B-learning system architecture

For ETEROB Project

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Approved by

Name	Position	Partner	Date
Mariusz Trojanski	Administrative/technical	BSW	12/09/2014

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1. Introduction

Blended learning is an approach associated with the combination of face-to-face and fully online modules (tools employed in an e-learning platforms) and is the most logical and natural evolution of learning agenda. It is also suggests solution to the tailoring learning and development to the needs of given group of audience or even individuals. Blended learning represents an opportunity to integrate the innovative and technological advances offered in traditional learning. The real importance in blended learning lies in its potential and real opportunity to create learning experiences that can provide the right learning at the right time and place for every individual. It can be truly universal, bringing groups of learners together through different cultures and time zones.

First of all we have to consider students online activity and its relationship with the face-to-face components of the course. In our model the instructor/teacher should not maintain an online activity such online virtual consultations or advices. Any formative assessment (tests) is set up in advance and delivered to students automatically. Educational materials are developed and delivered through e-learning platform or any website you choose to support practical training sessions for each modules. Thanks to this approach students have opportunity to learn at their own pace before participation in face-to-face classes. Each e-learning module contains self assessment test in form of series of questions that related to the teaching materials of particular module. Every set of questions includes automated feedback available for students after they had submitted resolved test.

All educational materials are grouped together in the form of a self-learning pathway but student has opportunity to choose given modules and set up your own learning pathway according to his/her interest. This approach is particular important for professionals engaged in the construction business (energy efficient renovation of old buildings in particular) already and they are interested in getting additional knowledge or improving their professional skills. In this case specific tutorials are necessary for directing students and enable them to choice appropriate modules. Course materials should be provided alongside short tests for formative feedback and checking acquired part of knowledge and enable students/learners to assess their understanding. Release of further course modules may depend on the successful completion of each consecutive tests (usually one or two tests for checking knowledge and understanding). Final assignment might be in form of short face to face discussion performed in traditional classroom or students work in a small team (or alone) on resolving given problem or managing project prior delivery of final presentations. Supporting materials are also accessible through the Internet.

Modules chosen by learner is automatically released after a test has been attempted (student must achieve a minimum score setting up in advance by module leader). Test may give randomly generated selection of questions from a collection of various questions. The best solution is giving students possibility to choice an answer from the set of two or three various answers from which only one is correct. The next one is opportunity to write a short essay (several sentences of free text) treated as an answer. A given score is allocated to each questions and then sum of scores is used for final assessment. Educational material

delivered through e-learning platform should be followed up by face to face interaction between students and instructors/trainers and practical classes but online activity is assumed the main part of entire courses. Participants will meet face to face at the beginning of the course. The next meetings will be arranged in the middle and at the end of course schedule.

2. Learners activities

Using Honey and Mumford Learning Styles Questionnaire, all learners can be divided into four groups (listed below) according to their personal learning style. It is important to chose most appropriate teaching environment and the course content delivery methods.

1. Activists – enjoy new experiences and opportunities from which they can learn; often do things first and think about it later; prefer to be active than sitting and listening; often look for new challenges; like to learn with people, they are willing to make mistakes;
2. Reflectors – prefer to stay back from events, absorb information before getting started doing something; like to hear other people's viewpoints, prefer to take a decision in their own time, do not like to be under pressure;
3. Theorists – like to explore methodically to think problems through in a logical way and ask questions; prefer models and systems;
4. Pragmatists – like practical solutions; dislike too much theory; like to find out how the experts do something; like to experiment and search for new ideas; tend to act quickly.

Synchronous vs. asynchronous activities

Creating asynchronous activities is one of the most time – consuming of development processes, as such activities require attention to detail and usually a lot of programming. One of the most prevalent of rapid development techniques for asynchronous activities is to repurpose classroom activities that have already been developed for a stand – up class. This is a common practice simply because of the number of trainers who have been trying to repurpose entire classroom programs into asynchronous deliveries. The lack of a facilitator restricts the use of classroom activities significantly. Many classroom activities may be translated well to an asynchronous program and should be chosen well and develop intricately. Group - based activities will not translate well, as there is no group when we introduce learning in a self - instructional mode, but question/answer activities translate very well, as do simulations that are not team based.

Comparing to synchronous e-learning asynchronous one enable us to avoid some important disadvantages of the synchronous e-learning mode, such as:

- Requirement of proper communication software or technology.
- Ineffectiveness due to lack of trained facilitators.
- Special preparation of learners for a synchronous e – learning delivery.
- Lack of effectiveness when content requires face - to - face delivery.
- Not efficient when the class needs to be run many times.
- Lack of eye contact between facilitator and learners.

- Difficulties in obtaining positive reinforcement.

Most good learning experiences usually take place in a special environment. By recreating the sensation of that special event learners can apply the lessons learnt then to different situations. This very much links to the concept of '. By remembering the sensation of special learning events it may be possible to enhance other learning situations.

The role of the tutor

Supporting blended and online learning involves rethinking the role of the tutor, but it can also open up opportunities to coach and offer support. We can also develop materials, and 'e-tutor' through the virtual classroom. By rethinking some of the knowledge aspects we can make the actual physical training events very special. It is important for tutors to identify where their provision fits within the learning cycle. Their input fits within the overall concept of knowledge transfer that can be enhanced by helping learners learn through their senses. Therefore the more the tutor involves learners in their learning the more effective it will be (in our course this is very important for face-to-face part). A skilful and effective tutor will be closer to the role of the storyteller but however inspiring they are the limit of this presentation should be about 20 minutes.

A tutor designing and orchestrating a perfectly balanced event will need to provide a wide range of learning opportunities. We have to avoid situations where too many learners are being subjected to large classrooms of training content delivery, which only really serves the purpose of recording attendance. The real role of the trainer is to recognize what the learner needs to learn through classroom learning and to identify the value-added benefits. It will be important to look at each area of content and find the most effective way of delivering as well as to look at the overall content and identify whether the needs of people with different learning styles are being met.

List of important roles of tutor:

- Prevention of conflicts among learners and between learners and tutor.
- Encouraging learners to self-paced learning via Internet.
- Scheduling access to resource and quizzes.
- Monitoring of learners progress.
- Assessing overall learning outcomes for each module.

Changes in Face-to-Face Meetings

Changes in blended course design influenced decisions about face-to-face meetings as much as online components. These changes can be organized around the purpose, number and duration of live meetings in blended courses. Initially, most instructors used the live meetings to cover topics that could not be easily done online and to coordinate upcoming learning activities. The presentations featured the traditional format of lecture/discussion and a PowerPoint. It was common for instructors and learners to arrive at live meetings with the entire course run off. The number of live meetings fluctuated between three and six. A portion of the live meeting should be devoted to discussing upcoming projects and

assignments and focused on learner objectives, and these centered on learning activities that could not be easily done online: role playing in counseling, individualized 'in the moment' reading lessons in literacy, group activities and simulations, requiring immediate feedback and interaction between and among participants. A session might be longer or shorter than the usual three hours, it might involve an individual meeting, small groups of learners.

3. Blended learning as a rapid learning technique

The most useful is the actual blending process itself. There are many possibilities for blending delivery systems to reduce development time. It also allows us to develop the required practices without going through the involved process of creating full - fledged simulations. Training materials for performance practice and the evaluation of performance are much less intricate and therefore require less development time than their classroom equivalents would. Blend should combines an asynchronous program with a classroom program, usually with the asynchronous portion being developed as pre – work, learners do not need to be in the classroom quite as long. However, this blend can be a rapid development technique if we are developing a program that is an asynchronous delivery to begin with, but we can make part of it classroom without losing too many of the advantages of the asynchronous delivery that caused us to choose it in the first place.

This is particularly efficient if we can move the interactions and simulations into the live class, as they take so much longer to develop in an asynchronous mode. In our course blended delivery comprises of about 5 - 10 hours of asynchronous learning for each module and 30 hours of classroom session, which we spent in practical activities or placement learning (real case-study). Asynchronous deliveries are most efficient in situations in which a pure classroom is simply impossible for a long time due to distance or timing problems. Blending an asynchronous program with a synchronous classroom can be very effective, and it can save us a lot of asynchronous development time as well and giving us better interactions. The learners have opportunity to acquire theoretical and technical knowledge in their own pace using e-learning modules delivered through the Internet and treat them as important preparatory element for practical tasks that will be done in traditional classroom.

This form of blending can also allow us to take advantage of another rapid development technique, the repurposing of classroom - based group activities. It is difficult to create a group activity in an asynchronous environment. It can be done, but it is very cumbersome and time - consuming. With a synchronous/asynchronous blend though, many of our classroom activities can be repurposed into the synchronous portion of the program. Usually, most blends are chosen based on necessity (you have too many people in too many places and not enough trainers) or for the cost savings (combining synchronous and asynchronous deliveries so that learners do not need to travel many times) what is very important especially for businesses.

4. Content planning

The main task of storyboarding is breaking down content of particular modules into small units easy to manage them. This is very important in case of online educational materials because smaller units are more friendly for users/learners. Also we have to decide how our materials/modules will be made accessible and navigable. Good planning enables us to identify any potential difficulties in advanced before making content accessible. Breaking down a content is needed for large education as well as reference materials that can not to be consumed at one time. Good workable framework is crucial for collaborative design of entire course where each partner develops his/her own modules. One of the best method for breaking down a content is writing a storyboard, especially for blended learning where linking e-learning modules to face-to-face learning is very important. We may treat storyboarding as a predevelopment process.

We can give up design of storyboard if our course is small enough and it has a form similar to storyboard itself. It depends on us and our judgment only but we have to keep in mind that in case of collaborative work storyboard helps to avoid problems or mistakes in development process of even small projects. This is also important for person who is new in a given phase of development process (who joined a team later and not participate form the start) – storyboard provides her/him with a logical start point for new work and helps prevent inappropriate use of content units or tools, inadequate module/unit structure or chaotic hierarchy, etc.

E-learning module content development

Having a working storyboard document all participants are able to move to development of content of their own modules quickly and efficiently. Content development process should include the following stages:

- Identifying appropriate educational/teaching materials.
- Gathering of specific resources of educational/teaching materials.
- Identifying students access to the Internet opportunities and possibilities for avoiding potential limits in course content accessibility and/or usability of our target groups (analysing connection speed. Hardware and software limitations, browsers, necessity of special pug-ins, etc. as average values of entire target group- students, managers, small business). We should use lowest common denominators. Developing two alternative contents, for those with good access and those who have not a good hardware or software is best solution (for example older machines process Flash animations much slower). Content should be achieved with various kind of browsers (Internet Explorer and Firefox at least).
- Navigation rules. The good idea for design of navigation through course/module contents is to copy out (extract) the Title column of storyboard and treat its content in holistically way (as a whole) and then draw a scheme of moving through one unit to another and how to be linked each other.
- User interface design. Interface structure should be corresponded to requirements of specific module content. Interface might be divided into three

areas: general navigation bar (usually in form of graphic tabs, contains like *help, library, contact, homepage, etc.*) at the top of a window (same for almost all pages of the course), unit specific menu on the left side and the main module content frame with step by step navigation trail (may be simplified to graphic arrows for example). Interface must be intuitive and simple for learner to use. Too many graphic elements should be avoided.

5. Delivering blended modules

Blended module planning and delivering process may be broken down to five stages:

1. Design stage – preparation of the module (analysing and identifying relations between e-learning and face-to-face activities also how complement seach other). Developing appropriate complementary activities for promotion of active learning and student engagement. Learners should know how face-to-face component is relevant and value adding in the sense of practical classes and exercises. We should set self-assessment and assessment tasks (both class and online based) for motivating learners for moving forward and gathering knowledge.
2. Starting stage - main objective of this stage is to familiarize lerners with the aims of module and what they can gain from it as well as how they can use appropriate tools. Set up introductory exercises in the form of written and verbal instructions that will be given to learners in the classrom as well as via online platform.
3. Supporting stage – during an early phase of teaching (introductory lessons), we have to provide ongoing support to students at this time. The main objectives of this stage are: minimize anxiety and build confidence, encourage learners to team working (important for practical exercises) and providing feedback to trainers.
4. Sustaining participation stage – includes monitoring of students participation and progress in learning as well as reinforcing connections between online and face-to-face activities.
5. Assessment stage – the end of module, assessment of learning outcomes (both online and classroom) as well as discuss important issues arising for learners in the blended approach.

6. Checklists

Using checklist make course development much easier and enable us to avoid potential problems and mistakes or eventually to pass over some essential issues or materials. We have opportunity to check whether all important elements have been implemented or not.

Presentation of educational materials

Element	YES	NOT
Purpose of supporting learning materials with short description explaining that purpose (for example, links to diagrams, reading material		

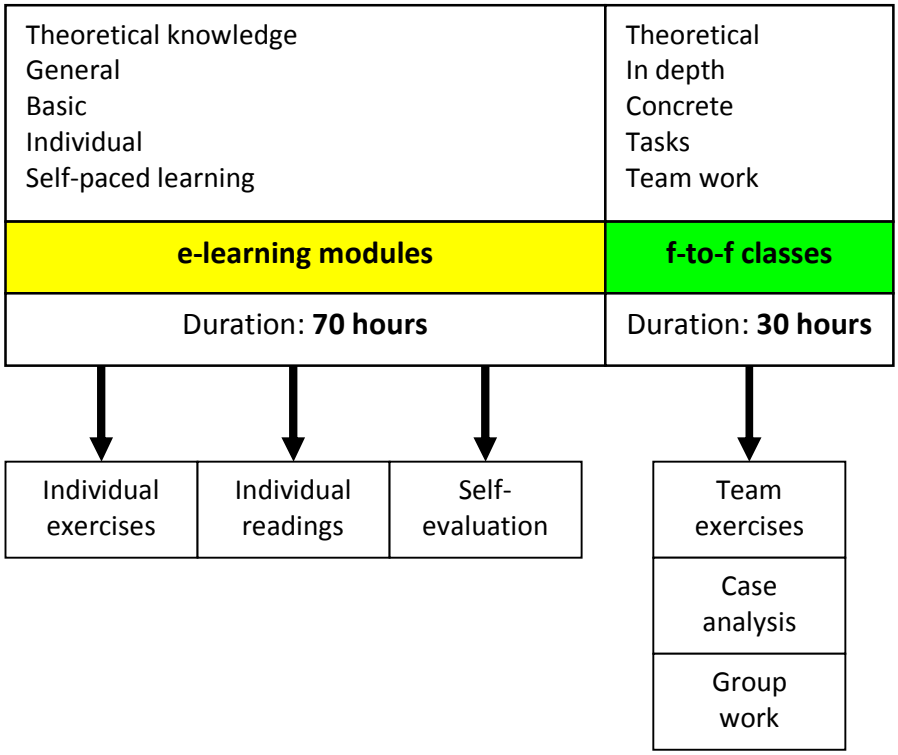
for downloads, videos, etc.). Short explanations may be included as a link description (for example: diagram of supply chain)		
Instructions for using quizzes (explanation how learner should fulfil forms, requirement for answers (one or multiple), etc.		
Copyright statements for all external materials if needed		
Announcement section for information about new events, updating materials and others		
Student participation section includes such information as deadlines for specific tasks to do (may be included in announcement section		

Module delivery checklist

Element	YES	NOT
Welcoming statement to students		
Explanation about purpose of the module website in relation to face-to-face learning/activities		
Any unused menu items are removed		
Any unused tools are removed		
Explanation for using folders (brief description about contents and purposes)		
Short instruction for downloading files		
Information about what additional tools are needed (plug-ins, readers), if any		
Module is available to learners for testing and checking its accessibility and getting practical knowledge how to use it		
All files are marked as “read only” (should be)		

7. Programme architecture

The e-learning training modules are integrated with face-to-face practical classes creating the entire course content according to the following schedule:



The e-learning module content is based on the integration of individual readings, exercises and self-evaluation. This module includes two main elements: content packaged in the 9 modules and supporting materials (in the form of e-book) and self-evaluation system in the form of test at the end of each module. Each module is divided into learning units:

Module	Learning Units
Introduction to building refurbishment for energy performance	Improving the energy efficiency of heating systems in residential buildings in Europe
	Weatherization and energy efficiency improvement for existing homes
	Benefits of refurbishment
Conservation of historic buildings, fundamentals	Introduction to architectural conservation
	Structural aspects of historic buildings
	Energy efficiency and historic buildings
	Understanding the building before starting upgrading works
	Upgrading buildings elements
Assessment and evaluation of old buildings related to energy performance	Comparison of standard assessment methods
	Life-cycle energy performance evaluation
	Effective tracking of building energy use
	Green energy audit of buildings

Standards	LEED
	ASHARE
	PHC
Materials used in building refurbishment	Opaque building envelope
	Modern, high performance insulation materials
	Transparent building envelope - energy-efficient windows, nanogel windows, shading device
	Phase-Change Materials
	Materials for Sustainable Energy
	Materials for energy efficiency and thermal comfort in buildings
	Materials skills for historic building conservation
Modern technology	Thermal energy storage technologies
	Switchable glazing technology
	HVAC systems
	Low energy cooling systems
	Micro CHP power generation
	Energy efficient lighting
	New technologies for energy efficiency
Renewable systems and their application in building retrofitting	Solar photovoltaic/thermal technologies
	Renewables for heating and cooling
	Wind energy for homes
	Heating pumps
	Planning and installing photovoltaic system
	Small scale renewable energy applications
Cost control of conservation projects	Uncertainty in refurbishment investment
	Cost and Financial Benefit of Green Buildings
	Cost Optimal and Nearly Zero Energy buildings
Introduction to construction project management	Construction project management
	Project planning and scheduling
	Project resource planning
	Estimating, budgeting and cost control
	Construction project execution

8. Summary

Blended learning has been chosen as course model with three important features:

access in time is ensured by a mix of asynchronous e-learning mode and synchronous face-to-face learning as a tutor-led practical classes and placement learning (case-study in real environment realized by visits of learners in chosen enterprise involved in the RES field), technology: Internet e-learning platform (LMS) or rapid e-learning micro-site for distance learning part of the course and traditional classroom equipped with multimedia devices, computers and access to the Internet, learner/tutor relationships: self-paced learning (for e-learning modules) and tutor led practical classes and placement learning (for face-to-face modules), formalization: non-formal teaching that is not connected to formal higher education courses/study and ECTS points system, participation is voluntary.

Management tasks at the module level:

For tutor/instructor: managing programme development, programme adaptation and managing current classes. For learners: managing personal development, exploring options (e-learning and face-to-face as well as placement learning) and managing current learning.

Principles of pedagogical base of courseware:

- Encourage contacts between learners and tutor/instructor.
- Develop cooperation among learners especially in case of doing tasks in face-to-face practical classes (team-works).
- Use active learning techniques (quizzes and feedback in e-learning environment, participation in practical classes.
- Give learners prompt feedback, especially about their learning progress and acquired knowledge.
- Emphasize time on particular tasks.
- Good verbal communication between learners and tutors/instructors and between learners themselves.
- Respect diverse talents and learning skills.

Pedagogical instructions for tutors/instructors:

- Gaining attention from learners.
- Inform learners about goals and objectives.
- Stimulating learning and recalling of theoretical material needed for starting practical classes.
- Presenting good stimulus and interesting teaching materials.
- Providing learning guidance.
- Eliciting the performance that is especially important for practical classes.
- Giving feedback about performance correctness.
- Assessing the performance and the level of acquired knowledge.
- Enhancing retention and further knowledge transfer in business environment.

Process of the learning conversation:

- Tutor sets the tasks goals.
- Tutor describes conception of the particular subject.
- Learners can describe their own conception of the subject.
- Tutor can re-describe in the light of the learner's conception of action.
- Learners can act to achieve the tasks goals.
- Tutor can control the learning environment to give feedback on action.
- Learners can modify their actions.

9. Supporting documentation

Document	Description
Blended Learning - how to integrate online	Thorne K., 2003, Kogan Page
Hybrid Learning Models	Wang F.,L., 2010, IGI Global
Blended Learning across Disciplines	Kitchenham A., 2011, IGI Global
Online Teaching Survival Guide	Boettcher J., 2010, Jossey-Bass