Danish University Colleges

Design of MOOC`s for Health Education

Steen, Britt Højgaard; Lausten, Thomas

Publication date:
2016

Document Version
Pre-print: The original manuscript sent to the publisher. The article has not yet been reviewed or amended.

Link to publication

Citation for published version (APA):
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Lausten, Thomas, ¹ and Steen, Britt ²
¹ University College Zealand/ Center for Nursing and Bioanalysis, Næstved, Denmark
² University College Zealand/ Center for Nursing and Bioanalysis, Næstved, Denmark

Abstract — This Project is a coupled bridging course developed by associated professors from University College Zealand in cooperation with students, middle schools and high schools. It is designed to show the students different educational opportunities coupled with themes from their existing education all demonstrated in the setting of University College. This is supported through E-learning objects from MOOC’s in co-creation with the students and face-to-face education where application oriented education are used and communicated from student to student at theme days. The key focus is co-creation about the E-learning objects to the MOOC’s, communication from student to student, application oriented learning and career choices in the future.

Index Terms — career choices, co-creation, Health education, MOOC.

I. INTRODUCTION

This project deals with a coupled bridging course where students and pupils of middle school and high school have worked together – virtually with both MOOCs and F2F – for 5-8 weeks, focusing on a scientific theme primarily within the health professions. We have chosen to present four different courses in the health professions: Malaria and International Healthcare, Chemistry and molecular gastronomy, Cardiovascular system, Biological methodology (CSI). An additional requirement for the project that students from all three levels of education have been co-creational to MOOCs.

The project is funded by University College Zealand (UCSJ) and Region Zealand. Appreciations are extended to Region Zealand for their contributions to this project. The goal of the project for Region Zealand has been that pupils in middle school and high school gain:

1. A picture of career options;
2. A bridging between subject and industry;
3. The presented with alternatives to traditional career- and educational guidance.

1) In order to motivate children and teenagers, the project creates a clear connection between education and career options, so that it is perceived to be relevant spending time on the teaching in the various fields of study. The objective of the project is to create a picture of the career options in which the participating pupils can see themselves. Additionally, a connection is made between theory, practice, and subject.

2) Studies show an evident link between choice of education and the educational level of parents [1]. There is a clear tendency for teenagers whose parents are unskilled or low-skilled to choose shorter educations with a clear professional aim. Thus, the aim of this project is to open the eyes of the young to the vocational educations offered in Region Zealand.

3) Traditionally, teenagers are introduced to the choices of education and career through a network of guidance which offers instructions in both middle school (Unges uddannelse, (UU)) and high school (Studievalg Zealand (SvS)). The network of guidance visits schools to talk about educations, and offers personal guidance. In the MOOC, educations are presented in the forms of both smaller e-learning objects and in shorter virtual meetings with the industry. According to Thomas Ziehe, who highlights the zapping-culture, the structure of the MOOC supports teenagers’ need to zap through their educational search. The different e-learning objects illustrate the many options of the professions and appeal to the need for choosing a career with a lot of options [2].

II. THE PROJECT

The actors of the project have been the middle school, high school, and University College Zealand, where the latter has had to operationalise the above goal. The project is constructed as a model development process where the participant and stakeholders of the project have been co-creational both in terms of content, structure, and design of the project. The participants from middle school and high school have been entrusted with ensuring that the content supports the existing curriculum in the middle school and high school. Moreover, the project has had to adapt to the existing schedules. Furthermore, it has been
made a requirement to have the pupils experience different learning environments than their usual ones.

The model development process allows for a coherent bridge building course vertically across the educational levels, where a new way to look at bridge building arises. A more active learning should hopefully arise for the participating students and pupils than in the usual bridging courses that have been more excursions based. One condition for the participation of middle schools and high schools is that the content of the model development course supports the currently existing content of teaching. In contrast to traditional MOOCs, where an individual can sign up and participate to various degrees, the participation for this MOOC has been obligatory for the registered classes.

III. DESCRIPTION OF THE PROJECT

The project is divided into four different courses each with their own focus within their scientific area. The four different courses have common denominators, as shown in the form below. These common denominators have been obligatory parts of the bridging project. Furthermore, the four courses each have their own distinguishing features in that they have been built around each of their individual themes, and with the involvement of different combinations of educations from UCSJ.

Malaria and International healthcare: The teacher, nurse, and laboratory technician educations created a joint course revolving around geography, biology, prevention and health promotion, and diagnostics in relation to “What is malaria?”

Chemistry and molecular gastronomy: The laboratory technician education includes descriptive biochemistry with the application of carbohydrate chemistry in the clinical field. The students' existing knowledge of cooking is related to the course of biochemistry by testing different combinations of carbohydrates such as starches in cooking.

Healthcare and treatment: The nursing and teaching educations put focus on the cardiovascular systems along with the fields of anatomy/physiology, nursing, and sports, biology, and social studies.

Biological methodology (CSI): The laboratory technician and teacher educations put focus on the teaching of biology and science method in middle school, which related to biological methods of investigation within forensic science

IV. EXAMPLE: COURSE DESCRIPTION

The course about Malaria and international healthcare and geography is an example of an exemplary course where the students and pupils from middle school, high school, and UCSJ have participated in a MOOC with a themed day, and a following virtual meeting about the educations for nurses, laboratory technicians, and teachers. The project started with students from the three educations at UCSJ having been giving the task with finding literature and producing e-objects along with other teaching material, which linked the themes of biology, malaria, international healthcare, and geography, relative to the careers of teachers, nurses, and laboratory technicians. For instance, e-objects were synthesized produced which revolved around the classification of parasites (including malaria parasites), classic microscopical diagnostics of malaria parasites, prevention of malaria, and geographical spreading of malarial mosquitoes. The e-objects were designed as podcasts, powerpoint presentations with speech, text files, and more. The pupils of middle school and high school were giving the task to work with the uploaded elements in their biology and geography classes in order to prepare for the themed day. One the day, six workshops were prepared which worked with the subjects of the MOOC. For instance the pupils and students from middle school and high school had to try to diagnose and differentiate between five different types of malaria parasites through regular microscoping of slides with blood from patients infected with malaria. After the themed day the students and pupils were giving the task to answer obligatory questions, which were designed to give better knowledge about the three educations. The course ended with arrangements for the students and pupils to be able to correspond, via e-mail or Skype, with a mentor-network from the three professions. Here, the pupils could ask questions which they felt were relevant in regard to wages, work conditions, career options, etc.

V. CHOOSING THEMES

We have been conscious in the collaboration with the educations (middle school/high school and University College) about choosing teaching themes which were already obligatory areas at middle school and high school level, in this regard getting easier access to time and resources of the schools while also linking this obligatory teaching to application-oriented elements present at the UCSJ educations

The themes were also chosen for their interdisciplinary aim with a wide appeal with respect to the students and pupils participating in the MOOC. At the same time, the diverse professional competences of the involved educators had to be taken into account so that we had educator/teacher-competencies to qualify the teaching material which was put into the MOOC by students and pupils.

VI. PROBLEM-BASED LEARNING

The bridging-course is a model development course containing four primary elements. These four primary elements are:
Table 1: Overview of time schedules of the bridging course and elements in the course

<table>
<thead>
<tr>
<th>Start up</th>
<th>Theme day</th>
<th>Post processing</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOOC course, duration 2-8 weeks</td>
<td>duration 1-2 dage</td>
<td>MOOC course duration, 1-2 weeks</td>
<td>Focus group interview with students and pupils, and lectors of all 3 levels in the educational systems</td>
</tr>
<tr>
<td>Introduction to MOOC and work with curriculum on the</td>
<td>Work with MOOC elements both practical and theoretical</td>
<td>MOOC</td>
<td>Questionnaire surveys with students and pupils</td>
</tr>
<tr>
<td>Mandatory assignments</td>
<td>Participation of pupils from middle schools and high schools and students from University College</td>
<td>F2F/ virtual meeting with occupation and industry</td>
<td></td>
</tr>
<tr>
<td>Virtual meeting, high schools and middle schools</td>
<td>Participation from industry/ occupations</td>
<td>Post processing of mandatory assignments in MOOC</td>
<td></td>
</tr>
<tr>
<td>F2F meeting: High schools and middle schools or/and University College and High schools</td>
<td>Participation from career counselors</td>
<td>Meeting with career counselors</td>
<td></td>
</tr>
<tr>
<td>Co-creation of e-objects</td>
<td>Co-creation of e-objects to the MOOC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Traditional MOOC elements, the combination of MOOC and F2F, application-oriented learning, and mediating of knowledge on different levels.

**Traditional MOOC elements:**
One of the strengths of using MOOC as a learning tool in the teaching is that the MOOC supports a lot of learning approaches, including the manner by which learning among students and pupils takes place in the social meeting between themselves (peer to peer) and the teachers [4]. MOOC supports a learning environment where pupils are encouraged to create products, which are then put into the MOOC and is used by others, motivating both pupils and students. As an example, the laboratory technician students and teachers chose various methods of analysis, found relevant (English-languaged) videos, and described the theory behind the used methods of analysis which were to be used in the MOOC for the CSI-course. High school students then transformed these learning elements to videos where they explained the methods of analysis in their own words and native language, thereby making it easier to understand for the middle school pupils. The objective for the middle school pupils was then to go through these videos, and then perform the methods of analysis in the laboratory in a face-to-face situation with the high school students.

Another strength imparted by the MOOC to the teaching is for students and pupils to have an opportunity to access the learning elements which fit the level of teaching of the student/pupil at the time needed as describe by Siemens 2006 [3].

A lot of the e-objects and learning elements were put into the MOOC at many different levels before the start of e.g. Malaria and International healthcare, so that the elements were adjusted to middle school pupils, high school students, and teachers and educators [4].

**MOOC in combination with F2F:**
The bridging course is a model development course where we combine face-to-face teaching with a MOOC. This MOOC is not constructed as a traditional MOOC course, where the pupil signs up for a course and at the end can sign up for an exam. This model development course is characterized by the MOOC functioning as a platform of resources with different learning elements, which can be combined according to the individual teaching course. The MOOC also contains exemplary descriptions of how to use the teaching courses. There has been a continuous experimented with the configuration and combination of the elements, the teaching method e-objects, and the content of the individual themes.

We have been inspired by Vinka Simovska, who looks at learning through interaction where student participation is transformed through the common activities, and they hereby become more competent members of the communities. Simovska argues that the processes of structuring knowledge in different manners promotes learning. The pupils move the focus of learning to exchange, meta-cognition, and cooperation, making it possible to link their everyday knowledge to the scientific health care knowledge [5].

For example, in the CSI MOOC the students’ reference framework from the media links to the biological...
methods of analysis and methodology used within a scientific paradigm. Equally, the students' everyday knowledge about cooking is moved into the laboratory in the course about Chemistry and Molecular Gastronomy, where they experiment with known and unknown kinds of starches, with which they work theoretically in regards to chemistry and descriptive biochemistry. The pupils can then see how chemistry can be used whilst cooking.

The bridging courses have had strong elements of co-creation in that the students are co-creating new and relevant information for the e-objects in the MOOC. Furthermore, the students have created further e-objects during the themed days in the form of presentation material and video clips of their performances, which can later inspire and motivate other users of these MOOCs. These processes for cooperation in productive activities greatly enable common learning processes, which subsequently allows for a common reference framework and a common basis for structuring knowledge. This interacting structuring of knowledge is a part of Simovska's interpretation of learning through interaction, which is based in communities of learning consisting of zones of proximal development [5]. The teacher is given a facilitating role, and the visions are responsible for giving the students new means of action, new kinds of knowledge, and leads to structuring knowledge through action. This structure of knowledge can link "to learn" with "to live", and can thereby help to promote the students' competence to act – in this bridging course with a focus on the later choice of education and career. This kind of bridging with learning through interaction, where e-objects in the MOOC are combined with face-to-face teaching, has given a good dynamic with motivated and engaged teachers, students and pupils at the themed days.

The MOOC has contributed to the theoretical basis of knowledge, which has helped support the activities of the themed days so that the application-oriented learning has been able to be carried out at a higher level of learning than initially assumed. The bridging courses could not have been done without the MOOCs since the MOOCs have given the students and pupils options for increasing their level of knowledge in the exact areas where there has been a need for an increase. The teachers have been able to form their teaching from the e-objects according to the need of the individual classes without having to use excessive resources for planning. The MOOCs alone have been unable to carry the bridging courses without the themed days since the students and pupils actively try to meet the learning expectations through imitation, meaning that the individual pupil attempts to mimic what others have done, and the students have hereby functioned as role models for each other, or, more specifically, as instructors. The Brothers Dreyfus have pointed out that computers never will be able to completely replace teaching and social learning because they do not carry this option for imitation [6].

Application-oriented learning: Application-oriented learning is rooted in the experimenting, examining, and activity based methods of working, where the focus is on the pupil's active participation and learning. The activities are hereby predominantly centered on pupil rather than teacher. The use of specific material contributes to the pupils' understanding of theoretical parts of the teaching, and the material is characterized by practical and functional learning resources. This specific material assists in bridging the applied and the theoretically abstract, and vice versa.

For example, pig hearts were used for dissection during the course of Healthcare and Treatment in order for the students to link their theoretical knowledge of the anatomy of the heart, blood flow through it, and the size of the heart, with the actual pig heart in their hands. This exercise gave the students a much bigger understanding of the theoretical knowledge they had, which the students also expressed during the exercise.

The advantages of using application-oriented learning is further justified by the increased motivation of the students, since they experience the teaching being centered around them, and becomes much more experimenting which supports those students that are weaker theoretically.

All four bridging courses had elements of application-oriented learning, which were put into play during the themed day. The students had previously all acquired a basic theoretical level which related to the application-oriented learning. This theory-acquisition took place either through the MOOC, or by face-to-face teaching together with their assigned teachers.

The results of those studies found in this area point in the direction that application-orientet learning has a positive effect on the students' performance, and a positive effect on their motivation. The studies regarding efforts after leaving school are few, and the area calls for more research [7].

Communication of knowledge on several levels: The bridging courses have opened up opportunities for the students from UCSJ and high school to experiment and acquire abilities within the field of didactics, in that they have had to communicate their technical knowledge to students and pupils with lower levels of knowledge than themselves. Nordenbo has researched in the competences a good teacher should possess. These three competences are: [8].

- Scientific competence
- Competence with relations
- Leading competence
The students have the opportunity to experiment with all three competences during the bridging course Healthcare and Treatment. Specifically, students from UCSJ have communicated knowledge to high school students and middle school pupils, and high school students have communicated their technical knowledge to the middle school pupils. This has taken place during two themed days.

It is very relevant to acquire these competences when all three of them are looked at from a future professional education, since a nurse has to be able to relate to a patient, exercise leading in the sense of handling and grasp the treatment process of a patient, and at the same time have the technical knowledge that the actual decisions are based on.

The communication which the students and pupils have been presenting can be explained through Kolb's learning circle which serves as an analytical template for systemizing the learning processes. The learning circle can explain how reflection takes place based on the individual's experiences in a dynamic process – and not with a specific result in mind. This realization takes place in a cycle with four stages: A specific experience, reflection of an observation, which through an abstract conceptualization becomes an active experiment.

Both the students and pupils have been through the reflection process, where specific situations regarding health and treatment are integrated into earlier experiences. In the process of reflection the specific situation is put into play with previous experiences, the theoretic basis, and is brought into new contexts that have had to involve students at various levels of education. These specific situations have then been conceptualized in the actual meeting with the students and the experimentation they have conducted [9].

This form of work in the bridging course has greatly motivated both students and pupils, since they are challenged in having to communicate their knowledge. Their knowledge thus becomes special and unique, and has to be worked with in a different manner in order to make it accessible for students at other levels of education. This helps to strengthen their own level of knowledge, and for the students' part, their own professional identity.

VII. THE MENTOR NETWORK

Each course has had a network of mentors attached, which consisted of people from the industry and students in the education for that correlating industry. Furthermore, people from career counselors were brought in in order to provide guidance for the middle school pupils and high school students in regards to choice of education. A task was included in the MOOC, designed to facilitate contact between the students and the mentor network. The goal was to give the students and pupils a clear picture of in which industries the region offered educations, and for the work and career options these would offer. The intention was to motivate more teenagers coming from unskilled or low skilled families to complete a medium education in the field of healthcare.

In the various courses it was experimented with creating a contact between pupils and the mentor network, for example, some pupils were tasked with making questions for a mentor of the network, who would then be interviewed through Skype in regards to that person's work and career choices. At the same time during the course, the pupils have been to lectures with another mentor about job and career path, where the focus was put on the mentor having had an interesting career path, for instance a laboratory technician who has working for Doctors Without Borders. Another example of an activity we performed in middle school was creating a star run (a run in the shape of a star), where pupils were to run to a post with students from the fields, and then run back to another post and report, what they had learned.

VIII. EVALUATION

The project is designed to collect data according to three elements: i. Factual yield ii. Motivation for the participation in the project iii. The students' knowledge of the professions/industries presented. Data is collected from focus group interviews with participation from educators and students, and a survey for groups of students and pupils from middle school and high school. The survey was designed with a test group and a control group, and the primary focus of Region Zealand was to research, whether the participation in the bridging courses had an effect on the knowledge of the educations. The results are yet to be completely worked out, but there seems to a tendency for the test subjects to have gained a higher knowledge of the educations of the Region than the control group.

IX. PERSEPCTIVES

In order to pursue the positive experiences with the application-oriented learning and the established network at the educational institutes, it has been thought about conceptualizing the individual bridging courses. This could be an option in regards to funding to continue working on the individual courses and adapt them to the specific wishes and needs that the educational institutes have. Further funding could open up options for expanding the existing MOOCs with more e-objects, involve more students and pupils in each course, and increase the co-creational part. It could also make it possible to link the existing courses to other professions.
In order to measure the effect of the pupils’ participation and observe their future choice of education and career, it would be interesting to spend resources on a cohort study and thereby put focus on future bridging courses in a combination of MOOCs and face-to-face teaching both with involvement of students and pupils at several levels of education.

X. REFERENCES
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XI. ACKNOWLEDGMENT
A thank to University college Zealand and Region Zealand for funding the work. And a special thanks to the effort and co-operation from students, occupation healthcare partners, work fields partners and other users and we like to express our gratitude to the participants for interest and encouragement.

XII. AUTHORS
Thomas Lausten is senior lecture at Center for Nursery and Bioanalysis, University College Zealand, Denmark. (E-mail: tla@ucsj.dk).

Britt Steen is associate professor at Center for Nursery and Bioanalysis, University College Zealand, (E-mail: brst@ucsj.dk).

Manuscript received 15. Marts 2016.
Published as submitted by the authors.