DISTANCE TEACHING IN THE FIELD OF TECHNOLOGY AND SOFTWARE

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ABSTRACT

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Distance teaching is a growing subject matter that is seen important in schools and industry. Students are participating courses remotely that is more effective and cost saving when travelling is not needed. Web based courses require a different pedagogical approach to teaching compared to classroom teaching.

This development project was done to make distance teaching more effective in software and technology area in enterprise environment. Distance teaching process includes designing the material, exercises and planning teaching techniques. Development project included the follow up of an ongoing course flow and collecting the feedback from it. Based on student and teacher feedback, the course flow was improved and in this study is referred to as “the new delivery pipe”.

The planning of the course structure was done based of familiar methods of authentic and social learning. During the development project, it was seen that students had many kinds of different expectations concerning material, exercises and practical examples during the teacher’s presentation. The results of the project were promising, after implementing the planned changes; the post-test results indicated improved learning outcomes.

Keywords: distance teaching, distance learning, course planning

TIIVISTELMÄ

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Verkko-oppimisen ja siihen liittyvät aihepiirit on nähty kasvavan kouluissa ja teollisuudessa. Oppilaat voivat osallistua kursseille omista lähtökohdistaan ja haluamistaan paikoista kuten työpaikkaa tai kotia. Kustannukselliset vaikutukset ovat suuret ja ajan käyttö on tehokasta. Matkustaminen on vähentynyt. Verkko-oppimisen onnistumisen avaimet ovat asiantuntijuus ja opetusmenetelmien tunteminen.

Tässä kehityshankkeessa suunniteltiin opetusmallia, joka toimisi laadukkaan ohjelmisto- ja teknologiakouluttamisen yrityksissä. Koulutusprosessiin kuuluu materiaalin tuottaminen, opetusmenetelmien ja välineiden suunnittelu, kurssin toteutuspolun sekä harjoitusten suunnittelun. Projektissa seurattiin alkuperäistä kurssiputkea ja kerättiin havaintoja ja palautetta. Opettajien ja oppilaiden palautteen johdosta kurssiputki suunniteltiin uudella tavalla.

Kurssin suunnittelua tehtiin soveltaen autenttista ja sosiaalista oppimista. Oppimiselle verkossa nähtiin haasteita ja oppijoilla oli hyvin erilaisia näkemyksiä ja toiveita materiaalista, harjoituksista ja opettajan havainnoinnista. Projektin lopputulos oli lupaava. Tehtyjen muutosten jälkeen oppimistulokset paranivat lopputestejä verrattaessa.

Asiasanat: etäopetus, verkko-opetus, verkko-opetuksen suunnittelu

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1 INTRODUCTION

Companies that have multiple international sites around the world have challenge of keeping employees trained and competent. Classroom specific training is necessary in many areas, but emerging number of distance trainings are growing. E-learning has been discovered to be very cost-effective and therefore gains more interest among training organizations.

The term e-learning is really just an umbrella term which covers a wide set of electronic educational applications and processes such as Web-based learning, computer-based learning, virtual classrooms, and digital collaboration. It includes the delivery of content via network, audio and video recordings as well as many others.

In this development project, ways are found to improve teaching employees online without the need of travel and making the change from teaching-centered to learning-centered environment. There are many ways to build online learning experience, and this project focuses those that are useful for big corporations and don’t bind learners to specific locations.

Most typical and positive feedback from students in distance teaching is:
“I like to stay at home base to follow the training. I love the possibility to reach the system still when the training is over”

2 DISTANCE TEACHING

Training and competence development has been seen as key success factor for companies that require innovative employees and staff. The past 10 years have shown no change in this respect, but still training budgets have become tighter. At the same time there is a growing demand for high quality education to people all over the world.

Distance learning is any learning system where teaching behaviors are separated from learning behaviors. The learner works alone or in group, guided by study material arranged by the instructor in a location apart from the students [Quality 1999]. Internet offers the best tools for communication between students and teacher. In distance teaching technologies there are two modes of delivery: synchronous learning and asynchronous learning.

Using internet and computers as teaching devices has grown rapidly. While the initial cost of developing an e-learning course can be higher than that of traditional classroom training, this expense is more than offset by the savings in implementation and delivery of the course in long run. Time is saved when people can attend the training wherever they are located. When travelling is not required, money is saved in travel tickets, normal daily costs like food and entertainment.

E-learning is flexible and fits perfectly to on-demand model. When material is available 24/7, it’s easy to take into use when needed. Organizing distance-teaching sessions is more complicated when enrollments and scheduling are used. Distance teaching is flexible considering only time zone related challenges.

Classroom training is slightly different each time it is given; Instructors vary the way they present material each time they give a particular class. E-learning is some cases like a taped or recorded performance. No matter how many times the class or learning module is presented it will not change or vary. This leads

to very consistent delivery of material that is not possible in a traditional classroom approach.

2.1 Idea for development

Technology and software training has been delivered mostly in common classroom trainings in many IT and telecom industry companies in the past years. Technology training refers to the used technologies e.g. databases, internet protocols and programming languages. Software training is either user specific (how to use?) or administrative (how to maintain and troubleshoot). Common factors for these topics are need of practical hands-on exercises and variance of training material.

Organizations that have used mostly used classroom specific learning are now moving more to distance learning models. Challenge is to provide such e-learning courses that still have same objectives and goals than classroom events. The quality and end results should be the same.

2.2 Background for development project

This development project focuses to develop new model of planning and delivering large course flow remotely instead of classroom delivery. Full course flow comprises a set of technology and software competence transfer to technical experts that have to stay on the edge with new software versions and products.
Original course flow had 4 individual courses with length of 1 week. When delivered in classroom, it took up to 120 hours for one person to participate the actual teaching. This was calculated with assumption that one day has approximately 6h of effective training time and added with pauses and lunch up to 8 hour days.

2.2.1 Research objectives

In this development project, the distance teaching methods are under investigation. Aim of this study, is to gain better learning results. In effective distance learning students are more independent and teachers need to find better ways to activate them. List of recommend tools and delivery methods are given. It is being critically evaluated, what type of materials should be used in different parts of training. Based on study, the training is designed to follow new methods. In this project, it's being explained in details how training is organized and managed. Based on new delivery model, feedback and course evaluations are collected and analyzed.

2.3 Learning Objects

"A learning object taken into the training is a collection of content items, practice items, and assessment items that are combined based on a single learning objective" [Cisco 1999]. Idea is to present the theory as short but effective, then provide the practice and hands-on activities made by the learner and finally testing that learning object is being finished successfully.

Learning object is a term for an educational object or an achievement target, where students gain knowledge or skills. All teaching should focus to complete learning targets that are measurable. Other synonyms for learning object are information objects and reusable learning objects. Components are reusable when they can be placed into many different training curriculums that require similar learning objectives. Learning objectives can be also re-arranged inside one course. "Learning objects offer a new conceptualization of the learning process: rather than the traditional several hour chunks, they provide smaller, self-contained, re-usable units of learning [Beck 2002]".

Course creation starts always by defining the learning objectives. Target is to define the objectives that are measurable and precise. Example of a simple objective could be: "After completing the lesson, the student will be able to list 5 differences between software versions A and B". It's a clear outcome and easily measurable. What is to be noticed is the learning target type. In this kind of

simple object, the type of the learning is target based. It's all about the content, presentation and following, like behaviorist method of teaching. Actually this kind of training, the learner needs just to remember what was presented.

Distance learning should be effective. Simple type of behaviorist learning could be delivered self-learning way. This type of trainings is e.g. online e-learning or any other material that is accessible directly by the trainees for self-study. In software related studies, videos are as sufficient as books and web pages.

Learning seed is a type of learning objective that creates learning process in learner and guides knowledge processing – learning [Silander 2003, 69]. Teacher forms a set of questions and activates for the learners knowledge processing. Material work as a source of information, teacher can work as supporting in practical exercises and providing feedback. Written objective in course planning is more complex for learning seeds. Measurement is now focusing understanding in different levels. Target is to gain higher order thinking skills. Learning objective could be then written e.g. "After completing the lesson, the student will be able to check/investigate and execute software A troubleshooting".

Cognition is something that happens inside of human mind as mental process. Through cognition we can use our reasoning and problem solving skills, which is important human behavior. It is about knowledge and the way people use their knowledge. "The cognitive process dimension represents a continuum of increasing cognitive complexity—from remember to create. Anderson and Krathwohl identify 19 specific cognitive processes that further clarify the bounds of the six categories [Anderson 2001]".

The cognitive processes dimension — categories, cognitive processes (and alternative names)					
Lower order thinking skills ----------→ higher order thinking skills					
remember	**understand**	**apply**	**Analyze**	**evaluate**	**create**
recognizing (identifying)	**interpreting** (clarifying, paraphrasing, representing, translating)	**executing** (carrying out)	**differentiating** (discriminating, distinguishing, focusing, selecting)	**checking** (coordinating, detecting, monitoring, testing)	**generating** (hypothesizing)
recalling (retrieving)	exemplifying (illustrating, instantiating)	implementing (using)	organizing (finding coherence, integrating, outlining, parsing, structuring)	critiquing (judging)	planning (designing)
	classifying (categorizing, subsuming)		attributing (deconstructing)		producing (construct)
	summarizing (abstracting, generalizing)				
	inferring (concluding, extrapolating, interpolating, predicting)				
	comparing (contrasting, mapping, matching)				
	explaining (constructing models)				

[Table 1 adapted from Anderson and Krathwohl, 2001, pp. 67–68].

Technology and software based distance learning can be mix of all kinds of cognitive processes. Designer teacher selects learning objectives that show what kind of skills is required when course is finished. Teacher creates purpose-

ful learning environment to support objective fulfillment and higher level of thinking. Thinking skill line (see Table 1) helps teacher to select objectives and desired thinking levels. Course objectives should not come from one end of a lower- higher thinking skill line. In software and technology learning, it is good to plan objectives using many different levels of thinking.

Remembering requires less thinking from a student. This kind of processes basically requires less teachers help, and should then be mostly available by self study ways. Example objective for remembering could be: “how to check product version”. Effective ways are written material, videos and online-guides.

Training must focus of active use of knowledge and skills. Learning to become e.g. administrator of computer system requires understanding, ability to analyze and evaluate the system. Learning objectives are defined using job analysis. Job analysis defines certain key activities done by administrators. Example of activities could be setting system to maintenance, troubleshoot or follow data flow. Learning objective is set e.g. “understanding system data flow” or “understanding system behavior in overflow situation”.

2.4 Teaching process

Teacher’s role is to create of locate material that supports effective learning in subject area. Teacher creates learning material that suits best for length of the course and objectives. When course objectives are defined, it’s straight forward to construct material that supports the learning and fulfilling the objectives. Course is build from topics or modules that includes topics. Overall length of the course or modules are calculated when amount of topics and their estimated length is know. Finally after material and course creation, the teaching and course delivery sums all together the whole process.

“Implementing distance learning programs requires new technical and pedagogical skills [Quality 1999]”. Teaching in classroom differs from distance teaching. Distance teaching event should be short and effective. It shouldn’t have same

6h length daily like in classroom. Same principles like keeping trainees as center and focusing the target objectives are crucial. When teacher is listened through speakers or headphones, the sense in use is hearing. Teaching should be very simple and straightforward to avoid information overload. Overload might happen when information is coming in text and speech at the same time. When teacher focuses the key messages, learners can follow and have time to stop and think what they have heard.

It is possible to record a video when teacher is showing examples from the learning environment. This enables learners to get back to the topic and see the procedures again. Video material is very effective when kept short and topic is not too wide. Videos can be linked to learning management system among the other module specific material.

2.4.1 Learning material creation

Learning material creation is handled as a project. Basic project rules like effort estimation and cost is being calculated and total project cost is being known. Training curriculum is planned as a whole. Planning is also taken into hour level, with right kind of material and delivery method. The mix of asynchronous and synchronous communication methods is planned.

In distance learning, the material must be always available for students to access. Typically this is enabled by learning management system or document storage system. Method of security is considered, but basic principle is to provide all materials inside the organization. Material can be text documents (pdf), videos or other. When learning material is document, it should be as book. Book is readable, understandable by self reading and tries to explain even complex topics using also pictures. PowerPoint slides are typically just presenting short phrases that easily lefts open issues for reader to wonder. PowerPoint slides are good for teacher to support the presentation. Teacher should bring always something extra to the topic among the slides. Document templates are used to ensure that design and development is consistent across the course.

In distance teaching, the teaching time is always limited and is typically shorter than in classroom training. Material must cover the whole learning process that learning objectives are met. In distance learning, the student has to take more responsibility in self-study. In technology and software learning there are always some prewritten material like marketing materials or customer documentation. Learning material should not copy the existing material that everybody can access. Existing materials should be linked if necessary, learning management system offers good tools to have materials linked. Learning material itself is focusing the learning process. Course module combines typically topics that include certain software component, functionality or technology. One module must contain following items:

1. Pre-test
2. Learning material (Theory)
3. Practical and/or theoretical exercises
4. Post-test

Testing as part of practices is good method of following student progress. Pretest can open upcoming learning objectives or check that certain concepts are familiar, as prerequisites are completed. Students have to take part of introduction course before administration or troubleshooting course. Prerequisites ensure that in advance level course the teacher does not have to go back to basics when teaching time is limited.

Learning material is the key to personal studies that is not meant to be read during the theory session. Students should be guided to study the material already forehand so teachers information should mapped to already existing knowledge. The material content should be focused closely to learning objects that could be concept, fact, process, principle or procedure. Technology and software is a science, that requires understanding by learning and doing. Each learning objective should have introduction, theory and examples. Material should be built using Microsoft Word or similar word processing tools. Pictures are most simply

done by Microsoft PowerPoint or similar. Slides should be embed to the written material, so the presentation could be followed afterwards by learner self.

Complicated configuration tasks in work are not possible to do successfully without practice. Exercises are important part of learning. In technology and software learning, the student must have access to that subject which is currently ongoing. Learning environment should be available during the course and after. System should be designed so, that user management is simple even in large scale and hundreds of users. There are two types of exercises: individual and group. Tests and assessments must always be individual. Exercises relating system usage or understanding the theory can be group specific or individual. It is difficult to simulate classroom environment and communication between students in distance teaching. Technology offers same kind of learning environment for student groups than instructor-led group. Student should be encouraged to use groups to complete exercises.

2.4.2 Social learning theory

“The social learning theory of Bandura emphasizes the importance of observing and modeling the behaviors, attitudes, and emotional reactions of others [Bandura 1977]”. Observation is basic human behavior and helps individual to compare own behavior to others and make further decisions related to own behavior through learning. Bandura proposed that the modeling process involves several steps:

1. Attention: In order for an individual to learn something, they must pay attention to the features of the modeled behavior.
2. Retention: Humans need to be able to remember details of the behavior in order to learn and later reproduce the behavior.
3. Reproduction: In reproducing a behavior, an individual must organize his or her responses in accordance with the model behavior. This ability can improve with practice.

4. Motivation: There must be an incentive or motivation driving the individual's reproduction of the behavior. Even if all of the above factors are present, the person will not engage in the behavior without motivation.

In distance learning the usage of live video is effective to provide social context. When teachers hand, body and face movement is shown, the learner can focus better to the teacher's presentation e.g. having better attention. Using mouse cursor adds automatically more visual movement to follow.

It's recommended to get learners to use webcams during the training. When all people participating the training can see each other in video, they automatically follow others behavior. Webcam is easy to use, and brings participants visually closer each other. This helps e.g. in group work but most importantly helps teacher to follow who are participating.

Exercises are recommended to be done in groups. Grouping can be done either by teacher or learners. Group work provides environment for discussion and helping others that is very powerful way to learn. When topics are discussed properly and notes are being taken personally in separate groups, the learning process has more time.

2.4.3 Teacher personal development and feedback channels

Teacher needs to develop professional skills among pedagogical skills. This development requires feedback and self reflection. It's important to have critical evaluation for the whole. Teacher should be able to receive participant feedback for every session, module or course event. Self-reflection is an important individual activity. It's also clear, that more effective reflection is being done in teacher community to each other. Reflection among peers is often seen as a threat, but it should be seeing more like a resource. Feedback from a colleague is more honest than average student's feedback.

Shared expertise refers to expertise knowledge that is shared by two or more persons or organizations. Sharing the expertise among teachers can be seen as next step of going beyond personal development. When teachers are working together the information sharing can be informal or formal. Shared expertise keeps community creative. Teachers are up to date with the knowledge only by training themselves continuously.

2.5 Authentic learning

Authentic learning is taking learning process closer to the real life practices and environments. Authentic learning is taking students closer to working life when problems are real and they require specialists to work with them. Working together with specialists and learning from real life issues should be automatic in enterprises where knowledge is important and valuable asset. “Problem solving forces students to study harder and teach metacognitive and thinking skills [Leppisaari 2007]”. In enterprises the internal communication and information sharing is and should be automatic process. Internal bulletin boards and discussion forums work for all larger and smaller groups. In online training, information sharing is key feature and one excellent delivery channel of social learning.

2.5.1 Authentic context

Authentic online learning first principle is to provide an authentic context that reflects the way the knowledge will be used in real life. It’s simple to create environment to the students available online, when it’s available through internet. Challenging issue is to create context that implements problem situation and students can practice their skills in real life. “The context needs to be all-embracing, to provide the purpose and motivation for learning, and to provide a sustained and complex learning environment that can be explored at length [Herrington 2006]”. Exercises should be practiced in real working system with live data or equivalent. This is done using simulators that generate e.g. traffic to the system.

2.5.2 Authentic activities

“The learning environment needs to provide ill-defined activities which have real-world relevance, and which present a single complex task to be completed over a sustained period of time, rather than a series of shorter disconnected examples [Herrington 2006]”. When customer support engineer is learning system behavior and functionality, one authentic learning topic is to answer customer’s technical questions or solve their problems. Typically all software systems have wiki- pages and Q&A discussions, where students can interact and place their own answers. When work is done together with older specialists, information is reliable.

2.5.3 Expert performances

“In order to provide expert performances, the online learning environment needs to provide access to expert thinking and the modeling of processes, access to learners in various levels of expertise, and access to the social periphery or the observation of real-life episodes as they occur [Herrington 2006]”. In the beginning of course planning, the objectives and modules were planned to offer competence to students based on target job analysis. Course design is already planned to support certain group of experts. Questions for students are like: “how should specialist work in certain situations?” Students should work together and also with specialists at their own organization. During the course planning and development, co-operation with R&D and other information sources is important. Same connections can be used later, with students to make authentic connections.

2.5.4 Multiple perspectives

“In order for students to be able to investigate the learning environment from more than a single perspective, it is important to enable and encourage stu-

dents to explore different perspectives on the topics from various points of view, and to ‘criss cross’ the learning environment repeatedly [Herrington 2006]”. In software systems educations, this is done by categories of groups who are users of the system. Typical user groups are e.g. administrators, support engineers, and end-users. Making exercises to all those groups, it gives view for all aspects of software usage. Software is being seen different way by R&D people than customers. Students can get viewpoints to different groups by just studying customer and own enterprises processes.

2.5.5 Collaborative construction of knowledge

“The opportunity for users to collaborate is an important design element, particularly for students who may be learning at a distance. Consequently, tasks need to be addressed to a group rather than an individual, and appropriate means of communication need to be established. Collaboration can be encouraged through appropriate tasks and communication technology [Herrington 2006]”. Group work supports learning in many ways. Creating online learning environment for student groups is as easy as for the teacher using WebEx and teleconference systems. Creating the environments can be done by teacher or student. Main motivation is to build the required answers together, using brainstorming or other methods. Exercises should be challenging for groups. If online meeting for groups is not applicable, basic discussion board or email can do the same.

2.5.6 Reflection

“In order to provide opportunities for students to reflect on their learning, the online learning environment needs to provide an authentic context and task, as described earlier, to enable meaningful reflection. It also needs to provide non linear organization to enable students to readily return to any element of the site if desired, and the opportunity for learners to compare themselves with experts and other learners in varying stages of accomplishment [Herrington 2006]”. During online learning situation led by teacher, discussion is kept minimum be-

cause tight schedule have to be enough to go through all necessary learning objectives. Additional meetings and Q&A (questions and answers) can be arranged where teacher can more openly discuss with students.

Discussion is important in Q&A sessions. For group sessions, teacher can design list of questions or topics that should be discussed. Notes are not necessary during the meeting, but afterwards they could be listed as highlights in learning diary etc. Students have typically different opinions about systems functions. Working together with R&D, the feedback is always valuable and provides learning opportunity to both sides. Reflection is required by the student. Student should collect personal learning diary, where all notes and important topics could be stored. In the learning diary, the student can reflect the course topics generally.

2.5.7 Articulation

“In order to produce a learning environment capable of providing opportunities for articulation, the tasks need to incorporate inherent—as opposed to constructed—opportunities to articulate, collaborative groups to enable articulation, and the public presentation of argument to enable defense of the position [Herrington 2006]”. In software and technology teaching, it is not typical or practical to have formal debate. It is important to get students to talk and discuss relevant topics of the course and subjects. Discussion happens in groups, but also in common Q&A session is possible. Bear in mind that many students can refuse to discuss or talk. Main reasons for this are e.g. shyness or grammar. In global enterprises English is typically the main and official language, but not perhaps the most spoken language when students can come from different sides of the globe. Written argumentation, reflection or discussion works similar way than spoken. Main focus is to get students to think and use the information given in learning objectives.

2.5.8 Coaching and scaffolding

“In order to accommodate a coaching and scaffolding role principally by the teacher (but also provided by other students), the online learning environments needs to provide collaborative learning, where more able partners can assist with scaffolding and coaching, as well as the means for the teacher to support learning via appropriate communication technologies [Herrington 2006]”. Moodle learning management system supports discussion forum. Students can place their questions to forum anytime and teacher’s responsibility is to answer those as soon as possible. Any informal discussion between teacher and student should be provided using a little forethought. It could be hard if year after year all students come back to training environment and ask their work related questions from teacher. Enterprise must provide own forums or environment for work related questions and discussion. Teachers can then interact with those when time is provided. Teacher role can be then as mentor or supporter in external forums.

2.5.9 Authentic assessment

“In order to provide integrated and authentic assessment of student learning, the online learning environment needs to provide: the opportunity for students to be effective performers with acquired knowledge, and to craft polished, performances or products in collaboration with others. It also requires the assessment to be seamlessly integrated with the activity and to provide appropriate criteria for scoring varied products [Herrington 2006]”. Moodle platform helps in scoring and collaboration during the course. Pre- and posttests are valid tools for software and technology learning. Student can get instant feedback from online tests. Teacher can also receive exercise returns and send individual or group feedback. Teacher is able to follow student’s progress online. When teacher has time to be active with ongoing group of students, the students are more likely to be active too vice versa.

3 RESULTS

Teacher has to collect student feedback regularly. Teacher's methods to collect feedback are limited, because during training session there is no visibility between students and teacher. Compared to classroom training where teacher could use paper feedback forms, in distance teaching the only feedback method is web-based feedback through learning management system.

Student feedback requested using standard form (see appendix 1). It has various areas asking the level of course fit, course design, test bed, facility, instructor(s) and comments (open questions). Collected feedback indicated that students had many problems that made learning difficult. In some cases, distance learning showed to be difficult learning environment. Students were mostly comparing the distance teaching to classroom teaching, when responsibility of a learning process is more teachers led. Distance learning is challenging to those, who require more attention from teachers.

3.1.1 Original course delivery pipe

Original course delivery plan started with the assumption, that every participant is able to free their course week from other work like normally happens during classroom training in remote location. It was calculated that daily schedule gives possibility to have 2 modules length of 2-3 hours and max 1h exercises per module / day. During the development project monitoring period 3 months, there were 70 students taking the course. Totally 7 course deliveries and approximately 10 students / course. In table 2 there is presentation of a timetable. Modules are numbered from 1-11.

Delivery pipe had timeslot for exercises only 1-2h per daily, when totals learning day's length came closer to 8h. This caused, that most of the exercises was not

made or they were postponed. Taken into account, the course had no mandatory exercises if student was not targeting to certification. Main motivation for making exercises is full completion and possibility to precede e.g. other courses.

Students are learning in different pace. Training curriculum should be planned so, that there are enough time to do all practices and participate theory sessions. Training schedule should be planned so, that there are enough time to do necessary practices in given time. Originally the exercises could have been returned much later.

Original course module delivery days

	Mon	Tue	Wed	Thu	Fri
Week 1	1 ,2	3,4	5,6	7,8	9,10,11

Theory session length 2-3h per module

(Table 2 original course delivery time table)

Exercises were the most common feedback issue, even they were suppose to carry out individually and in own time. There were 2 types of exercises, practical hands-on and theoretical. Hands-on tasks are targeted to help students to practice system usage like starting applications and checking configurations.

Teacher were asked to show more examples during the training, even this was always included in training. Time was seen as difficult entity. For some students there was not enough time to follow and do e.g. notes and read the material. Teacher have to remind what activities are done during the session and what tasks are suppose to do in group and individually outside the teaching session. For some students the course length is too long, when they already know many topics. Students, who are new to the matter, might feel that many issues are left outside and for self-study. Requirement for self-study might be stressful, if students are not used to manage their own working tight.

3.1.2 New course delivery plan

Teacher resources were planned so, that weekly deliveries would always have primary and secondary (backup) teacher. This makes possible for weekly work planning but also gives possibility to engage another teacher to the theory session at the same time. When 2 teachers are available at the same time, they can support each other. While primary teacher keeps lecture, the secondary teacher can answer student's questions in chat window. This makes possible to create larger learning groups. Group size can vary between 10-14 students.

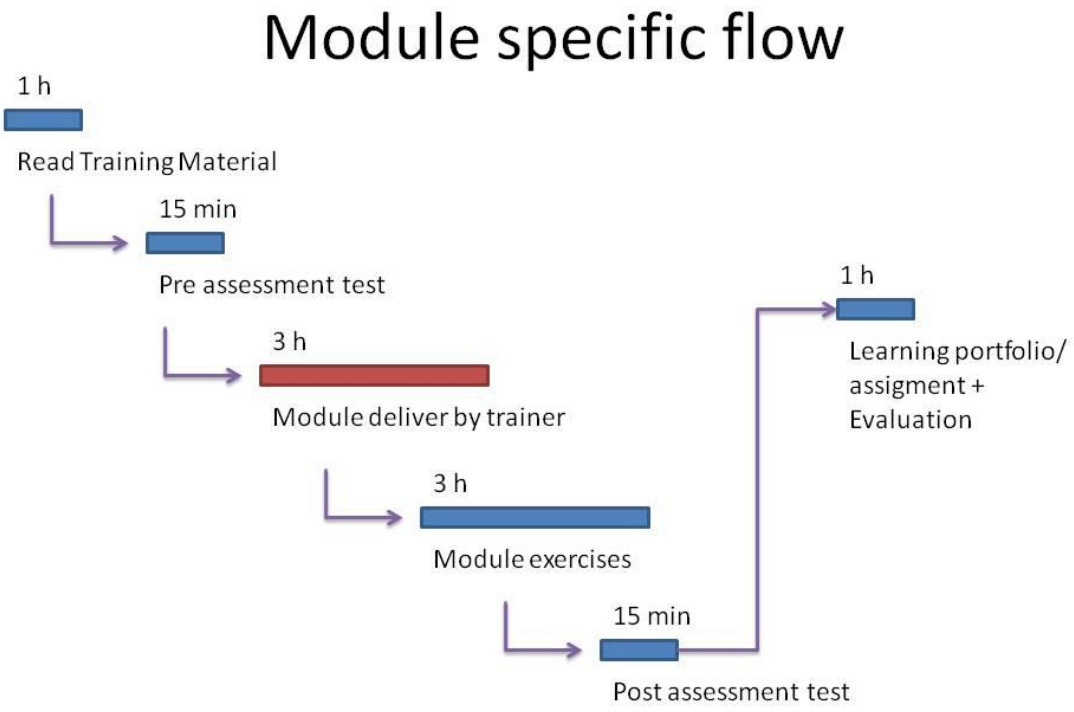
Teaching is delivered every second day by distance teaching sessions (see table 3). This enables more time for students to complete all tasks before next session and possibility to add more authentic learning methods for students and student groups. After first new delivery pipe, students returned 25% more exercises before next module delivery.

Course module delivery days

	Mon	Tue	Wed	Thu	Fri
Week 1	1		2		3
Week 2	Q&A	4		5	
Week 3	6		7		8
Week 4	Q&A	9		10	11

(Table 3 New delivery schedule for course)

Individual training module was build having more individual and group tasks. Picture 1 presents the designed module flow that points the order of certain tasks and estimation of needed time to complete individual tasks. Blue color bars are tasks done by student and red color presents the time when teacher is keeping presentation. Model shows clearly to student that self study is mandatory.



(Picture 1 Module specific student process)

3.1.3 Learning results

Learning results (appendix 4) were taken from module post-test results from the course. Same test was included in **old** and **new** delivery pipe. Results showed that there was great enhancement in average grade in 3 randomly selected modules

1. module: 0.12% better result
2. module: 8,98% better result
3. module: 13,59% better result

Average grade result is clearly showing that students got better result in test because they had more time to put effort on the modules. Also better results were statistically in error ratio and internal consistency

4 CONCLUSION

First feedback from students after changing the delivery pipe to the new mode was promising (appendix 3). Student appreciated the gap between teaching sessions. Student had training during normal working days. Student's time reservation for daily routines was easier.

It was studied that authentic learning is the right method in online context. Students need to establish groups and networks that support them also after the training. In enterprise environment the authentic collaboration methods are created automatically. Specialists need to establish communication flow with others to learn and get help in problem solving work.

Teachers need to follow closely the course feedback and quality indicators. When teachers are thinking and working like any other worker, they might forget the student process focus. Students require different level of help if any, but the help should be automation by teacher when needed. Teacher should create networks in enterprise to enable authentic methods in course delivery.

Most important result was that students got better learning results in course module post-tests.

References

Herrington J. 2006. Authentic e-learning in higher education: Design principles for authentic learning environments and tasks,
University of Wollongong, janherrington@gmail.com

Leppisaari Irja, Vainio Leena 2007. Autenttinen oppiminen verkossa – näkökulmia ja käytäntöjä asiantuntijuuden kehittämiseen. Virtuaali AMK- seminaari.

Cisco 1999,
http://www.cisco.com/warp/public/779/ibs/solutions/learning/whitepapers/el_cisco_rio.pdf

Beck 2002, Robert J., "What Are Learning Objects?", *Learning Objects*, Center for International Education, University of Wisconsin-Milwaukee, retrieved 2008-04-29. http://www4.uwm.edu/cie/learning_objects.cfm?gid=56

Anderson 2001, L.W. (Ed.), Krathwohl, D.R. (Ed.), Airasian, P.W., Cruikshank, K.A., Mayer, R.E., Pintrich, P.R., Raths, J., & Wittrock, M.C. A taxonomy for learning, teaching, and assessing: A revision of Bloom's Taxonomy of Educational Objectives (Complete edition). New York: Longman.
http://www.celt.iastate.edu/teaching/RevisedBlooms1.html

Quality 1999 Issues in Distance Learning.
http://www.aacsb.edu/publications/whitepapers/quality-issues-distance-learning.pdf

Bandura, A. (1977). Social Learning Theory. New York: General Learning Press. http://www.instructionaldesign.org/theories/social-learning.html

APPENDICES

APPENDIX 1

Interview form for students after training

Did you read the course description prior to the course start? yes no
The course duration was _____
To what level did you meet the course requirements (e.g. prerequisite training and/or experience)?

Course Fit (evaluation from 1-5)

1) How well did the course meet your needs?
(Did we offer the best training solution; does your job profile match the target group)

Course Design (evaluation from 1-5)

2) How do you rate the quality of the presentation material and student material?
(E.g. easy to understand, up-to-date, useful, well structured)
3) How do you rate other course content?
(E.g. exercises, case studies, simulations)
4) How well did the course design support the objectives outlined in the description?
(E.g. relevant technology and product knowledge, important concepts, relevant procedures)

Test Bed (evaluation from 1-5)

5) How well did the test bed equipment function?
(E.g. correct configuration and availability of telecom equipment, sufficient number, good connectivity)

Facility (evaluation from 1-5)

6) How suitable was the classroom for this training?
(E.g. quality of learning environment, breakout area, presentation & audio services used)

Instructor(s) (evaluation from 1-5)

7) How would you rate the subject matter knowledge of the instructor(s)?

(E.g. could answer course related questions; practical experience)

8) How satisfied were you with the teaching skills of the instructor(s)?

(E.g. presented complex information easy to follow, interaction, language ability, use of media)

9) How well did the instructor(s) manage your needs?

(E.g. handling of questions, handling different participant experience levels, timing of breaks)

Comments (open questions)

What I liked

What I disliked

What I suggest or wish

APPENDIX 2

Feedback from original course delivery model (distance teaching with daily 4h and 5 days training)

Some additional time for this module
Too fast still - basically same issues as the previous module
Little more time and supporting material to read
A little bit too fast
Some examples didn't really work out - at least not on the first try
Length of the course need to be increased, and more hands ongoing through exercises
More breaks and practicing
Too much information at one time.
Training environment (many participants, un-muted phones, bad connection to test bed)
Network problems didn't allow showing some stuff
It is not really possible to ask question only by chat. And I missed what a trainer do in a classroom, writing additional info on the blackboard or flipchart.
I would have better interactivity with the trainer, but we are more than 30 students so it is a bit too much, we should be the same amount as for classroom training.
I missed the interactivity comparing to a classroom course.
It is difficult to take notes; I miss some time to take notes.
Could have used more time for discussion
Could be hectic with WebEx and following document and exercises
Duration was problem
Need to be more hands on
More time and material to read

Length of the training, too short
To fast in some parts
No enough time to discuss each topic at length and time to explore the LAB system
Not enough time to cover all in details.

More examples please

Too much exercises...

Course duration, need to be longer

Some short break would be nice every hour. Getting tired..

Another thing is that a training session should not last more than 1 hour, and then 10 minutes break.

Need to me more elaborate and duration need to be longer

More time and reference material

Impossible to keep my eyes open during this session

Teacher should go through exercises

Was sleeping all along the session - go to the platform - reduce this PowerPoint box and arrows to the minimum - give real example

Discuss troubleshooting in more detail, although this may be in a separate course?

Documentation was very theoretical

Short schedule during the training and no break

More practical demonstrations of theory

Go through exercises

This subject could need more attention and time

More practical examples

Less theory, more exercises.

Provide links to theoretical documentation. We can read that in our spare time.

During the training I would like to see a quick overview and then more practical stuff. Like what breaks when particular components of the system don't work. How to trace stuff, which logs are most useful.

More time and reference material to read

Couple of more short breaks, time for exercises and shortly go through exercises at some point.

APPENDIX 3

Feedback from new course delivery model (distance teaching with every second day 3-4h and 11 days training per month)

What I liked:
The approach of the trainer
The way training goes i.e. every topic with a day gap
Appropriate breaks to prevent monotony
Perfect session, prompt interaction on individual questions (engaging backup experts right away is good way of working).... well done!

APPENDIX 4

Below are results from module specific post-tests. Test results compared between old and new delivery methods.

	Total number attempts	Average grade of all attempts	Standard deviation	Coefficient of internal consistency	Error ratio	Standard error
old	52	85.34%	14.16%	29.89%	83.73%	11.86%
new	24	85.42%	16.35%	53.03%	68.54%	11.20%

	Total number attempts	Average grade of all attempts	Standard deviation	Coefficient of internal consistency	Error ratio	Standard error
old	39	77.69%	14.95%	37.31%	79.18%	11.84%
new	15	86.67%	15.89%	62.05%	61.60%	9.79%

	Total number attempts	Average grade of all attempts	Standard deviation	Coefficient of internal consistency	Error ratio	Standard error
old	32	78.91%	16.93%	42.07%	76.11%	12.89%
new	5	92.50%	11.18%	42.86%	75.59%	8.45%

Explanations from Moodle wiki for statistics:

http://docs.moodle.org/22/en/Quiz_statistics_report