courses can be combinations of, for example, basic and advanced courses, as the case has been for many MagiCAD for AutoCAD courses.

The first day is often reserved for discussing what Revit is, its basic tools, MagiCAD Common tools and other general background information. The next two days are discipline-specific training. When planning a tailor-made course, a fluent co-operation between the customer, Progman sales team and software experts is especially crucial. As for MagiCAD for Revit, there has already been general courses as well as company-specific courses. However, these private company-specific MagiCAD for Revit courses have so far mostly followed regular agendas because Revit is such a new software and that is why customers do not yet necessarily have any special wishes on course contents (3). Template developing (MagiCAD for Revit) has also taken place during a longer period in collaboration with experts in customer companies.

What there has not yet been is on-site consultancy, BIM training or advanced courses. All these course types has been put into practice with MagiCAD for AutoCAD but not with

MagiCAD for Revit. It is yet to be seen at what extent there will be demand on these topics concerning Revit. For now, all training happens in a classroom situation, except for webinars.

4 ANALYSIS

In this chapter I am going to analyze the questionnaire answers and discuss their relevance for each step.

4.1 Background information

Questions 1, 2.1, 3, 4 – 6 and 8 combine elearning and general background information, such as recipients' job titles and prior experiences on elearning or Revit before any courses. Among the respondents, there were one electrical engineer, three HVAC engineers and three data model specialists. Six out of seven respondents attended the template workshop. Here we can see that an employee may possess more than one of the defined roles.

According to the answers, many of the respondents did not have noteworthy prior experience in Revit or MagiCAD for Revit before the actual courses but some of them had independently acquainted themselves with the software.

Question number three was about what learning methods the respondents would see meaningful when acquiring a new software. All the methods (classroom, elearning, on-site, webinar) were seen as possible choices but it appeared that the majority considered classroom-centric training to have a primary role. However, this may have to do with the fact that the respondents did not have prior experience on elearning. On the other hand, when asked what functions they would like to learn by elearning, only one respondent mentioned the option where a student would practice completing a whole project in an online course module, that is, everything from setting up a project, designing the systems, and last, publishing it. This suggests that the role of elearning, at least for now, is seen as supportive. Hence, using the idea of blended learning when developing the path of learning, in this case, reflects the response received from the survey and the discussions.

Question four was about if the respondents had used any elearning application before. None of the respondents had done so. The respondents experiences might have helped Prozman in avoiding mistakes when creating online content in the future.

In the last question, number eight, the respondents had the possibility to give general feedback concerning training, elearning or co-operation between Progman and the customers.

4.2 Introduction to Revit

When it comes to question number 2.2 about an introductory course, the respondents felt positive about the idea of such a module in the form of elearning. This is how the training provider could ensure that course attendees are on a similar starting level. An introductory course module might make the classroom learning more effective and even make the first classroom day unnecessary, depending on how big a role it is given.

Regarding to the discipline-specific, physical training manuals in paper format or as a pdf-file, one respondent suggested that it could be handed out before the classroom phase of the training. This could be done once the students are about to start going through the introductory module and the manual could be a supportive element from the beginning, a material a student could go back to even outside the trainings. In an introduction course, the users are provided with guided preliminary information instead of them trying to independently find scattered information from, for example, YouTube or similar sources.

Introduction would also be the same for everyone regardless of potential discipline-specific courses that follow. This is an essential factor considering the fact that aiming for generic courses (non-market area-specific) reduces the need for creating content to elearning courses.

The responds suggest also that there is a need for a course consisting of pure Revit functionalities. Basic knowledge in Revit is needed in order to begin learning MagiCAD. This could be included in an introduction course.

4.3 MagiCAD Ventilation & Piping

Questions 2.3, 2.4 and 2.5 were about content and expectations course attendees had regarding the course they had taken, and whether they would see it beneficial to learn about the differences between Revit and AutoCAD during courses.

Two respondents answered they would like to be introduced in the differences between AutoCAD and Revit (question 2.4). Many HVAC engineers have a strong expertise in MagiCAD for AutoCAD and they may feel it difficult to acquire Revit having such a background because it is hard to avoid comparing the two softwares with each other. However, it would be challenging to integrate an aspect of this kind in training because it would distract users from the learning itself.

When it comes to the amount of new information on the courses (question 2.3), most respondents considered the workload to be suitable, but one respondent found it to be excessive. This respondent suggested that training could be chopped up in smaller entities. This is partly the idea behind elearning. When it comes to basic training, a natural place for elearning would be immediately before and perhaps after basic training, if the basic course training is organized as classroom training, that is. Elearning is also seen as an additional tool, whereas classroom training still is the main source of learning.

Contentwise, it seems that expectations for the course were met (question 2.5).

4.4 MagiCAD template workshop

Question number seven was about template workshop. It was seen as a necessary forum because template in Revit has a big impact on how the design work is done. General opinion about the meeting was positive and that template developing work should be continued.

The idea behind a template workshop is to come up with a MagiCAD for Revit template that follows certain standards and makes the daily design work with MagiCAD as fluent as possible. It is a forum for template specialists to share ideas and efforts. Since the attendees were companies located in Finland, there is a possibility to create general guidelines and have impact on the development of the product. This requires cooperation between the meeting attendees and that everybody's wishes are taken into consideration (4). When a customer purchases MagiCAD, a ready-made template file with Finnish HVAC standards comes along with the software. This template is partly a result of these workshops (3).

MagiCAD Template workshop is not easily converted to an elearning course but there is still possibilities to make template making more approachable for users by introducing principles of template making in an elearning module. A part of the respondents also considered this as a possibility. It is also challenging to compose an agenda for template workshops because it is a meeting where different views are discussed, rather than training.

4.5 BIM with MagiCAD and advanced training

Question number six was about tools and functions that the respondents would find useful to learn with the help of elearning. Four out of seven respondents answered Import/Export. This confirms my assumption that these tools might be suitable for being covered with an elearning module.

According to the respondents, BIM and project management related tools are such functions that they would like to learn online; worksharing, annotative tools like Sheet manager, Legend tool and Tag tool, IFC export, Property set manager and Provision for Builderswork Openings, to name a few examples. All these functions are not directly related to drawing and perhaps these functions are not used in everyday work by HVAC engineers. When thinking about what elearning modules Progman could offer in the future, modules that are based on one single function might be useful because then the users could choose exactly the modules they need, for example in a repetitive purpose.

4.6 After training

Question 2.6 was about what happens after training. It plays a big role in how a new software is acquired. Three of seven learners considered it challenging to begin with independent work after training. Whether or not the students are able to start using the software after training depends on many issues but with the right tools it can be facilitated. My conclusion regarding this is that training manual could have a role in this matter. Whenever a student attends a MagiCAD course, Progman provides them with a discipline-specific training manual in paper format or as a pdf-file. The material follows the course agenda but depending on how fast

the topics are covered on the course, the teacher does not necessarily have time to go through everything in the manual. The manual is, however, not often used during the courses but rather for self-studying which is meant to take place after the course. In this case there is a risk that the manual is not fully utilized by the student, but with the help of right kind of exercises that the training manual provides we have the opportunity to activate the student more than before. This would also be the easiest way for Progman to take care of students' continuous post-training learning, without the need to create elearning modules for this. As mentioned before, the training manual could be introduced to the students already during an introductory phase.

Some companies may offer their designers rehearsal projects of their own or other possibilities once they have completed courses, so that they get in contact with independent design work as soon as possible (4). All companies do not necessarily have this possibility so that is why it is beneficial that Progman offers such a tool. This physical training manual might also have a role when preparing students to following courses, such as advanced course for instance.

4.6.1 On-site consultancy

Consultancy is a follow-up process. It is a way for Progman to ensure that everything goes as planned. The customers have the opportunity to take up specific questions or problems extensively regarding any topic. Consultancy can take place, for instance, after the customers have had time to apply themselves to the software independently.

In order to gain full potential from consultancy it is important that there is a clear plan how this is carried out. One alternative here would be that once the course attendees have had time to use the program independently, they gather questions and issues that have occurred along the way and those issues are then solved with the help of an instructor from Progman on specific occasions reserved for consulting.

Consulting is not primarily meant to be a way of teaching new things. It is merely a guidance to overcome obstacles emerged along the way in a face-to-face situation.

5 LEARNING PATHS FOR EACH GROUP

In this chapter I am going to present course paths (5.1 – 5.4) and course module contents (5.5.1 – 5.5.5) that could fulfill the training needs for the four groups by combining classroom training with elearning. Each step that are presented in the tables and concern the group in question, are marked with blue color, others are toned in grey. The goal is to present the tables in a way that they could be used as a guideline in MagiCAD for Revit training planning or as a tool by sales department when they offer training and tailor course trays in collaboration with customers.

I have separated the steps from each other with subheadings. Steps number three, four and five belong under the subheading *Introduction and discipline-specific training*. Six, seven and eight belong under *Consultancy and project management*. I made the division because of the different nature of the steps. Steps 3-5 are more discipline-specific than steps 6-8. The following tables are an indicative suggestion. In reality, one might not complete the steps in the exact presented order, especially regarding steps 6-8, because for example consultancy can take place earlier than presented in the table. It might also be difficult place BIM course and template workshop exactly on a chronological line in relation to the other steps.

As mentioned in the beginning of the thesis, steps number one and two have no direct connection to training. Steps one and two are negotiations with customer. The customer estimates how many of their staff members need training and decides the number of software licenses they need, and for which disciplines (Ventilation, Piping, Electrical or Support & Hangers).

5.1 HVAC engineer

The first course package is meant for HVAC engineers. It is a suggestion that covers the whole path from the beginning to the end, when the user already is able to work independently with MagiCAD for Revit.

The biggest change concerns the three-day long basic course. According to my plan, the first day, that has so far been carried out by traditional face-to-face training, is replaced with elearning. The student would complete this introductory module before attending the classroom training. This way the learners only have to attend a 2-day-classroom course. The idea is make the course more available and appealing, potentially even cheaper, because it is, for employer, a logistical and schedule-related challenge to find a 3-day slot for employees to attend a course that long (3). This would also be a good way to ensure that the learners are on the same level when they attend the classroom course. When introduction is carried out by elearning, classroom courses can begin by creating a new project.

Table 1. The learning path for HVAC designers.

Steps	What	Goal	Means
1	Kick-off	Scope of deployment is agreed.	Meeting
2	Assessing competence development needs	To understand the level of competence in a customer company	Meeting
Introduction and discipline-specific training			
3	Introduction	Understanding basic Revit functionalities	elearning
4	Basic course VP	Learn how to use discipline specified MagiCAD	Classroom
5	Advanced course VP	Deepen the skills and understanding of the program	Classroom/elearning
Consultancy and project management			
6	Consultancy	A follow-up to ensure fluent deployment	On-site
7	BIM and MagiCAD for Revit	BIM functionality that MagiCAD enables	Classroom/elearning
8	Template workshop	Template knowledge sharing.	Meeting (+elearning)

After the basic course and before consultancy or advanced course it is important that students use the software regularly. This can be done for instance with exercises in the training manual.

When it comes to the advanced course, my solution is that classroom training is offered, in the same way as it is currently done for MagiCAD for AutoCAD. At this stage, users might have very varying skills in the software (3). Others might have had better opportunities to get acquainted to the program than others. Depending on personal preferences and skills a user could attend a classroom training or take the same training online, and perhaps, if they choose, leave out some tool modules that they are already familiar with. This is how a user can independently contemplate the personal need for training and choose suitable elearning modules. Moreover, if elearning modules would be chopped up in suitable entities, they could be purchasable for repetitive purposes after trainings.

The BIM course and the advanced course have partly overlapping agendas, at least when it comes to collaborative tools. If a HVAC engineer wants to learn more about BIM functionalities, she/he can choose suitable elearning modules without having to go through the whole BIM training.

5.2 Template specialist

The second course package, the most extensive one, is designed for template specialists. Their path is otherwise similar to the one for HVAC designers, but template specialists attend template workshops. Template making requires familiarity with the program and a template specialist could, for example, take the template elearning module before attending the meeting.

Table 2. The learning path for template specialists.

Steps	What	Why	Means
1	Kick-off	Scope of deployment is agreed.	Meeting
2	Assessing competence development needs	To understand the level of competence in a customer company	Meeting
Introduction and discipline-specific training			
3	Introduction	Learn about basic functionality in the program, both MagiCAD and pure Revit	Elearning
4	Basic course VP	Discipline-specific learning.	Classroom
5	Advanced course VP	Deepen the skills and understanding of the program	Classroom/elearning
Consultancy and project management			
6	Consultancy	A follow-up to ensure fluent deployment	On site
7	BIM and MagiCAD for Revit	BIM functionality that MagiCAD enables	Classroom/elearning
8	Template workshop	Template knowledge sharing.	Meeting (+elearning)

As well as data model specialists, template specialists can be considered to be Revit key users. They may have an important role in mentoring other designers, because in addition to what Progman provides for training, the companies give guidance in Revit internally, too. The usage of new software may happen for instance so that it is initially tested with smaller projects, before moving on to bigger ones (4).

As mentioned before, offering template workshop online is not possible. However, basic principles in making templates in Revit could be taught with the help of elearning.

5.3 Data model specialist

Data model specialist is a person who is needed when a new project is launched. Especially in the beginning they have to make many decisions concerning how different systems – HVAC, electricity, constructions – are combined in the same model. These systems might even be on the responsibility of different companies, which adds complexity. In other words, a data model specialist has the control over and administrates an entire 3D data model of building.

Table 3. The learning path for model specialists.

Steps	What	Why	Means
1	Kick-off	Scope of deployment is agreed.	Meeting
2	Assessing competence development needs	To understand the level of competence in a customer company	Meeting
Introduction and discipline-specific training			
3	Introduction	Learn about basic functionality in the program, both MagiCAD and pure Revit	elearning
4	Basic course VP	Discipline-specific learning	Classroom
5	Advanced course VP	Deepen the skills and understanding of the program	Elearning/classroom
Consultancy and project management			
6	Consultancy	A follow-up to ensure fluent deployment	On-site
7	BIM and MagiCAD for Revit	BIM functionality that MagiCAD enables	Classroom/elearning
8	Template workshop	Template knowledge sharing.	Meeting (+elearning)

A model specialist does not necessarily have to possess knowledge of template making or even discipline specific functionality on advanced level. The importance of BIM, though, is emphasized.

5.4 Project manager

The fourth path is designed for project managers who do not necessarily use engineering softwares in their daily work. There is still certain tools and functionalities that they need to know, such as Bill of materials and other functions that are essential from a project management perspective.

Table 4. The learning path for project managers.

Steps	What	Why	Means
1	Kick-off	Scope of deployment is agreed.	Meeting
2	Assessing competence development need	To understand the level of competence in a customer company	Meeting
Introduction and discipline-specific training			
3	Introduction	Learn about basic functionality in the program, both MagiCAD and pure Revit	elearning
4	Basic course VP	Discipline-specific learning	Classroom
5	Advanced course VP	Deepen the skills and understanding of the program	Classroom/elearning
Consultancy and project management			
6	Consultancy	A follow-up to ensure fluent deployment	On-site
7	BIM and MagiCAD for Revit	BIM functionality that MagiCAD enables	Classroom/elearning
8	Template workshop	Template knowledge sharing	Meeting (+elearning)

Many project managers might have experience in MagiCAD for AutoCAD and therefore they already know how to use the software, but now, as Revit is becoming more popular, they should be able to do the same thing MagiCAD for Revit. Project managers, however, rarely attend MagiCAD courses and this is why I have created a learning path that consist mainly of elearning or on-site occasions. Also, they do not necessarily need that extensive discipline-specific training.

6 LEARNING PATH IN DETAIL

Principles of constructive alignment, 3P and blended learning are an underlying guideline in the path. With introductory modules we pay attention to a student's starting point for the whole path and at the same time, emphasizing the goal of training, a complete ventilation system for example, we can contribute to the student's deeper learning stimulating him/her with different approaches, such as classroom training, elearning and handing out training manuals including exercises. All this without forgetting interaction with other students.

In my thesis I have given elearning a certain role as a supportive way of learning but we have to make sure the offered course paths are coherent and cover all the needed functions, irrespective of a learner choosing an elearning module or a classroom training. The quality has to be as high in both ways of learning.

In this section I am going to present in detail what kind of bits and specific tools each step consist of. Also, I have defined a course objective for each step. I begin with step three since it is the first step where training is involved.

6.1 Introduction

Table 5. Step 3: Introduction.

3		
Elearning	Introduction	Revit user interface
After the introduction the student is aware of the role of views, templates and datasets in Revit. The student is also familiar with both Revit and MagiCAD tabs and tool ribbons, and the user interface in general.		Views
		Tools
		Revit families
		Basic functions
		MagiCAD user interface

Step number three provides basic information about MagiCAD and Revit. As mentioned in the section about guidelines behind execution of elearning modules, it is important what happens before training. In an introductory module we have possibility to motivate the student by giving a preparatory glimpse in the program and what they are about to learn in

following courses, thus making sure that the things to be covered later on during the classroom training are not entirely new to the students. In an ideal situation this means that the students' level of skills are closer to each other in the beginning making learning more effective.

As this step is supposed to replace the first day of a three-day long classroom basic course, it consists of non-discipline-specific basic functionalities mainly in Revit but also in MagiCAD, such as tabs, tool ribbons and project browser. Since the first step is an elearning module, the students can go through it at their own pace.

6.2 Basic course VP

Table 6. Step 4: Basic course VP.

4	
Classroom	Basic course VP
After the course the student is able to use the key functions and productive tools when it comes to setting up a new project, drawing ducts, pipes and installing devices and managing Revit views. The student is aware of the basic principles behind calculations and knows how to perform calculations, such as sizing and balancing, to a simple system created during the course. The student is also able to use text tools to attach annotative text elements, text flags, to objects. Additionally, the student is introduced on a basic level in additional tools, such as worksharing, printing and reports.	New project:
	Worksharing:
	- Worksets
	- Central file
	User settings:
	- MagiCAD settings
	- Dataset
	- Creating duct series and systems
	Ventilation:
	- Installing devices and drawing ducts
	- Calculations
	- Duct Series
Options and editing:	
- Editing tools and running index	
- Parameters	
- 3D	
- Filter	
- Interference check	
Heating and cooling:	
- Installing devices and drawing pipes	
- Calculations	
Tap water:	
- Installing devices and drawing pipes	
- Calculations	

	Waste water:
	- Installing devices and drawing pipes
	- Calculations
	Annotation:
	- Tag tool
	- Edit text
	Reports:
	- Inventory
	- Bill of materials
	Printing:
- Sheet manager	

Step four is the most extensive of all the steps and makes the core of discipline-specific learning. Discipline tools, Ventilation and Piping, are also the main tools for HVAC designers. It would be challenging and time-consuming to create an elearning course package for such a large entity, and that is why I have decided to retain it as a traditional classroom course. The course is a 2-day classroom course led by an instructor where students have opportunity to interact with each other and the instructor. Most of the tools are directly linked to drawing actual ducts and pipes and installing devices, like air terminals and radiators. Project management tools, such as bill of materials and central file are also covered, but not as extensively as in an advanced course.

In the beginning of a basic course, students are told what the outcome of the course is, for example a complete ventilation system with all the annotative elements and performed calculations, in order to help them comprehend a bigger picture and motivate them to learn.

6.3 Advanced course VP

Table 7. Step 5: Advanced course VP.

5		
Classroom/elearning	Advanced course VP	Collaborate:
After the course the student has deep knowledge about MagiCAD tools in discipline-specific situations and is able to use the software independently and extensively. The student has deeper understanding of calculations and is familiar with systems that are not covered in basic course, such as shunt groups and heat exchangers. The student is introduced on advanced level in functionality in additional tools, such as reports, legends and symbols.		- Manage Collaboration
		Actual ducts and duct details:
		- Duct Series and drawing
		Sheet manager
		Symbol management:
		- Create, convert and manage symbols
		Export/Import:
		- IFC, Navisworks, Bill of Materials
		Legend tools and reports
		Calculations:
		- Summation, sizing, balancing
		Substation and shunt group:
		- Installing

Advanced courses are discipline-related and they have only been organized for MagiCAD for AutoCAD, but not Revit. Advanced courses share to some extent the same agenda with basic courses, but with a deeper insight in the covered topics. Advanced courses are useful because due to the complex nature of the softwares, Revit and MagiCAD, the students might not be aware of tools that facilitate the everyday engineering work (3). This even if they had used the software for a longer period of time.

6.4 Consultancy

Table 8. Step 6: On-site consultancy

6		
On-site	Consultancy	Follow-up to ensure fluent deployment
After consultancy the user is more skilled to perform the daily work and better equipped to overcome problem situations.		

Consultancy happens on-site and it is a chargeable service. There is no specific agenda for it, but the things that are going to be covered are agreed on between the service provider and customer in advance. A practical example for this could be a case where a project manager has a problem or a question related to viewing a model and picking up certain information from it. She/he can now turn to an instructor during consultancy, or if it is an urgent problem, she/he can choose a suitable elearning module in order to deal with the particular issue on hand. Additionally, there is also other means than training related support available. The manager can contact the Aftersales technical support team for help by email or phone.

6.5 BIM and MagiCAD for Revit

The tools in basic course and the covered topics are connected to each other and follow each other in a logical order. For example, a simplified workflow in basic course could be the following, from the first to the last: drawing ducts, installing air terminals, making annotations and text flags, performing calculations, that is, making a simple but complete system. In BIM and advanced courses, on the other hand, the tools that the student learns to use are perhaps, to a more extent, separate entities. That is why it is relatively easy to make elearning modules out of them, the content creator does not have to contemplate the mutual relations of the modules as much as with modules that are more dependent on each other.

Table 9. Step 7: BIM with MagiCAD for Revit.

7		
Classroom/elearning	BIM with MagiCAD for Revit	BIM
After the course the student is familiar with BIM in general and is able to use BIM related tools in both MagiCAD and Revit in collaboration with other project contributors.		<ul style="list-style-type: none"> - What is BIM? - BIM and Revit - BIM advantages - BIM and MagiCAD - Collaboration tools

Besides the actual tools and functions, a comprehensive BIM thinking is covered during a MagiCAD for AutoCAD BIM course. As Revit is meant to be a tool for BIM design, trainings should also reflect this aspect. One of these BIM-related tools is worksharing, missing in AutoCAD but an essential tool in Revit. Since data model specialists have an important role in Revit projects, this module is designed especially for them. If Revit grows in Finland, providing training for these tools becomes important.

6.6 Template workshop

Table 10. Step 8: Template workshop.

8		
Elearning	Template workshop	Principles of creating a template
After the course the student is aware of the principles behind template making the technical procedure of creating one.		
Meeting	Template workshop	Template meeting, knowledge sharing
After the meeting the attendees are more aware of different perspectives and practical solutions concerning templates. They have been shared with information that they can utilize in their own companies.		

Working on and revising a template is a preparatory process. The more it is developed, the less it needs to be paid attention to. Some companies might use MagiCAD's ready-made

templates, while other companies may want templates to be edited according to their needs (3). The latter can be worked on for example by on-site consulting. However, the more the template is developed in the beginning, the easier the everyday engineering work becomes and the less there is need to do anything about the template in the future. In principle, step five is a question of two different things; template meeting attendees discuss the underlying guidelines concerning templates, whereas an elearning module only presents the principles of creating one from a technical perspective. It is recommended that employees working with templates take the elearning module before attending the meeting.

7 DISCUSSION

In the future it is possible that elearning covers a larger part of the software and achieves a role that is no longer a supporting one but sets the target higher in teaching larger entities. The feedback from customers has been quite clear that elearning should, for now, have a smaller role that supports classroom training. However, at the same time new disciplines are under development, such as Supports & Hangers and MagiSchema that customers would like to get training to and – as demand from customers dictate to a big extent what kind of elearning courses Progman provides – Progman has to consider on providing full-scale elearning modules for entire disciplines as well in the future.

As a general notice can also be said that, since elearning is a training form that is easier available than classroom training, it enhances employee's possibilities for continuous acquiring of new skills, which is interesting from a modern working life perspective.

When it comes to differences between the two programs, AutoCAD and Revit, it is not necessary to emphasize differences between the two softwares during the actual courses. However, a separate module to enlighten learners about Revit workflow compared to AutoCAD may be useful because it would perhaps help them to “unlearn” from AutoCAD.

The magnitude elearning is going to have in the future is a result of many things. How many hours does it take to product one hour of elearning material? How much customers are willing to pay for such courses? What is the solution for localization and version release issues? These questions need answers in the future.

At the moment when Revit has not yet gained full potential in Finland it is a good opportunity for Progman to impact on how uniform the practices are on the field of HVAC engineering. The template in Revit has a bigger role than in AutoCAD, it pushes users into a more uniform practice instead of company-specific solutions. (4)

7.1 Conclusion

The six-step learning paths differentiated according to the four groups of professionals and presented in detail in chapters five and six make a framework on how an engineering professional could learn to use a software combining learning in different environments. With the help of these paths Progman is able to recognize different needs that customer companies might have and, in an ideal situation, Progman could also be able to use these paths and tables when planning on how elearning is implemented as a part of training in the future, together with traditional classroom training.

The four different roles are HVAC engineers, template specialists, data model specialists and project managers. The six steps for these groups are Introduction, Basic course VP, Advanced course VP, Consultancy, BIM and MagiCAD for Revit and Template workshop. Not all steps concern all these four groups, but the paths are designed taking into consideration the specific needs for every group. On the other hand, one employee might have several of these roles simultaneously. The detailed paths presented in chapter six provide information on the functions in MagiCAD for Revit that are covered in the steps. Also, I have defined a course objective for each step.

The main point or goal of elearning is not to decrease the time spent in trainings but to even out the workload and make training material better available and appealing in a form that enhances a learner's knowledge building. Even though an uncertainty regarding MagiCAD for Revit trainings prevails because of the slight experience on trainings, this thesis gives a guideline how blended learning could be executed when elearning is available in wider extent, maintaining a suitable pedagogical approach

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APPENDICES

Appendix 1. The survey

Tämän kyselyn tarkoituksena on kartoittaa asiakkaidemme toiveita ja mielipiteitä koskien MagiCAD for Revit -kursseja ja tulevaisuudessa käyttöön otettavaa MagiCAD eLearning -verkko-oppimisympäristöä, eli laajemmin sanottuna koko sitä niin sanottua oppimispolkua, jonka henkilöstö käy läpi uuden ohjelmiston omaksumisessa. Toivomme palautteen avulla voivamme kehittää MagiCAD for Revit -kursseja vastaamaan paremmin asiakkaiden tarpeita ja helpottaa uuden ohjelmiston implementointia asiakasyrityksissämme. Antamanne palaute eLearningistä taas auttaa meitä määrittämään verkkokurssien mahdollista roolia tulevien MagiCAD for Revit -koulutusten osana.

Kyselyyn voivat toisin sanoen vastata kaikki, jotka ovat jo osallistuneet MagiCAD for Revit -kurssille, tulevat osallistumaan tai joilla on kokemuksia tai odotuksia eLearning-kurssien suorittamisesta yleisesti.

Jokaisen kysymyksen alla on tilaa vapaalle kommentoinnille. Vastaukset käsitellään luottamuksellisesti.

1.

Työtehtäväsi

2.

Oletko osallistunut MagiCAD for Revit -kurssille? Jos et, siirry kohtaan 3.

2.1

Olitko käyttänyt MagiCAD for Revitiä ennen kurssia?

Kyllä En

2.2

Olisitko halunnut saada jonkinlaista ohjattua perustietoa tai pohjustusta MagiCAD for Revitin käyttöön ennen kurssille osallistumista esimerkiksi jonkunlaisen sähköisen kurssikokonaisuuden muodossa?

Kyllä En

2.3

Koitko kurssilla annetun tietomäärän olleen sopiva?

Riittämätön Sopiva Liiallinen

2.4

Toivoisitko, että koulutuksessa kiinnitettäisiin enemmän huomiota MagiCAD for Revitin ja MagiCAD for AutoCADin eroihin?

Kyllä Ei

2.5

Koitko, että koulutus vastasi niihin odotuksiin joita sinulla oli?

Kyllä Ei

2.6

Koitko, että kurssin jälkeen oli helppo alkaa omatoimisesti perehtymään ohjelmiston käyttöön syvemmin?

Kyllä Ei

3.

Millä tavalla mieluiten opettelisit uuden ohjelmiston käyttöä?

Kurssimuotoinen opetus luokkahuoneessa

Webinar

eLearning

On-site-mentorointi

TÄMÄN OSION KYSYMYKSET KÄSITTELEVÄT ELEARNINGIÄ.

4.

Oletko aikaisemmin käyttänyt jotain eLearning-sovellusta tai suorittanut jonkin eLearning-kurssin?

Jos et, siirry kohtaan 5.

4.1.

Mikä kurssi oli kyseessä?

4.2.

Oliko kurssissa joitain mielestäsi erityisesti hyviä asioita? (Liittyen esimerkiksi videoihin, tehtäviin tai muuhun sisältöön)

4.3.

Entä huonoja?

5.

Voisitko ajatella opettelevasi MagiCADin käytön kokonaisuudessaan verkkokurssin avulla? (1=en missään nimessä, 5=ehdottomasti)

1

2

3

4

5

6.

Onko MagiCADissa jokin osa-alue, jonka näkisit mielekkääksi opetella eLearningin avulla?

- Import/Export (IFC, BCM, Property Set Manager, Provision for Voids)
- Templaten luonti
- Projektin julkaisu (Sheet Manager, Legend Tool, Tag Tool)
- Projektin luonti ja hallinta (Dataset, Work Sharing)
- Symbol Management
- Laskentatyökalut
- Piirtotyökalut (Duct, Pipe, Install Product, Device Connection)
- Kokonaisen projektin läpivienti (projektin luonti → järjestelmän piirto → projektin julkaisu)
- Joku muu, mikä?

7.

Mikäli osallistuit Template-palaveriin 15.2.2017, tähän voit antaa palautetta tilaisuudesta.

8.

Tähän voit antaa avoimesti kommentteja aiheeseen liittyen.

Kiitos arvokkaasta palautteesta!

Swedish summary

Implementering av MagiCAD for Revit i ett företag: introduktion av ett ramverk för en inlärningsstig och elearning som en del av användarutbildning

1 INLEDNING

Detta examensarbete baserar sig på mitt jobb i ett finskt mjukvaruföretag som heter Progman och på Aftersales-avdelning som har hand om slutanvändarutbildning och -stöd. Progman utvecklar och säljer ett CAD-program som heter MagiCAD. Det är ett så kallat add-in-program, det vill säga, MagiCAD använder ett annat CAD-program som sin plattform. Denna plattform heter Revit och den har utvecklats av det amerikanska mjukvaruföretaget Autodesk. Man pratar om MagiCAD for Revit när de här två mjukvarorna används tillsammans.

Inom VVS-branchen har AutoCAD, också en produkt av Autodesk som fungerar ihop med MagiCAD, nått en betydande position bland olika projekteringsmjukvaror i Finland och norden. Progman har länge erbjudit kontaktundervisning i MagiCAD for AutoCAD, men i och med att Revit blir ett alltmer vanligare verktyg, har det också uppstått ett behov att arbeta fram ett nytt ramverk vad gäller användarutbildning, något som i detta examensarbete kallas för inlärningsstig. Med inlärningsstig avser man hela den process som ett kundföretag genomgår när det tar i drift en ny mjukvara. Progman kommer att i framtiden erbjuda nätbaserade kurser i MagiCAD i syfte att bättre kunna möta de behov som växande marknader ställer på olika håll i världen. Detta innebär att traditionell kontaktundervisning och nätkurser (elearning) kommer i framtiden att fungera ihop så att de tillsammans blir ett effektivare sätt att undervisa slutanvändare i programmet.

2 METOD

Eftersom detta nya ramverk berör Progmans kunder direkt, har jag skickat ut en enkät till några utvalda kunder som redan deltagit i MagiCAD for Revit-kurser för att få veta om deras synpunkter vad gäller MagiCAD for Revit-kurser och elearning överlag. Utifrån deras svar och diskussioner kring ämnet med experter, samt med visst stöd av pedagogiska principer,

har jag lagt fram ett förslag om hur en inlärningsstig kunde se ut för kundföretagens anställda som innehar olika roller som jag har definierat. Dessa roller är VVS-ingenjör, mallspecialist, BIM-projektör och projektchef.

De teorier som arbetet lutar sig mot är *Constructive alignment* och 3P (presage, process, product), utvecklade av John Biggs, samt *blended learning*, en idé där man kombinerar nätbaserade kurser med kontaktundervisning. I all undervisning måste man slå fast ett pedagogiskt tillvägagångssätt. *Constructive alignment* har som utgångspunkt att man har en målsättning; vad vill man att en studerande ska lära sig och vilka är de åtgärder för att man ska nå det satta målet. Här spelar in den så kallade 3P-modellen; vad som händer innan lärande, vad som händer under den, och till sist vad som händer därefter. *Blended learning* kombinerar elearning och kontaktundervisning. Med hjälp av dessa teorier, enkätsvaren och intervjun, har jag framlagt ett förslag för fyra olika inlärningsstigar för de respektive målgrupperna, samt definierat innehållet i stigarnas olika steg.

Jag använder begreppet disciplin i arbetet. I mitt arbete betyder disciplin en uppsättning MagiCAD-verktyg som finns grupperade enligt det de är till för, till exempel MagiCAD Ventilation eller Piping (V och P). Ventilation är alltså en disciplin och under den finns de verktyg som är till för att rita ventilationskanaler eller installera tilluftsdon.

3 ANALYS OCH RESULTAT

Med enkäten ville jag få svar på två grundfrågor: hur enkätdeltagarna ser på arbetsbelastningen under klassrumskurserna och vilka är de verktygen i MagiCAD de skulle se som ändamålsenliga att lära sig i en interaktiv nätmiljö. Med hjälp av intervjun kunde jag definiera de fyra olika rollerna och få en djupare insikt i kundens perspektiv.

I enkätsvaren kom det fram att ingen av de svarande hade tidigare erfarenheter av elearning och dess roll ansågs främst vara sådan som stöder klassundervisning. Beaktas bör, att brist på erfarenhet av elearning kan ha påverkat de svarandes attityd mot elearning. En stödjande roll innebär att disciplinsrelaterad grundkurs ordnas fortsättningsvis som kontaktundervisning. En förändring angående grundkurs är emellertid att en inledningskurs

i nätmiljö ordnas. Situationen för tillfället är att en grundkurs kan vara i tre dagar. Den första dagen är för att studeranden kunde gå igenom och lära sig om grundläggande funktioner i Revit och MagiCAD. De två följande dagarna är däremot disciplinsrelaterade. Nu är tanken att en inledande elearningmodul kunde ersätta den första dagen, som tidigare ordnats som kontaktundervisning. Detta skulle bland annat göra att kursdeltagarna bara skulle vara tvungna att vara borta från jobbet i två dagar istället för tre. I en ideal situation skulle en nätbaserad inledningskurs också bidra till att studerandenas kunskapsmässiga utgångsnivåer skulle vara närmare varandra. Detta skulle i sin tur göra kontaktundervisningen effektivare.

Arbetsbelastningen under kursen ansågs vara förhållandevis stor men inte omåttlig. Belastningen kan ändå jämnas ut genom att dela upp grundkursen på ett sätt som beskrevs ovan. När det kommer till tiden efter kursen, en del av de svarande ansåg det vara en utmaning att påbörja ett självständigt arbete med programmet. Den här saken kunde man påverka med en effektivare användning av övningsmaterial i pappersform, som alltid har delats ut för kursdeltagare. En lösning kunde vara att i fortsättningen ge ut materialet redan innan studerandena kommer till den del av grundkurs som ordnas i klassrum. Och efter kursen kunde deltagarna göra detaljerade övningar som finns i materialet. På detta sätt kunde man sänka tröskeln för användare att sätta igång arbetet med programmet.

Vad gäller verktyg som man kunde lära sig med nätbaserade kurser, fick sådana flest röster som har med projekthantering att göra. I motsvarande grad fick genomförande av ett helt projekt inte många röster.

3.1 Inlärningsstigarna för respektive målgrupperna

Inlärningsstigen består av åtta steg, av vilka sex berör de här fyra målgrupperna. De sex stegen är inledning, grundkurs i VP, fördjupningskurs i VP, konsultering, BIM och MagiCAD för Revit och arbetsgrupp för mallutveckling. Dessa stegen utförs som kontaktundervisning, möten, konsultering och elearning. Alla grupper behöver inte genomgå varje steg, utan bara de som är väsentliga ur de respektive målgruppernas synvinkel. En anställd kan också ha flera av de här rollerna samtidigt.

Inlärningsstigarna är alltså designade så, att efter en avklarad inlärningsstig besitter studeranden sådana kunskaper som är väsentliga ur den grupps synvinkel som studeranden tillhör.

Tabell 1. Inlärningsstig.

Inledning och disciplinrelaterade kurser			
3	Inledning	Att kunna grundfunktioner i Revit	elearning
4	Grundkurs i VP	Att lära sig använda disciplin-relaterade funktioner i MagiCAD	Klassrum
5	Fördjupningskurs i VP	Djupgående kunskaper i programmet	Klassrum/elearning
Konsultering och projektstyrning			
6	Konsultering	Säkerställa en flytande implementering av programmet	På plats
7	BIM och MagiCAD for Revit	Att lära sig använda BIM-funktioner som MagiCAD erbjuder	Klassrum/elearning
8	Arbetsgrupp för mallutveckling	Kunskapsdelning angående mallar	Möte (+elearning)

Av de sex stegen är det 3, 4, 5 och 6 som berör VVS-ingenjörer. De utför det dagliga planeringsarbetet och de behöver inte veta så mycket om hur man samordnar datamodeller av olika system eller hur man gör en mallbotten.

Angående mallspecialister är det bara BIM-kursen (7) som de inte behöver delta i. Arbetsgruppens möte (8) går ut på att företrädare från olika ingenjörbyråer i samarbete med en instruktör från Prozman delar med sig av sin kunskap och diskuterar hur en mall kunde konstrueras. En mall innehåller i princip förinställningar för projektering med MagiCAD for Revit. VVS-ingenjörer behöver då inte bestämma hur de klassificerar sina olika system i ett projekt, eller med hur tjocka linjer de ritar, utan allting är förbestämt. Det är svårt att bygga upp en elearningmodul om detta steg, men grundläggande principer om hur det tekniskt går till kan man presentera.

Enligt min plan deltar BIM-projektörer i stegen 3,4,6, och 7. De behöver inte djupgående kunskaper om mallutveckling eller disciplinsrelaterade verktyg på avancerad nivå. De har en stor roll i synnerhet i början av projekt när de ska samordna datamodeller på olika byggnadstekniska delar, till exempel VVS och elektriska system.

Projektchef har kontroll över hela projekt, de måste alltså kunna administrera det. De behöver inte nödvändigtvis kunna använda programmet lika bra som andra grupper, men de måste kunna plocka upp viss information av datamodeller, en kunskap som man får från BIM-kursen. De har också sällan möjligheter att delta i klassrumskurser varför jag har valt att hänvisa dem till kurser utförda med elearning och konsultering som sker på plats. Steg som projektchefer ska delta i är alltså 3, 6 och 7.

Vad gäller konsultering har alla målgrupper nytta av den. Då kommer en instruktör från Progman till kunden och tillsammans med anställda i kundföretaget kan de lösa problem som har uppstått.

5 SAMMANFATTNING

I en ideal situation bidrar de fyra inlärningsstigarna till att Progman kan lättare känna igen de behov som kundföretagen kan ha, och använda sig av stigarna till planering av framtida kurshelheter, delvis verkställda med hjälp av elearning. När man blandar elearning och kontaktundervisning bidrar det till en mer mångsidig inläring. Och i och med att man, med hjälp av olika metoder, tar till hänsyn vad som sker under hela inlärningsprocessen kan man säkerställa att en studerande får djupare kunskaper i det komplicerade programmet.