The Colibri Project:
Overcoming diversity in blended e-learning activity preparation

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INTRODUCTION

Colibri (Collaboration and Innovation for Better, Personalized and IT-Supported Teaching) is a three year project co-funded by the Erasmus + Strategic Partnership, starting in 2014. The project is being carried out by seven academic, two industrial, and one governmental organisation partners from eight different countries [1].

The main objective of the project is enhancing the quality and relevance of the learning offer in education by developing and systematically testing new and innovative approaches, and by supporting the dissemination and spreading of best practices. This is in the focus of increasing labour market relevance of learning provision and qualifications and promoting the take-up of innovative practices in education by supporting personalised learning approaches, collaborative learning, by making use of ICT and Open Educational Resources, and by exploring the use of blended and virtual mobility.

The overall idea of Colibri is to implement new and innovative teaching methods, and to establish a Living Lab of students from different universities, study directions and countries/cultures for a systematic testing and evaluation of these methods. An interdisciplinary joint master course on *Future Internet Opportunities* is part of the

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Living Lab, followed by 28 students and given by more than 10 different teachers. Both the teachers and the students represent different fields within computer science, electrical engineering, telecommunications, business informatics, management of technology, and entrepreneurship.

When organizing the course, we needed to face some of the fundamental challenges of diversity that are also being seen, at a smaller scale, in everyday teaching situations due to student mobility and an increasing amount of students: A) Not all students in the class have the same academic background and B) Students come with different learning styles and traditions.

We try to overcome this challenge by using self-assessment activities, Personalized IT-supported teaching approaches, and by practicing collaborative learning even across physical locations.

This paper presents the process we followed when developing the course. Complex matters had to be carefully considered when structuring and preparing it, such as remote student group work, blended mobility, and interdisciplinarity. The ideas described may serve as guidelines when preparing similar activities in the future.

1 DESCRIPTION OF THE PROJECT

Colibri is aimed to support the development, transfer, and implementation of innovative practices within higher education. When establishing the project, the idea was to develop creative and innovative teaching methods to be tested in a multi-cultural and interdisciplinary environment, by implementing living labs with students from the different partner universities. The confidence that the idea is implementable was partially based on the experience gained from a previous Erasmus Intensive Programme (IP) project entitled “Implementing Europe’s Future Broadband Infrastructure” (http://www.fbi.es.aau.dk). That project was focused on blended learning activities with students and teachers with different backgrounds from four different universities in EU. Summer schools about future broadband infrastructure were organized in a multidisciplinary (engineering + business) and participative way by having the students solving real-life problems hand-in-hand with industry. Based on the project evaluation, it is possible to affirm that the majority of the students felt that this type of learning activities would help them in their studies/careers and increase the chances of finding a job. Colibri is a step forward scaling up in size and time the previously implemented learning activities.

1.1 Colibri goals and activities

The project targets some of the most important needs and challenges faced in higher education in general and within the ICT domain in particular. The project goals can be summarized in the following three key points:

1) Enhancing the quality and relevance of the learning offer in education by developing new and innovative approaches, and by supporting the dissemination of best practices. The activities are designed to have a strong systemic impact on both participating organisations and outsiders.

2) Increase labour market relevance of learning provision and qualifications.

3) Promote the take-up of innovative practices by supporting personalised learning approaches, collaborative learning, by making use of ICT and Open Educational Resources, and by exploring the use of blended and virtual mobility.

One of the main activities of the project is to organize a joint course with students from the seven partner universities. The main theme of the course is Future Internet,

given from a business and an engineering point of view. The course will consist of remote learning including video lectures, assignments and on-line discussion forums integrated in a common platform, and joint seminars where students and teachers will work on selected topics and activities. This activity is structured in 3 yearly cyclic processes divided in the following phases: Teaching material development → Joint and blended learning activity → Evaluation → Dissemination.

This paper is focused on the teaching material development phase for the first year of the project. We believe that the documented insights about the process we followed will be valuable to other teachers trying to implement similar activities. In this context, it is worth highlighting two main features: A) The theme of the course (Future Internet) is in the forefront of current ICT and business development [2] and B) The preparation and unification of such an interdisciplinary learning activity, given by teachers and taken by students with different educational backgrounds and learning traditions, presents some real challenges to be overcome.

1.2 Project challenges and contribution to education

The project has been defined based on the following challenges to tackle, also in line with EU's modernisation strategy of higher education [3]:

- Meeting the labour market demands in education of qualified ICT graduates.
- Supporting student mobility in education.
- Increasing efficient and innovative use of ICT for education.
- Increasing European competitiveness through improved education.
- Improving interdisciplinary skills and training in education.

The outcome of Colibri will contribute to the modernisation of European Higher Education, among the participating organisations as well as to a wider audience. More specifically, the project contributes to the following aspects:

- European perspective: Colibri develops material in collaboration with universities all over Europe, which allows for testing the different teaching methods and material on a very diverse set of students.
- Systemic impact: The focus is not only on testing teaching methods but also disseminating the results, making it easy for others to adopt them.
- Focus on the end users: Active involvement of companies and students in all stages of the project, including teaching material development and evaluation.
- Systematic evaluation of new tools and methods in a European learning context.
- Teacher training: The teachers involved in the project gain a deep insight into the teaching methods through the coherence of the different activities including seminars, reviews, evaluations, and discussions throughout the blended learning activities.

2 DESCRIPTION OF THE COURSE

The course *Future Internet Opportunities* covers the trends and future challenges of Future Internet seen from variety of perspectives, with the aim of providing a comprehensive understanding of the field. Participating students have a unique opportunity of combining technological, business, and social aspects of the Future Internet and understanding the applicability of the knowledge acquired by solving real

life problems. In addition, the course provides the appropriate set-up for students to develop competences in working together in teams across different scientific areas, social backgrounds, countries, cultures and learning styles.

The course is divided into two main parts: **Modules** and **group project**s. There are ten modules, five business-oriented ones and five technically-oriented ones. Each module is subdivided into three levels: Introduction (1 h workload), basic (5 h. workload), and advanced (5 h. workload). The course structure is focused on a personalized diversity treatment to the students. Students with different backgrounds and prerequisites can adapt their learning by selecting the course modules at a convenient level, with a differentiation in how deep they will go into the different topics/modules. Each student is required to follow all the modules at introductory level (10 modules) and at least 3 modules up to advanced level. The total number of hours of the selected modules must be 60.

Afterwards, a project based on a real-life case (proposed by companies) is done in groups of 4 students from different universities, where each group consists of students having knowledge in both business-oriented and technically-oriented topics. Each group has the support of one teacher as supervisor/tutor. A significant part of the project work is carried out remotely. The group members must interact virtually to organize their work and to progress in the project.

The course time plan consists of five elements:

- A virtual kick-off where the course is presented.
- A period of studying course modules, based on online learning material but also including remote interaction with teachers and other students.
- A midway physical seminar to wrap-up the modules and start the project work.
- A period of virtual collaboration on group projects with remote supervision.
- A final physical seminar to finalize and present projects, and to have the exam.

From a pedagogical perspective, we have focused on three basic fundamentals:

1) Problem Based Learning (PBL), the Aalborg model [4]: The PBL foundation is learning as a constructive and not a receptive process. PBL is a way to approach learning objectives practically, and it is adopted by working on a concrete problem to understand more generic concepts. PBL is a successful practice to illustrate the applicability of the learning material into real-life problems or situations, in other words “Learning by doing”. Students can better consolidate their learning by applying it into a recognizable context rather than by just working on theoretical material [5].

2) Collaborative group work: One of the main features of PBL is for students to work in groups and it has shown some interesting benefits in the learning processes over students working isolated, especially when the groups are heterogeneous [6] and [7]. Following this principle, students not only develop their skills and competences within their education field but they also have the chance of working on a variety of valuable skills for their professional profiles. Examples are: improving communication aptitudes, developing a team work philosophy, experiencing challenges in project management, and learning how to teach their colleagues [8].

3) Remote teaching and learning: All the participating universities have systems for Internet support of teaching or remote teaching. In this course we chose for the first year cycle Moodle (http://www.moodle.com) as the common tool. This was partly due to Moodle being a GPL open-source Learning Platform, but mainly because this is the well-established system of Aalborg University who could support its use for the

project. Moodle (as well as several of its competitors,) has the ability to blend and utilize several teaching methods, which is one of the main goals of this project.

2.1 Course preparation: Challenges and solutions

The course preparation took place in an intensive five-day teacher training seminar where we had to define the structure and teaching methods used. It is worth highlighting that, at this stage, the curriculum and content of the modules were already decided and only minor overlapping adjustments had to be made. Therefore, the interdisciplinarity of the curriculum was already handled at the course definition stage by creating business-oriented and technically-oriented modules. The seminar was also used to exchange experiences on the use of new and innovative teaching methods, and to get inspiration from people external to the project.

The challenges faced at this stage mainly fall into one of these categories: Student and teacher diversity (background and traditions), remote teaching and learning, and group work organization and management. And more specifically, these are the main three challenges that had to be overcome:

1) Unification of modules' teaching methods, activities, and flow: More than ten teachers from seven different universities are involved in this course, each one having his/her own teaching traditions and habits. There was a high risk of ending up with a very complex course structure to follow if the teaching methods were not somehow unified. Moreover, having a course consisting of ten modules, and having different teachers as organizers and responsible for each one of them, may cause some confusion in the students if the working flow has significant variations from module to module. Hence, the structure of the modules was conveniently unified so the participants have a recognizable pattern to follow once they have completed a couple of modules. These are some of the common structural features for all modules but even these have some variations due to topic and lecturer:

Introductory level: Short overview video-lecture and assignments.

Basic level: Initial self-assessment quiz, literature study, video-lectures, assignments in between lectures, Q&A forum (in Moodle), and final consolidation quiz.

Advanced level: Initial self-assessment quiz, literature study, interpretation and presentation of a given topic or document (recorded video), larger assignments done in groups, and final consolidation quiz.

This module flow is expected to have two main outcomes:

A) Personalized self-assessment: The initial quiz for each level covers the preliminary knowledge (pre-requisites) any student should have before taking it. Students themselves can assess whether they are prepared or not to proceed with the module level. Additional introductory material is provided for students not succeeding in the quiz. In a similar way, a final consolidation quiz allows the students to identify whether they have achieved the learning goals or not. This quiz allows them to pinpoint exactly what concepts should be revised. The quizzes help the students to fulfil minimum requirements to start and finalize each of the levels. The use of quizzes in the process have to be evaluated after the first year and if needed changed, as some modules seem to be anticipating other pre-requisites than knowledge of applying students.

B) Activation and participation of students: Video-lectures and reading material are combined with participative activities as such group assignments and discussions, to keep a more active and dynamic learning environment. These will enhance peer learning which has been acknowledged as an efficient set of practices in terms of

teaching resources optimization, students learning to work and communicate with others, and (self) assessment [9].

2) Rethinking the teaching material: Most of the staff involved in the modules have been/are teaching similar material in their home universities. However, the context of this project is completely different. The mixture of students from different study programs and universities, combined with having most of the module work carried out remotely (and no real-time), made us rethink how to deliver the message. One of the main points to focus on was “to think about what can go wrong”, trying to avoid problems, doubts, or misunderstandings that cannot be handled as fast as in a traditional physical classroom. An interesting example of the diversity challenges we faced is related to terminology. The same term may have a completely different meaning not only for the students but also for the teachers, depending on their educational background. Hence, basic definitions for commonly used terms in the taught fields had to be explicitly defined, background material preparation had to be given more time than usual, and assignment procedures needed to be defined more specifically than when done in our home universities.

In addition, the dynamics in learning had to be taken into account. The course covers a lot of disciplines in a relatively short workload time period (5 ECTS). Thus, the video lectures were conceived as a short introduction to the relevant topics, triggering the attention of the students, the literature material was intended to provide a deeper insight into selected topics, and the assignments were primarily proposed to illustrate the applicability of the learning material. A typical issue is that Powerpoint slides as they are designed and used in common lecture rooms are close to useless in this remote setup. Lecturers may present slides with video or audio support, but there is still no possibility for on-the-spot questions or requests for fast and more detailed explanations which may cause student distress [10]. The text material, Internet links, videos, slides with/without audio etc that works as blended tools, all assume structured work from the students. They may read and view issues on their own, but the setup encourage them to communicate with lecturers, fellow students, and to seek additional material from open sources. It is a learning process, but in contrast to a process guided or pushed by the schedule of the lecturer, this process assume that the students recognize what they need to learn to be able to apply it in the later part of the course which is a “pull” process.

All of the above were conceived to prepare the students to be able to apply the newly acquired knowledge in the group project, and not necessarily for them to become expects in any of the studied fields by just finishing modules. Having such a short time and a wide thematic spectrum to cover, we have considered that focussing on the applicability and opportunities derived from combining essential knowledge around Future Internet would be more fruitful for the students rather than overloading them with highly advanced material.

3) Remote project group work: It presented a real challenge, containing itself a number of already important sub-challenges. It is worth highlighting a few of them; partially based on our own experience from the Erasmus IP project on having diverse students working on PBL oriented group projects:

- Working in projects where not all the “puzzle pieces” are given beforehand presents some difficulties for students who are used to working on more direct assignments in their home universities.
- Coordinating and carrying out group work becomes complex for students who have been working individually during their studies.

- Lack of common understanding across cultures and backgrounds may cause problems in the group efficiency.
- Presenting their ideas and results in front of a relatively large audience may represent a huge discomfort for students, especially when English is not their native language.

In addition, the distance factor presented the following sub-challenges:

- Coordination of remote collaboration when students are not even used to coordinating group work at physical locations.
- Use of IT tools for communication (ranging from classic e-mail to real-time videoconference tools) without having previous experience.
- Avoid a project outcome as the sum of individual contributions. There is the risk of having the students working isolated and joining the pieces in the end.

In order to overcome these challenges, we will try to prepare the students for the problems that may arise. We decided to give several lectures and prepare a number of activities dealing with issues at the midway physical seminar, before the beginning of project work. These lectures and activities will cover themes such as introduction to group work and collaboration, what to expect from supervisors, how to plan the project work, or how to make pitch presentations. In addition, the students will start to work physically together on their projects during this event. This will allow them to get to know each other, hold the first discussions in a more "controllable" environment than remote meetings, state the bases and rules for collaboration, and meet their project supervisor, among other valuable actions to start the project work.

2.2 Quality assurance

The process had three phases, two reviewing rounds and a final quality assurance round. For each module, each review was done by two partners not directly involved in the teaching of that particular module, and the final quality assurance for all modules was done by the same partner to guarantee coherency:

First round: Reviewing of the teaching material in terms of content quality, alignment with the predefined module learning goals, appropriate workload, and fulfilment of type of activities (predefined in the modules' structure rules).

Second round: Reviewing of video lectures and learning material display in Moodle.

Final quality assurance: Evaluation of the course as a whole, fusing on the overall course presentation in Moodle, unified module structure, and fulfilment of the course's learning goals.

3 OUTCOME AND EXPERIENCES

We think that there are several outcomes to emphasise from this:

1) We have the blending of people where we mix lecturers, students, and content from several countries. That alone is a levelling of teaching experience and knowledge transfer.

2) We utilize remote and ICT-based teaching tools in a blended mixture of methods. This includes the one way process where students read material or view videos, they check with quizzes, and then they communicate in groups partly in the basic module, and even more in the advanced modules. We also mix remote work via Internet with physical meetings at mid-term and final presentations.

3) We assume that students select modules on individual background and preferences, so we get a complex structure of module variation within the students instead of the traditional where all students follow one set of content in a course.

4) We have the problem based learning in the second phase of the course where we assume that the students in mixed groups will solve or elaborate real problems presented by real companies. This last part is supposed to provide the students with a need to learn the module content by applying it for a final presentation.

In addition, it is worth highlighting three important practicalities we had to deal with:

A) The teacher is more than just a content producer, who can make material in a certain form. Teachers need to feel comfortable with the specific learning activities they prepare in relation to their learning goals. And somehow we also need to be able to contain this and find more flexible ways of organizing the modules without increasing the structure complexity.

B) The students have very different approaches to learning, and not only with respect to content. Thus, it is necessary to be very explicit about what is expected from the students and why.

C) Learning to not only utilize but also master the technologies is a challenge, which takes time and experience (it's easy to record a video, but not to make good video based teaching material).

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