

MICRO-MODULAR DIGITAL LEARNING CONTENT DESIGN IN A CLOUD-BASED COLLABORATION ENVIRONMENT

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Abstract

Micro-modularity has become a central design principle in digital learning content design over the recent years. Micro-modular courses are split into bite-sized, topic-centered and easy to use learning objects which can be used independently or as part of a larger course or program in a flexible manner. When looking at the issue from the workplace-based learning context, the micro-learning approach has many benefits. These apply to employees “consuming” micro-learning modules while working e.g. in terms of added flexibility and possibilities for better targeted, on-demand use of learning modules. From the learning design perspective, micro-modularity has opened many new opportunities allowing learning designers and production teams to work more efficiently and increasing the contribution of subject-matter experts in various phases of the design process.

Shared cloud-based working environments are highly useful in digital learning content design as they allow a number of individuals to work on the same project similarly and in collaboration with each other. Together with the micro-modular approach, learning content development teams can run course productions very efficiently by following lean principles and utilizing the benefits of virtual collaboration. The process and outcome are quite different from the more traditional way of multimedia learning content development, in which content was designed and developed in a linear process and constructed as a whole, large entity. It was rather a product designed by digital learning content provider for the client organization than a product developed co-creatively with the client.

This paper focuses on the advantages and challenges of micro-modular learning content development processes in a shared cloud-based collaboration environment. We will review literature on micro-modular learning content design through a constructivist theoretical lens. This will include a critical exploration of models and approaches of instructional design, learning experience design and agile/lean methodologies. The paper then reviews a number of micro-learning content projects carried out in Finland in workplaces to develop online training for staff and operational partners. These projects were carried out in cooperation with an employer using the course (involving a project manager and a team of subject matter experts) and a vendor company in charge of learning design and technical development of the course. Experiences from applied project contexts are mirrored with the existing models of collaborative micro-learning design to identify where the challenges are and how these challenges could be overcome. Based on these findings, the paper suggests a streamlined process for micro-modular digital learning content design in a cloud-based collaboration environment.

Keywords: micro-learning, micro-modular learning, e-learning, elearning, learning design, learning experience design, instructional design, workplace-based learning.

1 INTRODUCTION

The roots of digital learning are in multimedia design and development. Already in early 2000, companies made massive investments in online learning programs following the old multimedia design and development mindset and processes that were highly labour-intensive. It was possible to make visually magnificent and entertaining productions, but the value to the learners was questionable as there was still little understanding about how multimedia can promote learning online. To utilize digital media for learning and development on a daily basis, a new mindset was needed – to make production more efficient and to put more focus on learning, particularly in terms learner-engagement, interactivity and collaboration.

Companies generally seem to believe that agile ways of working can be applied in most work tasks [1]. There are plenty of examples of organizations that have already undergone the transformation towards agile or where this transformation is well-developed. The new thinking about the nature of work has forced organizations to look critically at their ways of learning and competence development covering all aspects of workplace-based learning as well as administrative processes. Learners of today are

increasingly heterogeneous, and training requirements are more diverse too. Learners have often other important commitments, meaning that finding time and opportunities for training can be challenging. Diverse needs require pedagogically innovative and flexible approaches to learning and training. This was also suggested in the EU's The Changing Pedagogical Landscape study, in which digitization is an important facilitator [2].

The financial crisis that hit Europe in 2007/2008 made companies look for more efficient ways of operation. The Learning & Development (L&D) function was not an exemption. Many technological innovations, particularly the fast development of mobile networking technologies, had already made digital learning (also referred to as "online learning" or "e-learning") a realistic alternative to traditional forms of learning. With increased cost pressure the cost advantages of digital learning were attractive to employers, which accelerated the growth of digital learning in the corporate sector. Today, digital learning is often the preferred way of training in large companies [3].

As the popularity of digital learning increased, new concepts and new ways of developing digital learning solutions were invented at increasing pace. Micro-modularity emerged as a leading digital learning content design principle providing a solid guideline to develop bite-sized, topic-centred and easy to use learning objects. The concept of micro-modularity has made the production of digital learning resources more agile, efficient and flexible. Maintaining and updating courses is effortless and it is not necessary to "open" the whole course to make changes to one or two specific objects. There are many benefits of re-usability and mass-tailoring as well. With the same development effort, we can create content which can be used for various purposes, i.e. marketing or to create target-group specific versions of a course.

Studies on microlearning show that it tends to make learning better and creates better impact. According to Westfall [4] microlearning creates about 50% more engagement than traditional online learning. Engagement is known to be one of the crucial factors that determine how impactful learning eventually is. Micro-modularity is also one of the key enablers behind the success of mobile learning recently. Mobile devices have some limitations regarding the usability of digital learning solutions (including screen-size) and these can be overcome by designing learning solutions and courses following the micro-modularity principle. Mobility, in turn, offers some really significant advantages to learners. According to studies mobile learners are better motivated, they are willing to learn more and their learning outcomes are better [5], [6], [4], [7]. In the workplace-based learning context continuous access to learning makes employees better connected to their roles which increases belongingness, retention and productivity [8]. The issue of motivation is critical in securing enhanced employee buy-in to corporate values and shared objectives. It also provides a comfortable space around diverse learning needs and capacity as external and internal changes impact on the strategic context.

Learning developers are quite dependent on tools used in digital learning content design and whether these tools allow or limit the application of micro-modularity. Despite the many benefits of micro-modularity, there are still few development tools in the market that fully support this design principle. Micro-modularity has changed the process of designing and developing digital learning, particularly in learning content design. It's a shift from linear to parallel working that increases flexibility and adds agility in the process. New tools that are cloud-based, also allow online collaboration around and access to learning content design projects. With all these new opportunities, people working in learning content design (both on vendor and client sides) must be able to adapt to the new way of working which may require different kinds of contribution from them and sometimes also different skills than before.

Context Learning is the leading Finnish company specializing in the design and development of digital learning content solutions. The company has executed hundreds of digital learning content projects in the last 10+ years involving companies, public organizations, schools and universities. Over the years, the process and tools the company uses have developed rapidly and Context is currently exploring the potential of new technologies in learning content design. With this initiative Context wants to contribute to the common challenge of improving and modernizing training in the European context with particular focus on workplace-based training. Innovating and modernising training are key priorities in several flagship initiatives of the Europe 2020 strategy (e.g. the Agenda for New Skills and Jobs) [9]. The Digital Action Plan of the EU calls for openness in this regard: "Concepts, tools, methods, processes, systemic thinking and design thinking need to be more accessible to education professionals who are usually not fully aware of what is tried and tested elsewhere, sometimes even the next door." [10]

The primary goal of this study is to understand how micro-modularity impacts the design and development process and what are the impacts of collaborative working with clients. Experiences from applied client projects are in the core of this case study. From the basis of our long-time experience in digital learning content development and the findings of the study, we will propose a streamlined process

for digital learning content design in a collaborative working environment using the micro-modular design approach. We expect the findings to be relevant to educational professionals in a wider than workplace-based context as well. As digital learning design is becoming a day-to-day task at most workplaces, it is a particular benefit of the “consumers” of digital learning to understand how technologies and processes can best support operations. With this initiative we want to share this expertise and experience with all practitioners of digital learning.

2 TOWARDS A MORE AGILE, CO-CREATIVE ONLINE LEARNING CONTENT DEVELOPMENT MODEL

In this section, we will explore two alternative models of digital learning content production and examine how micro-modularity can make these processes more agile and efficient. From the perspective of digital learning agility is as relevant to the process of developing digital learning resources as it is to the process of actual learning. In the context of this study, we will primarily focus on the design and development aspect.

2.1 The linear process

The linear process of digital learning content design and development is described in the figure below. In this process the course is produced as a whole following the step-by-step process with different phases. After each phase there’s a milestone of approval, before the course production can continue to the next phase.

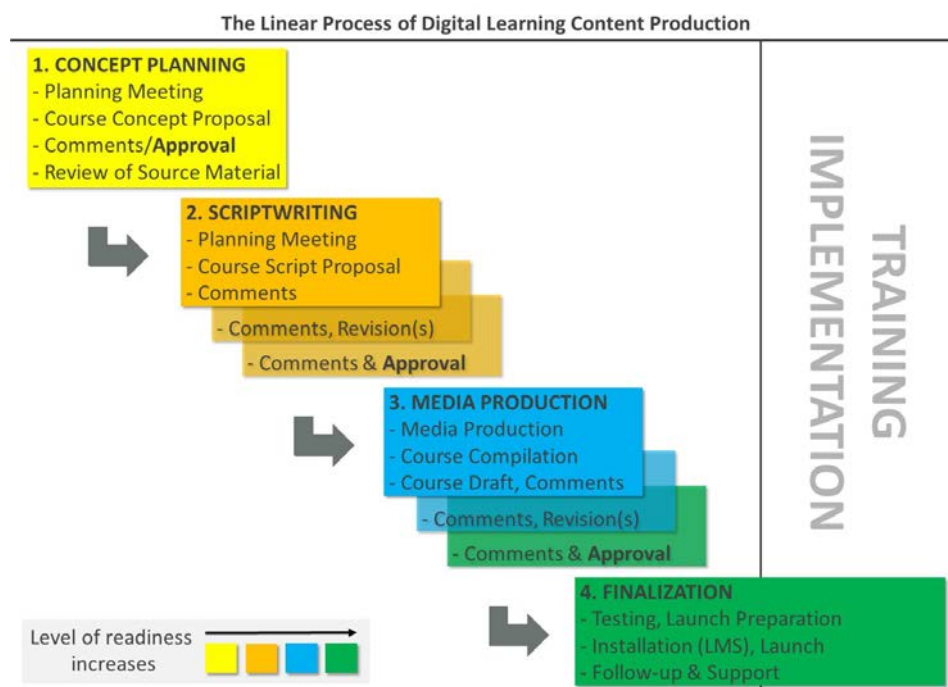


Figure 1. The linear process of digital learning content production.

2.2 The parallel process

The parallel process of digital learning content design and development is described in the figure below. In the concept design phase, the learning designer maps the content of the course in a modular structured outline in which each module is a stand-alone object pedagogically designed to address a specific learning objective. Often these objects form a set of modules or a course which touches a topic or theme, but they should be usable independently as well. The design and development of each module can be done independently noting interrelations it may have with other modules. Depending on the availability of source material and the readiness of content, different modules can achieve different development phases at different times. Different subject matter experts can work on different modules as well. Once a module is finalized, it can be implemented as a standalone object or together with other modules available.

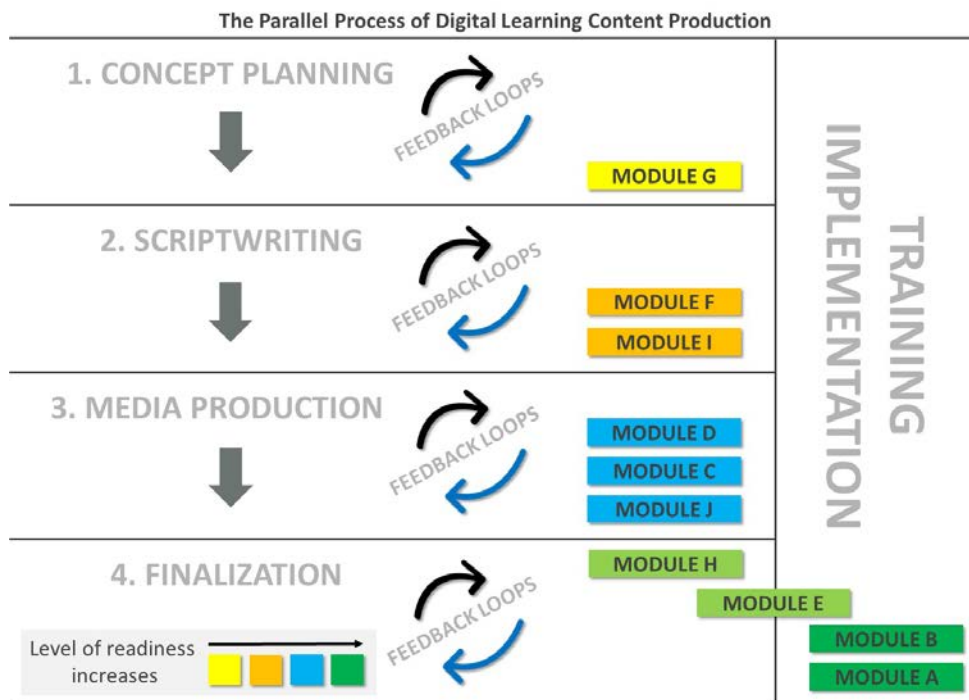


Figure 2. The parallel process of digital learning content production.

Basically, the principles of micro-modularity can be applied to all kinds of digital learning objects and this way of design has many benefits too. It allows us to develop a large course bite by bite, independent of each other, by different people involved in the design process at different times.

2.3 Pedagogical design principles

Whatever design approach is used, the selection of learning methods should be based on learning objectives and learner/target group-specific demands and preferences. These include, for example, existing levels of knowledge in the given topic, motivation to learn in this specific setting and readiness to learn using digital learning resources. Learner engagement, interest and motivation are known critical factors that impact how successful learning will be. It is the learning designer's task to select methodologies so that they support the achievement of the given objectives. [11] To help learning designers in this task, we use the *Types of Learning Intervention vs. Desired Learning Outcomes* triangle [11] to define what kind of learning interventions should be applied to reach the different levels of learning outcomes.

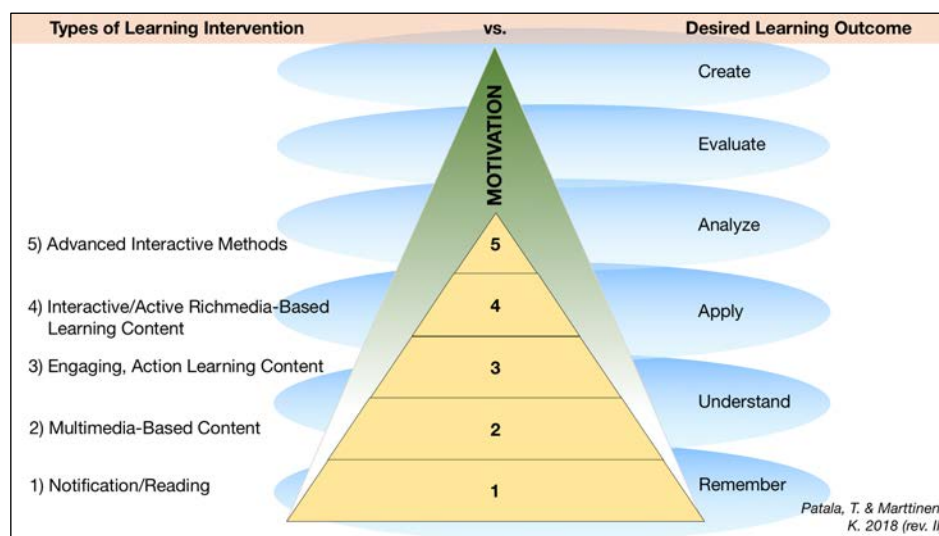


Figure 3. The "Types of Learning Intervention vs. Desired Learning Outcomes" triangle.

This model has been applied in hundreds of online learning development projects to ensure high quality learning outcomes. It is applicable to micro-modular design as well as any other design approach.

One of the typical errors in digital learning design is to overestimate the capabilities of diverse learners to study independently online. This refers to the factual content and how it is authored and the functional or usability-related aspects of the learning experience. Despite the rapid development of interactive learning systems and artificial intelligence, very few courses are able to adapt to learner-specific demands so well that learners with the lowest levels of motivation and capabilities would be able to learn just as any “normally” motivated or skilled persons. This is why course design should always address the specific demands of low-motivated and low-skilled learners by providing supports and interventions that trigger their engagement and raise their motivation. There are many learners that will never need these elements, but if we take motivation for granted and only focus on delivering the message, we will “lose” part of our learner audience.

2.4 Content creation and editing using collaborative working environments

A shared cloud-based working environment refers to a digital work-space accessible by web browser similarly by a number of users to work on a mutual task. Applications such as MindMeister and Articulate Rise are examples of environments used to design and develop digital learning content. Typically, the work is coordinated and instructed by a learning designer who establishes initial concept descriptions and storyboards and invites other team members to comment and further develop them. In a project where a dedicated service provider is in charge of content development, the client company's subject matter experts and other project team members contribute to the development of the learning content during review cycles by typing in comments to different revisions of the course content under work using the cloud-based working environment.

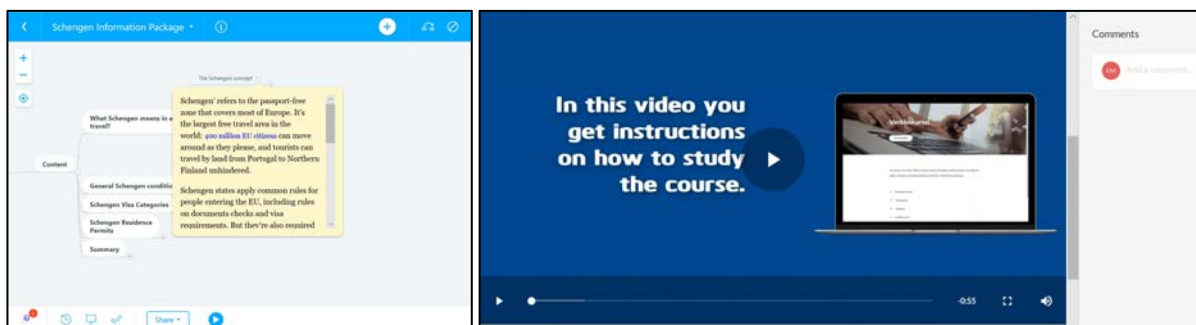


Figure 4. Sample views of MindMeister tool used in online course concept design (left) and Articulate Rise (right).

The online course development projects examined in this study were designed using MindMeister and Articulate Rise development tools which both allow for editing of content in the cloud. MindMeister was primarily used for concept design phase during which the modular course concept was constructed using a mindmap-type of format.

Once the concept was finalized and approved by the client, an initial course content draft was established using Articulate Rise. At this point all project members (most of them being subject matter experts) were able to review and comment the draft. After the first draft a number of improved versions and feedback loops followed until the course was ready to be finalized. The courses included static content such as text and images and more interactive content such as exercises, videos and animations.

3 METHODOLOGY

This study focused on three workplace-based online courses which were designed in micro-modular format. All of these programs were custom-ordered by a client and produced by a vendor company specializing in digital learning content development. Production followed the parallel design process and the tools that were introduced earlier were applied. Content development was done co-creatively in cooperation with the production teams of the vendor company and the client. The majority of project team members were located in Finland and the rest were located in Europe, Asia and the United States. Participants outside Finland used the collaborative working environments to access project documentation and contribute to the development tasks.

All three courses were primarily designed for self-study purposes and the courses focused on the following themes: a) First response equipment user training, b) Nursing practices, and c) Project change management & legislation. A structured interview with 9 helping questions was carried out 4-6 months after the course release involving the key persons of each client organization. The timing of the interviews allowed us to include user feedback and reviews to assess how the course met the expectations of the client and the user target group.

4 RESULTS

The results of client interviews are discussed in this section. Answers reflect how clients involved in the three online course development projects perceive the value of micro-modularity and collaborative content creation in course design. The following sections present the findings sorted per category and whether the comment is positive (+) or negative (-).

4.1 Category: Course concept design and production process

- + Establishment of the course concept and manuscript was very fluent.
- + Production of demo versions is very simple by selecting and using existing modules.
- + Further editing and updating of courses is effortless as it can be done per module.
- + Modularity allows mixing of learning objects or sections with other courses or versions.
- + Multi-usability of modules.

4.2 Category: Usability and pedagogical added value

- + The outcome is compact, well-focused and not too heavy.
- + If the same message is expressed the same way and shared across using the same module(s), the message is same to all.
- + Micro-modular concept fits extremely well for device/appliance user training.
- + Modules can be used and re-used independently, based on demand, for different purposes.
- + Modules can be used for other than training purposes as well (e.g. marketing material).

4.3 Category: Collaborative content creation in the cloud

- + It made working faster, more efficient and more interactive.
- + All project members have equal opportunities to express their different opinions (all comments appear neutrally to all).
- + Working has been much easier as we can now reach all project members independent of their location to work on the same project. Working is faster and more efficient and we get the job done sooner than earlier.
- + We can now do the initial planning in the cloud environment based on which the scriptwriter prepares the next version of the content outline in the actual course environment. This way we get a more realistic picture about the course at an earlier stage. It helps us understand what kind of changes or improvements are needed, what works and what doesn't (in terms of course usability).
- + Comments are better prepared and targeted when made to the actual course draft than by phone or sent by email.
- + This way of working seems to decrease the overall workload in projects.
- + It allows the project manager to see the status of project in real-time, and he/she can intervene when required, give comments, provide guidance and ask other project members for clarifications.
- + It was extremely useful to have an initial, rough version of the course online which can be commented by all project members.
- + Different development versions of the course could be shared to everyone online.

- + Our teams are global. People from all over the world can contribute to course development using the online collaboration environment.
- + In the old model sending back and forth comments and edit requests manually was not efficient as errors happen (broken telephone effect) and they have to be re-corrected – in the collaboration space this is not needed.
- Analysing and “distilling” of multiple comments and opinions is challenging, it requires careful and focused moderation, moderator must be prepared to receive and manage a flood of comments and change requests.
- Collaborative working with the course content was difficult because the material was quite large and it was difficult to see where last comments/edits had been made (e.g. the system didn't provide alerts about new comments).
- When a new version of the course was published, all previous comments were not there anymore.

4.4 Numerical rating

Interview participants were asked to give a numerical rating for the work done and the outcome. The rating was given using the Finnish school grading scale (4-10), where 4 is “failed” and 10 is “perfect”. All individual values given were 9 resulting in 9 as average for the whole study. The participants were asked to explain why they gave this rating and each mentioned the same reason: “schedule challenges”, which decreases the rating from 10 to 9.

4.5 The streamlined process

Based on the results and observations of this study a streamlined process for micro-modular digital learning content production in a cloud-based collaboration environment is proposed next.

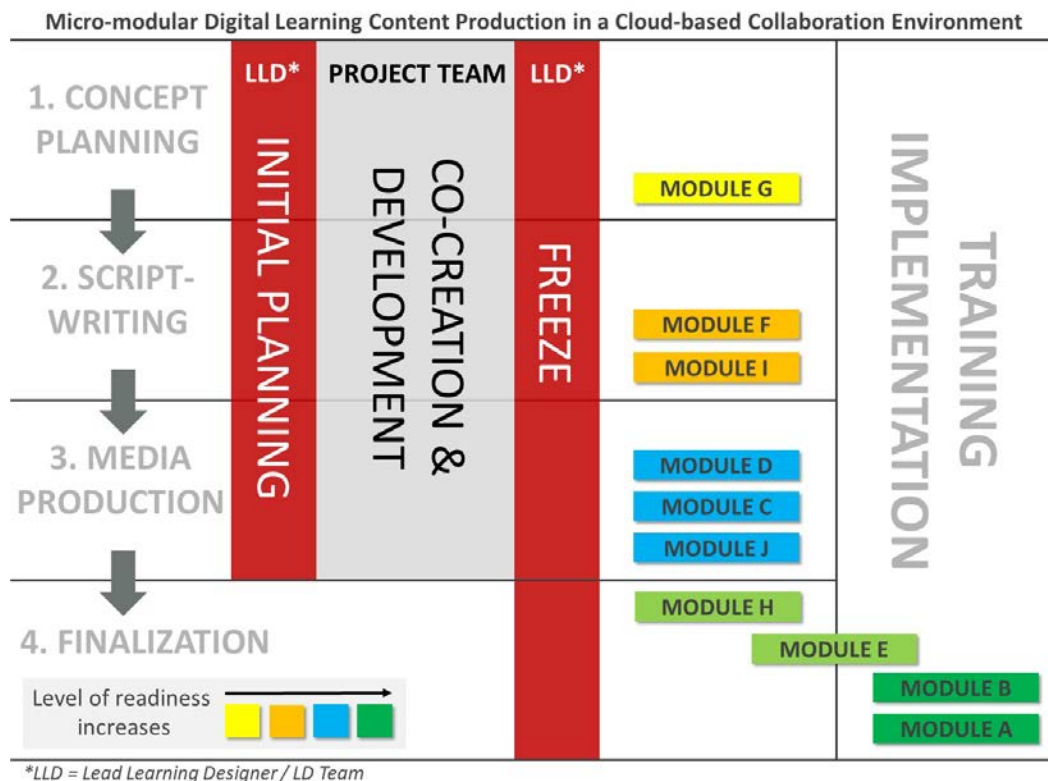


Figure 5. The streamlined process.

The process follows the parallel approach, but it highlights the role of LLD (Lead Learning Designer / Learning Design Team) in the initial planning and finalization (FREEZE) stages of each main phase (Concept planning, Scriptwriting, Media Production, Finalization) within a module.

5 CONCLUSIONS

The conclusions based on the outcomes of client interviews are discussed next.

5.1 General observations

It is clearly evident that the clients who have participated in the study are extremely satisfied with the new micro-modular production model and the possibility to work on content development collaboratively. Two of the three participants mentioned that the project exceeded their expectations. Main reasons seem to be *added flexibility*, *efficiency of working* and *increased opportunities to contribute* to content creation. Micro-modularity seems to increase the reliability and functioning of outcomes, as one of the participants mentioned that during their implementation phase with hundreds of users taking the course, they received no help requests or error reports. Based on personal experience from hundreds of similar projects, this is extremely rare.

5.2 Further considerations

Switching to a new kind of process model in which the role and expected contribution of all project members changes to some extent at least, always brings challenges. People involved should be open to unlearn old ways of working and welcome new methods and opportunities. Based on interviews one of the crucial points to ensure success is the action of those in charge of project management and facilitation. When many people work on the same content more independently than before, the rules and responsibilities must be clearly agreed and mutually understood. The approval process must be clear as well. It seems that strong project management would benefit this kind of project. The role of the learning designer (the person with the main responsibility in designing the course concept and scriptwriting) changes too. He/she will do less writing and focus more on content moderation. At certain points of the project, for example during initial concept planning and when approaching milestones, the moderator must limit the access and contribution of other project members. This is important to allow finalization of different phases within the given schedule and to ensure all contributions to content creation can be assessed and processed in controlled order. As with any work process, there are people that are more comfortable with working online than others. This means that careful selection of people for projects and matching of their roles is very important to ensure the best potential of staff is exploited.

The study revealed some interesting aspects in online course design that need further exploration. The new way of working and micro-modularity seem to have many advantages, but some new risks appear in projects as well. These have to do with the increased independence of people involved to contribute to content creation and schedule challenges. With strong project management and good communication most risks can be minimized, but it would be interesting to explore further how the process needs to change and how the development tools can better support this way of working.

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