Using Context Based MicroTraining to develop OER for the benefit of all

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ABSTRACT
This paper demonstrates how Context Based MicroTraining (CBMT) can be used to develop open educational resources in a way that benefits students enrolled in university courses as well as anyone who wants to participate in open-learning activities. CBMT is a framework that provides guidelines for how educational resources should be structured. CBMT stipulates that information should be presented in short sequences and that is relevant for the learner's current situation. In this paper, CBMT is implemented in a practical ICT course using video lectures that are delivered as open educational resources using YouTube. The experiences of enrolled students as well as YouTube users are evaluated as well as the actual results of the enrolled students. The results of the study suggest that users of the video lectures appreciate the learning approach. The actual results, i.e. learning outcomes, of the enrolled students are maintained. The study also demonstrates how using CBMT as open educational resources can free up time for teachers and increase the quality of teaching by benefitting from community feedback.

Author Keywords
Open-learning; OER; Context Based MicroTraining; on-demand learning; higher education; nanolearning

ACM Classification Keywords
H4.0: General
K.3: COMPUTERS AND EDUCATION
K4.0: General

INTRODUCTION

Openness in higher education is a phenomenon that has grown in popularity and debate in recent years, globally as well as in the EU. In the report "Opening up Education", published by the European Commission, Inamorato dos Santos and Punie [1] describe that opening up education is important for several reasons. Those reasons include making it easier and cheaper for learners to access education and that open learning helps modernize higher education, since open learning is commonly carried out using digital techniques.

The Open Education Consortium [2] describes open education as follows:

"Open education encompasses resources, tools and practices that employ a framework of open sharing to improve educational access and effectiveness worldwide."

Cronin [3] discusses this definition further and finds that open education is an ambiguous term than can mean different things including the following:

- Open Admission
- Open as in free
- Open Educational Resources
- Open Educational practices

The reminder of this paper will concern Open Educational Resources (OER) that are defined by UNESCO [4] as:

"teaching, learning and research materials in any medium, digital or otherwise, that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions. Open licensing is built within the existing framework of intellectual property rights as defined by relevant international conventions and respects the authorship of the work"

[5] Claims that OER can help improve education across the world and that they are an important tool in providing education in developing countries where access to resources and classrooms may be limited.

While creating and distributing OER undoubtedly offers lots of benefits to a lot of people, there are concerns that needs to be addressed. In a paper discussing Massive Open Online Courses (MOOC), Yuan, Powell [6] discusses if MOOCs follow a sound pedagogical approach that leads to quality learning for the students and recognizes that MOOCs generally lack quality assurance controls.

In the topic of quality assurance, Butcher [7] states that quality assurance is up to the provider of education. He also argues that when an institution is publishing OER they have strong incentives of ensuring quality as the quality of the OER will reflect on the institution. Looking from the

OpenSym '19, August 20–22, 2019, Skövde, Sweden

ACM ISBN 978-1-4503-6319-8/19/08…$15.00
https://doi.org/10.1145/3306446.3340814

providers point of view, Hylén [8] describes that a common argument for using OER is that OER enable community feedback that can in turn raise the quality of teaching material. Using that idea, a teacher could benefit from transforming material used in closed campus courses into OER as a quality assurance task

In this paper, we explore how teaching material in closed campus courses can be distributed to campus students, and the general public as OER. This is done by proposing and evaluating a framework for creating OER that can be widely spread in the public domain while serving as a teaching method for student enrolled in campus courses. The framework is called Context Based MicroTraining (CBMT) and can be implemented to facilitate open on-demand learning. This paper demonstrates how CBMT can be distributed as OER and used for teaching students enrolled in campus courses. Further, the paper evaluates how students in ICT experience using CBMT over traditional classroom teaching and the impact of the teaching method on student's results. As such, the study demonstrates a pedagogical approach to creating OER and addresses the general concerns about quality in open-learning.

The upcoming section will describe CBMT and the theoretical background to CBMT in detail while the upcoming section of this paper will in turn, describe the addressed research questions and methodology used in this paper as well as the results and conclusions of this study.

CONTEXT BASED MICROTRAINING (CBMT)

The concept of CBMT is based on the notion that people need motivation in order to learn. The idea here is that the likelihood that any adult will learn is increased if the knowledge seems meaningful for the learner [9]. This notion is based on the concept of andragogy as presented by Knowles [10]. Knowles [10] argues that an adult learner needs to be motivated in order to learn. That motivation can be external in the sense that you apply for a course to further your knowledge but it is also possible for the teacher to increase the motivation of the learner by using different techniques. As discussed by Hult [11], one such way is to adjust the examination of a course so that it supports learning instead of being a check of student knowledge regarding central concepts. The foundation in this way of thinking is that the learner will learn better if the knowledge presented seems meaningful. One way to accomplish this is to present the knowledge in a context where it is applicable. As discussed by Herrington and Oliver [12], presenting knowledge to learners in a situation where the knowledge is applicable will cause a more meaningful learning experience. This is the first requirement that CBMT tries to facilitate.

Further, an obstacle in the sense of providing the computer user with knowledge about information security has been to make the users participate in education. One technique that has gained an increasing interest in the past years is microlearning or similar strategies including nanolearning and micro-training. As described by Wang, Xiao [13], nanolearning is a teaching method where information is presented in short sequences. The idea is to facilitate just-in-time learning meaning that information is provided in small chunks, thus making the time needed to absorb the information short and in an on-demand fashion [14]. As described by Bruck, Motiwalla [15], there has been research showing positive results of microlearning both in terms of learner participation and satisfaction. Microtraining is the second fundamental building block of Context Based MicroTraining.

On a practical note, CBMT can be described as a framework that describes learning objects from two directions. The first direction concerns the delivery of the learning objects and states that the learning objects should be short sequences delivered in an on-demand fashion. On-demand learning object has the properties of not being ties to a person or location making it easy to distribute them as OER.

The second direction concerns the content of the learning objects. In this respect, CBMT demands that the information presented in a learning module is of immediate use to the learner and therefore assumes that the information is relevant to the learner in the learner's current context. In this respect, CBMT tries to facilitate the concept of "learn by doing" theories that can be summarized as a describing that leaners learn better when they perform tasks instead of just reading [16]. CBMT is also a learning method that includes aspects of problem-based learning (PBL) in that it is designed to guide the learner through real-world tasks[17]. In summary, the meaningfulness is achieved by the learner doing some task related to his or her situation.

Given the discussion in the previous sections, CBMT is a teaching method where information is provided in small segments to the learner. Further, the information presented is relevant for the learner in his or her current situation. A simple way of modeling CBMT is provided in Figure 1.

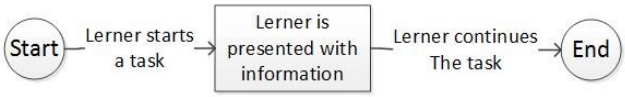

Figure 1 conceptual model of CBMT

Looking at the abstract model in Figure 1, CBMT begins with a learner entering a situation or starting a task. For the sake of this description that situation can be that the learner opens an e-mail containing a link. Based on this situation, the learner is presented to a learning module with short information relating to the current situation. In this example, it could be information telling the learner not to enter account information into links sent via e-mail or to verify that the e-mail address of the sender matches the source that the e-mail appears to be from. The learner is then supposed to carry on with the task, in this case reading and reacting to the e-mail. As such, CBMT is a process where the central concept is that the information presented is relevant for the situation that the learner is in. The actual format that the information that is presented in is not specified in detail by CBMT but should

comply with the ideas of nanolearning, namely facilitate just-in-time learning while the learner can maintain interest in the information.

As for the actual implementation of CBMT, there are two distinct ways in which it can be done. In the context of teaching computer users about information security, it would seem feasible to have a software monitor what is happening on the user's computer and present the learning modules whenever the users enter a situation or perform an action where he or she needs the information. In this case, you would rely on the computer to decide when the user is entering a context where the information is applicable. The implementation of CBMT in such a scenario is modeled in Figure 2.

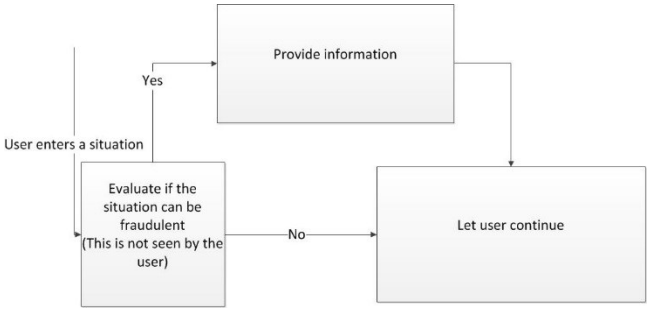

Figure 2 CBMT used to combat online fraud

The case in Figure 2 assumes that CBMT is used to combat online fraud. In this scenario, a computer would evaluate when to detect that a user enters a situation than the user is at risk of meeting a fraudster. If so, the computer will present information to the user so that she can handle the situation.

In the context of higher education, we realize that automatic detection is hard to achieve because of the wider range of subjects. A more feasible way to implement CBMT would be to provide the learner with a task and a series of learning modules. The task would include a number of steps where the student is supposed to use a learning module before working with a step of the task. In a simplified scenario where a carpeting student is supposed to learn how to build a table you could divide the task into several smaller activities:

1. Measure
2. Cut
3. Screw together

You would then create nanolearning modules for each activity and let the student do module one just before doing activity one, then the student does module two before embarking on activity two and so on. In this scenario, you would present the learning modules on an on-demand basis rather than in an automated fashion. The process is visualized in Figure 3.

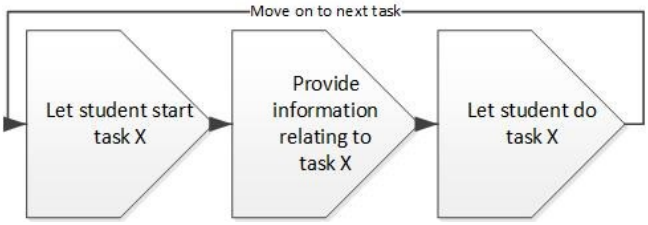

Figure 3 CBMT in education

As described by Kävrestad and Nohlberg [18], context based micro training has been evaluated as a way to teach Internet users about online fraud schemes with positive results. The method was further explored in the same context by Werme [19] with similar results. A more recent thesis by Skärgård [20] evaluated context based micro training as a method to teach information security in general and found that the method was appreciated by the users.

To summarize, CBMT is a learning method where short sequences of information are presented to the learner in a context where it is of direct relevance to the learner. The teaching method is similar to nanolearning. As described by Wang, Xiao [13], nanolearning is a teaching method where information is presented in short sequences. The difference between nanolearning and context based microtraining is that context based microtraining also present the information in a context where it is of relevance to the learner. Another difference is that CBMT in itself encourages the learner to immediately use the information presented to her. Thus, CBMT encourages retrieval of information, an important factor in learning [21].

MOTIVATION AND RESEARCH AIM

Creating and distributing OER as a part of teaching in higher education can bring several benefits to the global community, as discussed in the introduction. However, the main role of any teacher in higher education is to ensure the best education possible for the students enrolled in his or her courses. Further, the constraint of time causes a scenario where it would be ideal to incorporate creation of OER into the courses held for enrolled students rather than creating OER not connected to any course.

In this paper, we demonstrate how a practical university level course can be built around OER designed according to the CBMT framework. We then evaluate the student's perception of learning with the use of the CBMT learning modules instead of traditional classroom teaching. Since the actual learning outcomes are usually the student's grades, we evaluate the performance of the student's in relation to previous years of the same course to ensure that the use of CBMT does not impact the student's results in a negative way. Finally, we evaluate the community usage and feedback that was given from users of the OER, via YouTube. The research questions explored in this paper are the following:

- *Q1: What impact will using CBMT over classroom lectures have on student's results?*

- *Q2: What is the students' experience of using CBMT over classroom lectures?*
- *Q3: How are OER based on CBMT perceived by the global community?*

While the benefits delivering learning modules as OER are obviously that they contribute to the pool of open learning we also expect two benefits for the enrolled students as well. First, the presented literature suggests that context based micro training can be a teaching method that provides the learner with a more meaningful learning experience as compared to lectures and written examination. Second, one way to implement context based microtraining is through on-demand services using, for instance, recorded video lectures. As video lectures can be reused once they are created, CBMT ensures that the learners can reuse the learning modules as often as they want while the teacher can save time that can be used for other in-person learning activities, such as seminars or supervision.

METHODOLOGY

The methodology in this study is based on a real-world scenario where the research questions are addressed by implementing CBMT modules, distributer as OER using YouTube, in a setting with actual students that will study a practical topic that is new to them. As this study evaluates CBMT in a new context it is possible that using CBMT will have a negative impact on the student's ability to complete a course. Thus, a pilot testing of CBMT in a controlled environment was conducted and following positive results of the pilot, CBMT was implemented in an actual course. The research process is visualized in Figure 4 below.

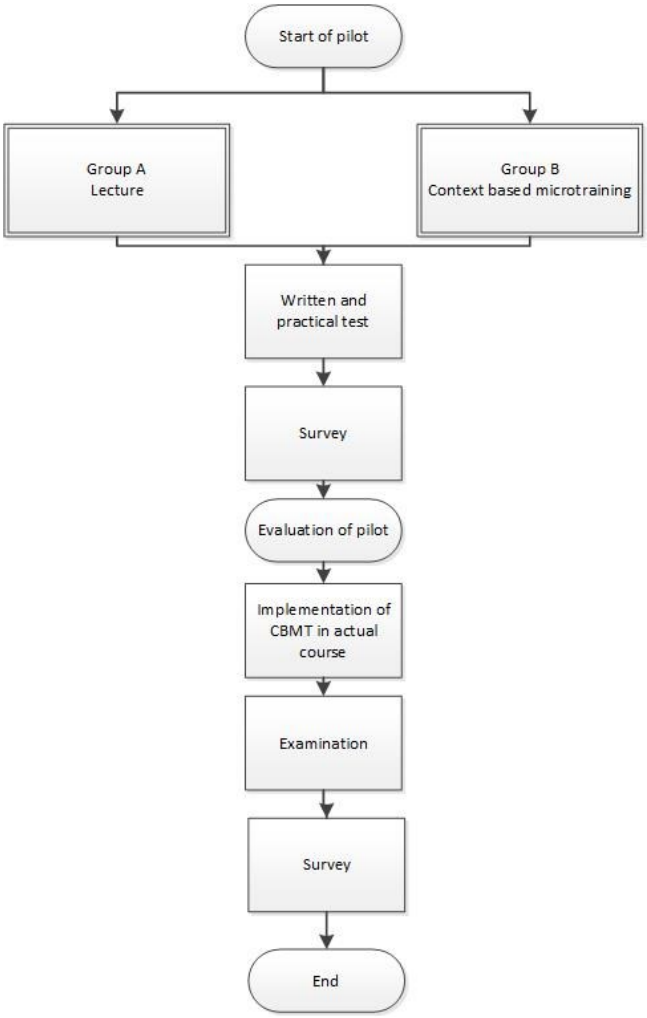

Figure 4 Research process overview

For the pilot, students from the third year of the Bachelor Degree study program Networks and Systems administration was invited to participate. The participants were split into two groups randomly, A and B. Group A was taught using traditional classroom teaching and group B was thought using Context Based MicroTraining. All participants were then be handed a test with a practical and theoretical part and the test scores from the two groups were compared. The practical test was taken from Cisco Networking Academy. Cisco Networking Academy delivers curriculum and tests to a multitude of teaching institutions around the globe. The theoretical quiz was developed by one of the researchers who has several years of experience in teaching in the subject area and is a certified Cisco Academy Instructor. Finally, a qualitative survey was sent out to the participants from group B. The purpose of the survey was to analyze how the participants perceived CBMT as a teaching method. The survey was designed to mimic semi-structured interviews as described by Robson and McCartan [22]. One could argue that in-person interviews would be a better method but since the participants in this study are students studying under the researchers, anonymous surveys were deemed to be a better

method in order to minimize bias. We argue that a face-to-face interview could impact the participants' willingness to provide honest answers, especially if they dislike the teaching method.

Following successful results from the pilot, as outlined in the results section of this paper, the research process continued with the implementation of CBMT in an actual course. The course used for this was a course in data communication and the material thought is delivered by Cisco Networking material and called CCNA2: Routing and Switching Essentials. The course has been running for several years using traditional lectured combined with supervision where the students could practice the practical aspects of the course. During this study, the course was modified by exchanging the classroom lectures for recorded lectured developed according to the principles of CBMT. Further, a session where the student was invited to study and discuss the theoretical material was scheduled. The course was examined using a theoretical exam and a practical exam in which the students need to fully understand the course content. After the course, the students were asked to answer a survey containing Likert-type questions designed to measure their experience of using CBMT. Also, the student's results from the examination were compared with the results from the previous run of the course. In an attempt to evaluate the usefulness of the learning modules for the global community, the usage statistics and feedback from YouTube was recorded and presented. Also, the total number of positive and negative feedback objects was recorded as an attempt to evaluate the perception of the learning modules from the global community.

RESULTS FROM THE PILOT

This section details the actual execution of the pilot and presents the results in this step of the research process. Prior to the tests and the survey, the participants received teaching, Group A had a lecture and group B worked with a learning module designed according to the principles of CBMT. To mimic a realistic setting, all participants gained access to written course material and practical training exercises. The material was the same material that is used in Cisco Academy courses and covered a data communication technology called BGP (Border Gateway Protocol).

Test

The first step in measuring the effects of CBMT was to give the participant an actual test containing a practical part where they had to configure BGP and a theoretical part with questions about BGP. The theoretical part contained questions that could be a part of a real examination and was developed by one of the authors, who is a certified Cisco Academy Instructor. The practical test was a standardized test developed by Cisco.

The theoretical test consisted of seven multiple choice question that each gave one point, thus the participants could score a maximum of seven points. The practical part was graded pass or fail. Further, the time spent by the participants to take the test was also recorded. The results of the test are presented in Table 1 below.

Table 1 Test scores (pilot)

Group	Theoretical score	Practical score	Time (min)
A - Traditional	6	Pass	21
A - Traditional	7	Pass	25
A - Traditional	7	Pass	20
A - Traditional	4	Fail	28
Group A Average	6		23,5
B - CBMT	7	Pass	15
B - CBMT	7	Pass	8
B - CBMT	7	Pass	10
B - CBMT	6	Pass	15
Group B Average	6,75		12

As seen in Table 1 above, the average results for the group that used CBMT were marginally better for the theoretical as well as for the practical task. However, due to the small sample, it is hard to eliminate chance as a reason for the difference. Looking at time spent to do the test, it is clear that group B, that used CBMT needed less time, in fact the average time spent to do the test for the participant in group B was close to half the average time spent by the participants from group A. Further, the slowest participant in group B was about 25% faster than the fastest participant from group A. The difference in needed time could indicate that the participants from group B were more confident when completing the test. Overall, the results from the test indicate that CBMT provides at least as good learning outcomes as traditional classroom teaching when used to teach practical skills. Further, the difference in score and needed time indicates that CBMT produces higher learning outcomes when used to teach practical skills.

Survey

To analyze how the learners perceived CBMT, a qualitative survey was used to ask the participants in group B about their experience with CBMT. The surveys were conducted in English using google forms to ensure the anonymity of the participants. The survey contained the following questions:

Q1: How was your experience of using CBMT in this course?

Q2: What benefits do you see of using CBMT compared to traditional classroom teaching?

Q3: What downsides do you see of using CBMT compared to traditional classroom teaching?

Q4: Do you see any other courses where CBMT could be beneficial and in that case which?

Q5: Do you see any other situations where CBMT could be used and if so which?

Q6: Do you have any further comments about CBMT and the study?

The survey was preceded by the following informational text:

"You recently participated in a study about the use of Context Based MicroTraining (CBMT) in higher education. This survey is sent out to the participants that used CBMT in the study. We would much appreciate if you answered the five questions in the survey, your answers will be anonymous and you may end the survey at any time. As far as possible, relate your answers to the CBMT teaching method rather than the actual content provided in this study. The purpose of the surveys is for us as researchers to gain a deeper understanding about how you as students perceives the use of CBMT, positive as well as negative aspects.

As background, the purpose of CBMT is to provide knowledge in a situation where the knowledge is of relevance to learner, for instance in a scenario where the knowledge will the applied in a practical exercise or a real-life situation. Further, the idea of CBMT is to rely on re-usable, on-demand and short sequences of information that could, for instance, be provided as video lectures or games.

The results of the study will be published in scientific forums, if you wish to gain access to the results or have any other questions about the study, contact Author at email"

The results from the survey are presented in Table 2. The first column identifies the question number (Q*n*), the second column identifies the respondent by number (R*n*) and the third column shows the answer. One respondent answered the survey in Swedish, the answers have been translated into English and are written in italic in Table 2. The answers are presented exactly as they were given.

Table 2 Survey Answers (pilot) Survey answers Note from the authors: NSA is an abbreviation for the Networks and Systems Administrations study program and the course mentioned are courses in that program.

Qn	Resp.	Answer
Q1	R1	I thought it worked really well. I learn while doing so this really worked for me.
Q1	R2	*It was an interesting way to learn, practical practice and presentation of theory combined.*
Q1	R3	Good.
Q1	R4	Good
Q2	R1	I think that CBMT has the advantage of making it available for the student to follow along the teacher both during course literature and during practical exercises. Teaching can also be "on-the-fly" without the restraints of the classic classroom.
Q2	R2	*Easier to maintain focus when theory is mixed with practice, I also find it easier to learn while doing something myself.*
Q2	R3	Possible to view the learning material multiple times and learn by doing at the same time.
Q2	R4	You can follow along with what the teacher does. Possible to pause or rewind. Possible to look at the material anytime you want.
Q3	R1	I would imagine that CBMT would be less efficient for people who have a hard time motivating themselves to study. Without the requirements of actually being in a classroom, other distractions when the student is at home, for example, could prove challenging for some.
Q3	R2	*Can be hard to use in non-technical courses that are not very practical*
Q3	R3	Lack of contact with persons with knowledge. Should be combined in some form with traditional teaching.
Q3	R4	Some student might procrastinate and view the video at a later time. As opposed to lectures that are at a specific point in time.
Q4	R1	All practical courses, where the student can follow along the teacher as the teacher does the exact same exercises as the students do. Having the ability to pause and go back helps tremendously, which is not always the case with traditional classroom teaching.
Q4	R2	*I think it can be adopted in any courses that contain practical element. That includes almost all NSA courses especially databases, script and so on where you can practice small parts and then end with some bigger task that involves the just finished small parts. It may also be usable in courses like Linux*

		and Windows where you can do something while you see how it is done.
Q4	R3	Courses with practical elements should all benefit from this.
Q4	R4	Most practical courses (Scripting, Linux/Windows Admin, Datacom, IP telephony, Database Systems, Computer Fundamentals)
Q5	R2	*When you search for information about, for instance, how to configure something, like a web server. In these cases I find it common to read step by step or watch a movie and configure the web server as you go.*
Q5	R3	Probably in many situations where some sort of learning is present.
Q6	R2	*It would be interesting to test during a longer period with deeper material since I think than more people than you think uses it.*
Q6	R3	No.

Looking at the responses from Q1 and Q2, the respondents all state that using CBMT was a positive experience and some positive effects of using CBMT instead of traditional classroom teaching are mentioned. These include the possibility to reuse the material and the fact that CBMT enables you to work with a practical task and the theoretical material at once. As previously described, this is one of the main targets with CBMT. Looking to Q3 where the respondent could express downsides with CBMT, they mention that one problematic aspect can be that it is easier to procrastinate when you as a learner have the full responsibility to actually study. In that sense, a scheduled lecture can increase the chance of the learner actually attending at all. One respondent also mentions that a lack of contact with the teacher could be overcome by combining it with some other teaching activity.

Looking at the answers to Q4 and Q5, the participants suggest that courses with practical content could benefit from using CBMT. It is also suggested that CBMT could be used in other learning situations outside of the classroom. In summary, the survey shows that the participants in this study appreciated using CBMT as a learning method for practical content. They argue that the fact that CBMT allows for a learning-by-doing apprise and that the material is available on-demand is beneficial and preferable to traditional classroom teaching even if they also state that the lack of teacher attendance can be an issue, especially for students with procrastination behavior. Thus, even if there are concerns that have to be addressed when using CBMT in higher learning, the survey does indicate that CBMT can provide a more meaningful learning experience compared to traditional classroom teaching

RESULTS FROM IMPLEMENTING CBMT IN AN ACTUAL COURSE

Following the positive results from the pilot, CBMT was implemented in an actual course, which was the first of three connected courses. The course was previously taught using classroom lectures and self-studies supported by supervised sessions where the students could practice the practical parts of the course. In this study, the lectures were delivered using recorded lectures developed according to the principles of CBMT. The students were also scheduled for supervision where they could work with the lectures and ask questions on the material as needed. The course ended with an examination consisting of a practical test and a theoretical test. The material taught in this course is standardized material developed by Cisco Networking material, the lectures and the tests were designed by one of the authors, who is a certified Cisco Academy Instructor. Following the examination, the students were asked to fill out a survey on how they perceived CBMT as a teaching method.

The results from the examination, with 28 participants, was compared to the results from the previous run of the course, with 23 participants. In the group of students using CBMT (heron called CBMT), 77% of the students passed the practical test compared with 79% in the previous year (heron called previous). As for the theoretical test 90% the CBMT students passed with an average score of 77% compared with the previous students were 88% passed with an average score of 75% percent. There results indicates that the use of CBMT had no or negligible impact on the students results.

Following the examination the students were handed a survey with questions about how they perceived using CBMT, all students answered the survey. The first four questions were Likert-style questions where the students were asked to rate 4 statements of a five graded scale where 5 was labeled “Fully agree” and 1 was labeled “Do not agree at all”. The questions and average response values are presented in Figure 5 below.

		The video lectures used in this course has encouraged me to do the practical exercises	The video lectured used in the course has motivated me in my studies	The video lectures, as used in this course, helped me understand the theoretical material	Practical video lectures fits well into this type of course
N	Valid	28	28	27	28
	Missing	0	0	1	0
Mean		4,46	4,57	4,44	4,79
Std. Deviation		,793	,690	,641	,568
Variance		,628	,476	,410	,323

Figure 5 Answers for the first survey question

As seen in Figure 5, the answers to the questions clearly show that students appreciated using the video lectures in this course. The next section of the survey measured how the

students used the lectures. The course contained 10 recorded lectures that all contained practical elements. As seen in Figure 6, 75% of the students used 9 or 10 of the lectures.

How many video lectures did you use?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	9 or 10	21	75,0	75,0	75,0
	7 or 8	2	7,1	7,1	82,1
	3 or 4	4	14,3	14,3	96,4
	1 or 2	1	3,6	3,6	100,0
	Total	28	100,0	100,0	

Figure 6 self-reported lecture usage

Figure 6 shows that a majority of the students used most of the recorded video lectures.

The next question measured how frequently the students completed the practical elements in the lectures, the answers are presented in Figure 7 below. The results for this questions shows that 57% of the students completed most or all practical elements and only 7% of the respondents report that they did not complete any of the practical elements.

Did you do the suggested practical elements during the video lectures?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Did all practicals	4	14,3	14,3	14,3
	Did most practicals	12	42,9	42,9	57,1
	Did no practicals	2	7,1	7,1	64,3
	Did some practicals	10	35,7	35,7	100,0
	Total	28	100,0	100,0	

Figure 7 self-reported engagement in practical elements

As a final question the students were asked to choose if they preferred to be taught using video lectures or classroom lectures and as seen in Figure 8, 92,9% of the participants preferred video lectures.

Do you to prefer to be taught using video lectures and supervision or class room lectures?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Lectures	2	7,1	7,1	7,1
	Video	26	92,9	92,9	100,0
	Total	28	100,0	100,0	

Figure 8 Video lectures vs. class room lectures

Evaluation of external usage of OER

The above mentioned evaluation was based on a course that was the first of tree connected courses that was all thought using CBMT video lectures distributed as OER using YouTube. This section presents usage statistics and analysis of feedback given from the users of the OER on YouTube. The usage statistics are presented in Table 3. The Lectures are name Cx-n, where x is the course they was used in, C1 being the course that was the basis of the just presented evaluation, and n is the lecture number. C1 was published in the end of June 2018, C2 in the end of July 2018 and C3 in the middle of January 2019.

Table 3 OER usage statistics

Lecture number	Views	Thumbs up	Thumbs down
C1-1	373	10	0
C1-2	153	3	0
C1-3	209	9	0
C1-4	112	5	0
C1-5	113	6	0
C1-6	123	5	0
C1-7	120	5	0
C1-8	93	3	0
C1-9	94	3	0
C1-10	116	6	0
C2-1	992	17	0
C2-2	396	11	0
C2-3	245	7	0
C2-4	257	10	0
C2-5	211	8	0
C2-6	887	12	0
C2-7	412	11	0
C2-8	452	18	0
C2-9	386	12	1
C2-10	377	10	0
C3-1	107	3	0
C3-2	84	2	0
C3-3	71	2	0
C3-4	41	3	0
C3-5	43	2	0
C3-6	37	2	0
C3-7	39	3	0
C3-8	48	4	0

As seen in table 3, the lectures was viewed between 39 and 992 times, leaving a big span that can to some extent be explained by the publishing dates. While the views counters is a blunt measurement that includes views from enrolled students the numbers show that others than the enrolled students made use of the OER. Further, the fact that all lectures received some like and only one video received one dislike, in some way, an indication that the learning modules was appreciated by the community as a group.

The notion that the videos was appreciated by the community is strengthened by the fact that two comments to the videos in C2 asked for videos for C3 before they were posted, and an additional five positive comments was received to the lectures in C2.

Further, comments for two lectures mentioned errors in the lectures. Following those comments, the lectures was corrected and the old ones deleted. This process demonstrates how OER can benefit from community feedback and increase the quality of the teaching.

CONCLUSIONS

CBMT is a teaching method originally developed to teach information security. The purpose of this paper was to evaluate if CBMT can also be used as a teaching method in higher education, for practical courses while generating learning objects distributed as OER. In this study, CBMT was used in a pilot test with third-year students from the study program Networks and Systems administration. Following successful results in the pilot, CBMT was implemented as the teaching method in an actual course. In the pilot and the actual course, CBMT was evaluated by measuring the actual performance of the students and by evaluating the student's experience of using CBMT compared to traditional classroom teaching. All learning modules was distributed as OER using YouTube and the usage of the learning modules was recorded.

The first research question addressed in this study was "*What impact will using CBMT over classroom lectures have on student's results?"* During the pilot, the group using CBMT scored marginally better than the group that was thought using classroom teaching. However, when implementing CBMT in an actual course the exam scores were comparable with exam scores from the previous run of the course.

The second question addressed in this study was "*What is the students' experience of using CBMT over classroom lectures?"*. This question was addressed in the pilot with a qualitative survey that indicated that students would prefer using CMBT over traditional classroom lectures. The pilot also suggested that CBMT should be well-fitted for practical courses. Similar results were obtained using a Likert-style survey to measure how the students that used CBMT in an actual course perceived CBMT. In that survey, the respondents reported that using video lectures designed according to the principles of CBMT, encouraged them to do practical tasks, motivated them in their studies and fitted well for the course content. Further, over 90% of the respondents reported that they preferred the video lectures over traditional classroom lectures. Thus, the study shows that students prefer using CBMT based video lectures over classroom lectures for practical courses.

The final question addressed in this study was *"How are OER based on CBMT perceived by the global community?"*. This question was answered by usage statistics from YouTube, there the OER was published, and user comments to the OER. While the instrumentation, analyzing views and reactions, must be considered blunt, the usage statistics suggests that the OER was used and appreciated by the community users. Further analysis of the comments does, even if they were few, emphasize this notion. Also, some comments pointed out errors in the OER leading to them being corrected and reposted which benefited the community users as well as the enrolled campus students.

This study examined how enrolled student experiences learning with learning modules designed according to the CBMT framework and distributed as OER. Usage statistics tracked on YouTube revealed that the learning modules was used by others than the enrolled students and since mostly positive feedback was given on YouTube, some indication was given that the learning modules was appreciated by the global community. However, the actual learning outcomes of others than enrolled students were not measured in this study.

In conclusion, this study does suggest that CBMT can indeed be a useful teaching method in higher education while generating OER useful for the global community. In this particular study, the participant's results were not affected negatively by using CBMT over traditional classroom teaching. However, it is important to notice that using recorded material can free up substantial time for the teacher and is reusable between different runs of the course. It also makes it possible to make the lectures publicly available as OER and thus, contribute to the life-long learning and the global pool of open-learning. Further, it is evident that the students participating in this study clearly preferred CBMT over classroom teaching making CBMT a teaching method that is feasible for use in practical courses in higher education.

FUTURE WORK

The results of this study suggest that CBMT can be an effective teaching method in higher education. However, the answers from the surveys also suggest that one could not completely substitute the teacher with CBMT modules. It is, of course, reasonable to argue that access to the teacher is of great value to the learning outcomes and experience in any course. Given our results, a direction for future work would be to implement and evaluate CBMT in a wider range of courses and in different subject matters.

Another note is that we did not at all examine the learning outcomes of those that was using the OERs but not enrolled in the course that functioned as test group. While we demonstrated how learning modules can be delivered as OER whit positive effects for enrolled students using them, a direction for future work would be to examine the learning outcomes for those not enrolled in a course, or the course that the OERs was specifically designed for.

We are happy to provide the material that we used for other researchers to use and be inspired by.

REFERENCES

[1] Inamorato dos Santos, A. and Y. Punie, *Opening up education: A support framework for higher education institutions*. 2016, Joint Research Centre (Seville site).

[2] The Open Education Consortium. *About The Open Education Consortium*. n.d; Available from: https://www.oeconsortium.org/about-oec/.

[3] Cronin, C., *Openness and praxis: Exploring the use of open educational practices in higher education.* The International Review of Research in Open and Distributed Learning, 2017. **18**(5).

[4] UNESCO, *2012 PARIS OER DECLARATION*. 2012.

[5] UNESCO. *Open Educational Resources (OER)*. n.d; Available from: https://en.unesco.org/themes/building-knowledge-societies/oer.

[6] Yuan, L., S. Powell, and J. CETIS, *MOOCs and open education: Implications for higher education*. 2013.

[7] Butcher, N., *A basic guide to open educational resources (OER)*. 2015: Commonwealth of Learning (COL);.

[8] Hylén, J., *Open educational resources: Opportunities and challenges.* Proceedings of Open Education, 2006. **4963**.

[9] Hedin, A., *Lärande på hög nivå.* Uppsala universitet, 2006.

[10] Knowles, M.S., *Andragogy in action: Applying principles of adult learning.* San Farancisco: Jossey-Bass, 1984.

[11] Hult, A., *Examinationen är kursen, En analys av examination i kurser över nätet.* 2007.

[12] Herrington, J. and R. Oliver, *Critical characteristics of situated learning: Implications for the instructional design of multimedia.* 1995.

[13] Wang, M., et al. *Mobile learning design: The LTCS model*. in *Intelligent Environments (IE), 2014 International Conference on*. 2014. IEEE.

[14] McLoughlin, C. and M. Lee, *Mapping the digital terrain: New media and social software as catalysts for pedagogical change.* Ascilite Melbourne, 2008.

[15] Bruck, P.A., L. Motiwalla, and F. Foerster, *Mobile Learning with Micro-content: A Framework and Evaluation.* Bled eConference, 2012. **25**.

[16] Koedinger, K.R., et al. *Learning is not a spectator sport: Doing is better than watching for learning from a MOOC*. in *Proceedings of the second (2015) ACM conference on learning@ scale*. 2015. ACM.

[17] Boud, D. and G. Feletti, *The challenge of problem-based learning*. 2013: Routledge.

[18] Kävrestad, J. and M. Nohlberg. *Online Fraud Defence by Context Based Micro Training*. in *HAISA*. 2015.

[19] Werme, J., *Security awareness through micro-training: An initial evaluation of a context based micro-training framework*. 2014.

[20] Skärgård, M., *Mikroträning som utbildningsmetod inom informationssäkerhet*. 2017.

[21] Karpicke, J.D. and H.L. Roediger, *The critical importance of retrieval for learning.* science, 2008. **319**(5865): p. 966-968.

[22] Robson, C. and K. McCartan, *Real world research*. 2016: John Wiley & Sons.