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The Usability of E-learning and Blended Learning Platforms

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Abstract

This article will outline a real-world example of development of user interface of the CreatINNES blended learning management system, which reflects: pure design, sophistication, easy and flexible interaction which is designed to catch learners' interest. It also aims to reveal the workflow of designing learning experience which includes the role of developing user interface (UI), user testing, as well as creating an appropriate course structure and hierarchy into the Moodle-based online campus of CreatINNES. It would shed some light on the preliminary practice-led research which was carried out by my colleagues and me as well as outlining the steps we have taken further - empathising and prototyping. **Keywords:** E-learning; Self-Regulated Learning (SRL); Learning Management System (LMS)

However, CreatINNES (Project Number: 2018-1-DE02-KA202-005232) is a European project funded by the ERASMUS+ funding scheme 2018 – 2021. Behind CreatINNES, there are six European organizations from Germany, Bulgaria, France, Hungary, and North Macedonia.

- Introduction
- What is UI and its role in the LMS
- CreatINNES Online Campus goals and objectives
- UI design and sketch
- Testing its usability among our target audience
- Conclusion.

Introduction

Some of the latest challenges for UI designers and researchers involved in the education are to develop learning management system (LMS) which assures effective learning. Most of them employ a Learner-Centered Design also knowns as a learner-centered approach which aims to engage learners throughout their learning path by concerning the following needs:

- Customization learner behaviours change over the learning path but unfortunately the LMS stays the same. There is a risk to disengage particular group of users which potentially lead to drop-outs. As a result, the learning domain would be designed in a way that enable students to take over full control of their settings and preferences.
- Adaptive Learning based on the notion that everyone learns differently, learners expect to receive learning resources which address their unique individual needs and receive prompt and personalized feedback.
- Facilitating student motivational beliefs learners have to set up their own self-regulated learning (SRL), which means: course participants have to set up their personal goals for their learning and then the instructor is expected to monitor, control and facilitate their cognition, motivation and learning behaviour in accordance with their personal goals. Alongside with student self-regulated learning, the student perceived self-efficacy is another important factor which reflects learner's self-confidence for achieving particular performances and dealing with some daily assignments.

However, the tremendous growth in e-learning has resulted in a major shift in education from an instructor-centered to a learnercentered focus and it is giving powerful impact on the LMS that have been developing - designers, developers, educators and students have to work in a close conjunction in order to provide students with the best possible learning experience [1]. Basically, the main purpose of the LMS is to deploy and track blended or e-learning activities and its type may vary depending on the organizational objectives and learner profiles. Therefore, choosing and customizing a LMS would be of a significant importance which concerns numerous aspects, some of which refers to carrying out a solid investigation and analysis of the learning behaviours, considering the learning objectives set up by faculties/instructors and administrators and designing an intuitive, user-friendly experience. Throughout the course of our research a few problems concerning the LMS user interface have been identified:

- Most of the LMS that our respondents have used feature confusing user interface which leads students to disengagement.
- The LMS is inaccessible from wide range of devices and browsers which means its design is not responsive.
- The LMS is unable to integrate a third-party tool.
- Students have to deal with numerous bugs and glitches, featured by the LMS.

This article will illustrate a real-world example of design of user interface (UI) and user experience (UX) of the blended learning campus of the Erasmus+ co-funded project "CreatINNES", called "CreatINNES Academy".

This EU project aims at developing high-quality blended learning programs and an effective blended learning campus for the needs of students, freelancers, entrepreneurs, regional multipliers and stakeholders who are active into the Cultural and Creative Industries (CCI), e.g. it spans a wide range of different fields – from architecture and music to advertising. Due to the widespread of Coronavirus disease COVID-19 in Europe, educational institutions have been rethinking the way they educate their students by adopting and testing new strategies. As a consequence of the corona virus pandemic, education has been changed dramatically, with the distinctive rise of personalized blended learning activities.

Therefore, one of the CreatINNES goals is to personalize the learning experience by motivating and engaging each learner – a

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great challenge that requires well-conducted research, analyses and recommendations and finally – to develop a full-fledged blended learning campus.

Target audience

One of the main challenges we faced was related with the development of blended learning that suits the needs of a varied target market. The CreatINNES beneficiaries range from people aged between 18-35, students, young entrepreneurs and people involved in the CCI. Project beneficiaries are also students who want to gather new cutting-edge skills or migrate to another field. CreatINNES also aims to support the Higher Ed by encouraging students to master skills that would enable them to enrol in one or more study programs focused on creativity or entrepreneurship. Into the very beginning of the project management, we did a thorough research among respondents from Germany, Bulgaria, France, North Macedonia and Hungary which identified learner behaviours and learning goals and most importantly outlined how the millennials and the Generation Z learn and will be learning into the next 3 years.

The choice of LMS

Based on the analyses, our research team considered a few learning management systems that reflects the needs and demands that were identified into our research. Finally, based on the LMS deployment options, customer and support types, licensing type and security features we limited the choice between Moodle and Blackboard.

However, Moodle was chosen because of its modular framework which allows any number of users, depending on the chosen hosting. However, Blackboard has a limited number of users which becomes a setback for larger companies and institutes. Moodle (Modular Object-Oriented Learning Environment) is an open-source learning campus- a software package for producing internet-based courses and websites. It is a Learning Management System (LMS) that allows effective and reliable cooperation among learners, instructors and students. In addition, Moodle uses a role-based access mechanism, and promotes three major roles: administrator, teacher (manager), and student. A user can be given any of these roles anytime as well as changing them due to certain needs, for example, a user can be a student in one course, and a teacher for another. Since Moodle is an open-source is not limited to particular technical requirements and can be installed almost from everywhere. We installed the latest Moodle release in 2020 - "3.9.1." which fixes all previous bugs and technical glitches and has a secure sign-in feature to protect sensitive data. To sum up, by installing Moodle 3.9.1 and making the right configuration and customization we could successfully deal with all of the abovementioned problems. This LMS promotes useful features, such as: user-friendly interface, ease of access for all type of participants, numerous interactive digital learning activities, a large number of powerful plugins and an ability to integrate a variety of third-party learning tools. In addition, the course pages render well on a variety of devices and screen sizes.

User interface design

Moodle is a template-based by enabling developers to add and customize new content relatively easy which makes its interface very intuitive. The LMS user interface should be aesthetically designed in a way that assure smooth interaction between learners and the LMS content. The CreatINNES Academy aims to promote not only sophisticated design, but also user interface that features a high-level of responsiveness, accessibility, and efficiency. In order to achieve these characteristics, an appropriate design of navigation, headers, footers, buttons, icons, search bars, user tour and other interface elements have been developed. It also refers to the right selection of colors, fonts, images and some other visual interactive elements. However, in order to design the best possible learning-experience, we considered the following challenges and their related solutions.

Challenge 1: Increase the number of the CreatINNES learners

• **Solution:** By employing the right UI/UX design approach, the CreatINNES blended learning platform would be easy to use, by encouraging new learners to enroll into the two blended training programs. Since CreatINNES is an Erasmus+ funded project, the CreatiNNES Academy is an open, tuition-free blended learning campus, which aims to boost skills and employability, as well as modernizing education and fostering international cooperation in order to tackle the skills gaps we are facing in Europe.

Challenge 2: High level of user satisfaction

• **Solution**: it refers to design and development of an intuitive and user-friendly interface which reflects pure design and clearness. The interface should increase learner confidence by enabling them to get an easy access and find the information they within maximum of 3 clicks. It refers to achieve at least 95% of browsing satisfaction during the UX tests.

Allow learners to get easily oriented into their training course

• Solution: By creating an efficient layout based on the CreatINNES corporate identity, as well as making UI patterns that give our learners some grounds of familiarity to consume the training content effectively. By creating a consistency and coherence between all UI elements – the user accessibility and responsiveness would be significantly improved.

Enable learners to have access to the CreatINNES Academy from smartphones and tablets

• **Solution:** In order to assure smooth interaction through a dynamic change to the appearance of the LMS pages on a variety of screen types and gadgets, a responsive web design (RWD) will be employed.



Image 1

The workflow

The IDEO's Human-Centered Design and Lean UX Design Thinking process was employed in order to make sure that our UI design will be supported by user research and feedback.

IDEO defines "human-centered design", as a creative approach to problem-solving that begins with users and ends with innovative solutions that are designed to meet their exact needs. The process consists of the following six phases.



Image 2: IDEO's Human-Centered Design. Source: https://www.usertesting.com/blog/how-ideo-uses-customer-insights-to-design-innovative-products-users-love

Observation

Our main goal here was to understand our learners and their learning behaviors. Therefore, a thorough-research was carried out during the first phase our project, called "Intellectual Output 1: Analysis and definition of qualification needs" [2]. Two types of surveys were distributed among respondents from the five European partner countries: Germany, Bulgaria, France, Hungary and North Macedonia. The first query aimed to explore the needs of those who are not involved into the CCI sector and the second one was designed to gather information regarding respondents who are active into the creativity and need to obtain new and relevant business and entrepreneur skills. Both studies were designed in order to promote the following aspects:

- Defining clear and attainable main goals, e.g. exploring the needs of the future learners as well as outlining their learning behaviors.
- Being short and well-focused. The usage of close-ended and open-ended questions was in a good balance.

However, both surveys were pre-tested among few members who were considered to belong to the CreatINNES target audience. Based on their response and feedback, the queries were improved and the identified glitches and unexpected question interpretations were fixed. Both surveys were widely distributed through Survey Monkey to respondents who are representative of our target audience. A qualitative and quantitative data analysis had been done in order to obtain valuable insights about our target audience. Regarding the UI design, it was particularly important to answer the following questions:

- How users perceive a product like blended learning academy;
- What learners believe are a product's most important features;
- What problems users have experienced with similar LMS.

However, the full analyses of the learner needs can be found in the CreatiNNES website.

Once we collected the required data, based on the analyses we did during this phase, the so-called "user-persona" was developed.

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Image 3: CreatINNES user-persona.

Ideation

In this phase, we brainstormed ideas in our consortium, based on what we learned from our observation in Intellectual Output 1. Ideas were accumulated and freely exchanged between the consortium. The team had to work in two groups – the first one was committed with the development of the course design and the course hierarchy, while the second one had to produce UI wireframes and mockups from scratch. Both teams worked in a close conjunction by exchanging their concepts and feedback on a daily basis – the UI and the course design are closely related and therefore it was extremely important to keep exchanging ideas and making critical consideration upon each proposal. Throughout this phase, we had to build up our ideas by sticking firmly with the user persona we created earlier as well as trying to stay focused on the identified problems.



Image 4: In stage "Ideation" we brainstormed and sketched some of of our ideas. Source: Budakov Films Ltd.

Rapid Prototyping

Our design team sketched UI concept of the CreatINNES Academy which consist of the required features, based on the last two stages in the process. In order to bring our ideas to life effectively, we used Sketch as a powerful software which enabled us quickly to lay the foundation of our UI design system with reusable, responsive components that automatically scale to fit the content.



Image 5: Lo-Fi sketches were created in order to specify the user path through different screens. Source: Budakov Films.

In addition, by using its shared cloud workspace, everyone in the consortium obtained instant access to the UI sketches, as well as facilitating the collection of feedback through comments, tests and sharing links to our prototypes.

During this phase, we executed some internal A/B tests, e.g. in the example above we had to decide whether to create a "Log In" button or just to set up a simple link that leads to the Log In page.



Image 6: We also tried to visualize how the "CreatINNES Academy" will look like on smartphones and tablets.

Perhaps the most difficult part in this stage was the organization of the LMS navigation structure. In spite of the fact that Moodle is a template-based platform it allows developers to fully customize the selected theme and its related navigation. Hence, our tasks here concerned:

- Organizing the LMS navigation structure in two categories primary and secondary;
- Developing UI prototypes of three pages that play crucial role in the user-product interaction: login page, index page, course page.
- Executing Guerrilla Testing in order to check whether we have to change, refine or update our wireframe.
- Choosing a Moodle theme that matches with the prototype layouts and customizing it.

However, since the content did not fit in one large menu, we had to distribute it to: primary and secondary navigation. The primary navigation refers to the content that most learners would be interested in, while the secondary navigation stands for content that would be of a secondary interest to the users. But importance is relative and the type of content linked from the primary navigation



Image 7: Rapid Prototyping. Source: http://www.freepik.com"> Designed by pressfoto/Freepik.

on one platform may be the same kind linked to the secondary navigation on another LMS. Therefore, in order to correctly determine menus and sub-menus, we carried out the so-called "closed-card sorting" – a limited number of participants who were given cards with content topics as well as categories and sub-categories to put them into. Participants were not responsible for naming the cards, rather they were labelled by our project team.

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Image 8: Closed-card sorting. Source: https://8o254421.optimalworkshop.com/ optimalsort/64312jf5/sort

Regarding the functionalities, it was vital to fulfil the following activities:

• Define what user levels our LMS would feature – several distinct roles individuals can have in a Moodle course. Each role provides access to a specific set of capabilities. The roles refer to getting access as a: student, teacher or administrator. • Specifying the content that each type of users would have – what type of content the logged-in and the logged-out visitors may consume according to their roles.

Furthermore, we distributed the interface elements into the following groups.

Input Controls	Buttons, text fields, checkboxes, radio buttons, dropdown lists, list boxes, toggles, date field
Navigation Components	Slider, search field, tags, icons
Informational Components	Progress bar, notifications, message boxes
Containers	Course boxes

Table 1: Interface Elements.



Image 9: Lo-Fi mock-up of the Course Structure. Source: Budakov Films Ltd.



Image 10: Hi-Fi mock-up of the Course Structure. Source: Budakov Films Ltd.

User feedback (Guerrilla Usability Testing)

The very first external feedback was collected by executing the so-called "Guerrilla Usability Testing", where 15 members of the public were approached by us during live intercepts in cafés, libraries and malls in Bulgaria and Germany. We chose this testing techniques, due it is relatively low maintenance. At its most basic, test respondents were given with series of tasks to complete and our research team was responsible for the following activities:

- Strangers were approached by our team in shopping malls, cafés and libraries.
- Participants were introduced briefly with the main project goals and requested to spend app. 10–15 minutes of their time.
- Respondents were given with a few scenarios several UI prototypes that they had to deal with and our team was in charge to monitor and track their user experience (UX).
- Data was collected by taking notes and even recording short videos when the participants provided us with their written consent to do that.



Image 11: We provided our testers with few Hi-Fi mock-ups and clickable prototypes.

However, the Guerrilla usability testing deliverables were qualitative rather than quantitative, as participants had been directly assessed. Based on the results, some pain points were identified and fixed and therefore we had a clear concept how to proceed further with the next stage – iteration.

Iteration

Once the usefulness of our UI was validated we started our design and customization. It refers with the choice of a Moodletheme that best matches with our needs which were identified into the previous stages. A thorough investigation was carried out and "Adaptable" was outlined as a theme which features satisfy all of the above-mentioned requirements. Adaptable is a highly customisable responsive two column theme which promotes an abundance of useful features. The concept behind "adaptable" is to have a common theme developed and tested by a community of users which can be branded and configured according to our needs. A custom layout by using drag and drop features may be defined for the following Moodle pages:

- Front page
- Course page
- Footer
- Dashboard

In addition, it offers fully-customisable: fonts, colours, block styles (including icons) and buttons (including their radius). Alongside with its high-level of customization, this powerful theme features the following functionalities: additional layout settings for width, slider width, padding of various elements, social icons or Search box in header. Furthermore, it offers very effective support for Social Wall Course Format, Support for Grid Course Format, a large number of mobile settings, option to add login form in header on front page, Favicon uploader, Background image uploader, Activities status, additional block regions for Adaptable News Slider and other plugins developers may wish to add. By taking into account the above-mentioned characteristics, "Adaptable" was selected as a Moodle theme that significantly facilitate our UI/UX by matching our target audience preferences. Since the CreatINNES corporate identity was produced by one of the consortium partners - "Budakov Films", the same company was in charge of the blended learning UI/UX design due to its familiarity with the usage of all visual elements and brand attributes. The project logo, font, images, icons and colour palette were successfully transferred to CreatINNES Academy and there is a coherence and consistency between the project website and its blended learning campus.

Once the theme was customized, a UI/UX test was performed among 55 respondents whose background belongs to our target audience.

Some of the most important findings are illustrated bellow:



Image 12: UX test executed via https://usabilityhub.com. Q1: This is your course main page. What is the first thing you are going to do?.



Image 13: UX test executed via https://usabilityhub.com. Q2: How you are going to set up your account?.

Based on the collected feedback we found out that most of our users have limited prior experience in using such kind of blended learning campuses. Some learners were confused regarding where and how they have to begin. Therefore, we decided to develop the so-called "user tour". When login into CreatINNES Academy, learners could find guidance that pop-up on the screen and clearly state how to get started. It serves to on-board and engage new users by guiding them through all essential parts that our LMS provides. The user-tour can be easily restarted by clicking on the link bellow "Reset User Tour" in case users want to get familiar again with the instructions.



Image 14: UX test executed via https://usabilityhub.com. Q3: Here you can see a preview of one of the learning modules. What is the first thing you are going to do?.



Image 15: User-Tour. Source: Screenshot from CreatINNES Academy.

Buttons

However, rounded buttons have been designed - based on the notion that buttons with rounded corners are better perceived by our brains than a rectangle with sharp edges. According to Barrow Neurological Institute "perceived salience of a corner varies linearly with the angle of the corner. Sharp angles generated stronger illusory salience than shallow angles". Some psychologists claim that the reason behind this phenomena came from our early childhood – we all know that sharp corners-toys could hurt whereas rounded corners are safer.

However, respondents stated that the "Log In" button on the home page is not very recognizable and hence, it slows the time the learners need to login in the campus. Based on their suggestions we solved the problem by swapping the basic and hover button colours.

Citation: Petyo Budakov. "The Usability of E-learning and Blended Learning Platforms". Acta Scientific Computer Sciences 5.1 (2023): 49-59.

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Image 16: User Tour buttons. Rounded buttons are better perceived due to the fact that it takes less cognitive effort to visually process. The selected font is: Open Sans.



Image 17: 25% of the respondents faced difficulties in spotting the Log In button for less than 3 sec.



Image 18: The modified Log In button is much more recognizable due to the usage of colour that is noticeable and drive the user attention for less than 3 seconds.

Padding

While the so-called "margins" designates the amount of space around the UI elements, padding controls the distance between the inner border of an element and its child content or elements. It is measured horizontally and vertically and its clever usage prevents learners from being frustrated by clicking on the wrong button. The vertical padding of editing buttons was set to 4px and the horizontal to 6px.



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Source: Budakov Films Ltd.

Colour

The use of colours is vital since one of our goals was to achieve a consistency and sense of familiarity between CreatINNES Academy and its official website: www.creatinnes.eu.

Alongside with this, we aimed to assure a very good contrast between the buttons and the other visual elements in order to guide clearly our learners towards taking important actions. The main button colour is designated to: #4E438D and when hoovering it goes to #B86FAE.



Image 20: Button colour. Source: Screenshot of CreatINNES Academy.



Image 21: The color that the button changes to when hoovering over it. Source: Screenshot of CreatINNES Academy.

Alignment

It was crucial to choose an appropriate alignment between all visual elements. Alignment makes the UI design organized and well-balanced which boost the student retention throughout their learning experience. It also concerns the establishment of visual hierarchy between the elements according to their usefulness and importance.

For instance, we faced a usability issue related with the course language preferences. Some German students expressed their willingness to set up their native language as a language of the platform and take their course in English. Hence, we assured them with more options for customization - learners can easily set up the language of the "CreatINNES Academy" by clicking on the topright drop-down menu and then to take their course produced on the language they want by choosing a course box. Since our main target audience is located in Germany, France, Bulgaria, North Macedonia and Hungary, we installed a package of those five languages plus English as well as currently translating the available courses to those languages. It means that our two blended training programs have to be offered in six languages which makes in total: twelve courses. In order to achieve well-arranged layout and good orientation we visualized each course in different box. The usage of boxes helped us to create good organization, separation, pure design and sophistication. Designers came up with different concepts regarding each program, e.g. Program 1 "Entrepreneurship for CCI freelancers and startups" and Program 2 "Creative Thinking for Innovations". However, the tone of voice is the same, concerning the utilization of fonts, colours, graphics and buttons.



Image 22: Alignment of the available courses. Sources: Budakov Films Ltd.

The alignment concerns also small elements such as pop-up windows. In this example, we tried three different options (bellow) and tests proved that learners placed their preferences on Option 3 – due to the invisible diagonal which starts from top left and goes to bottom-right corner.



Image 23: User Tour pop-up window and its buttons. Sources: Budakov Films Ltd.

Implementation (ongoing)

Based on the results, back-end functionality will be built by our development team and connects it with our UI.

However, our design team works in a close conjunction with the developers in this phase to make sure that everything will go according to the design projects. By taking into account some Moodle specifics, it is possible to raise the need of minor changes in design during the phase of implementation. The configuration of the platform and its related performance tests are currently ongoing and the purpose of this article does not aim to focus on that, rather to expose the UI/UX design of the CreatINNES Academy.

Conclusion and Recommendations

In order to create an effective UI design that fully satisfies our future learners we employed a human-centred approach of IDEO as an effective method to problem-solving which is completely focused on the people. One of the very first goal we set up was to collect relevant information and to analyse the needs of CCI freelancers, start-ups, and innovative companies within the partners' countries: Germany, Bulgaria, France, Hungary, and North Macedonia. In return, we will be able to create two tailored-made training programs covering their skill development needs as well as developing a blended learning campus, called "CreatINNES Academy". However, 55% of our respondents belongs to Generation Z (born between 1996 and 1999) and 45% represent Generation Y, known

Citation: Petyo Budakov. "The Usability of E-learning and Blended Learning Platforms (in English)". Acta Scientific Computer Sciences 5.1 (2023): 49-59.

also as millennials born between 1981 to 1995. However, based on the results, we managed to identify our learner profiles, which reflects their learning behaviours and needs.

Based on the analysis, we developed our user persona which helped us to move forward into accumulating ideas, initiate brainstorming and sketching basic concepts in terms of how our UI design will look like. Besides the executed Guerrilla Usability Testing which helped us to accomplish our general concept, we tested our UI design several times among representatives of our target audience. Collecting regular feedback, making analyses and improvements played a significant role into producing the so-called "millennial-ready" UI design. It was crucial to understand how actually millennials and the Generation Z consume learning content as well as how they interact with their gadgets. For example, about 81% of the interviewed millennials prefer reading digital learning content to printed text. We were not surprised by the fact we discovered our target audience requires very easy access to the information they are looking for – with maximum of 3 clicks. Furthermore, 7 of 8 stated that smartphones are their most preferred gadget and they tend to use it app. 45 times per day and spending in total 25 hours per week online. Therefore, responsive design was implemented which makes the LMS webpages to adapt to the size of the visitor's viewport. The user experience is rapid, seamless and consistent by enabling users to edit and customize their profile information and preferences according to their needs.

However, designing UI of learning management system is an evolving process that needs to be updated over the time, since the user habits and their learning behaviours also change. Those adjustments have to be implemented gradually, based on recently executed user experience tests and observations that lead us to modify even some tiny visual details that significantly improve the LMS usability and assure high level of responsiveness, accessibility, and efficiency. Sometimes change as small as enlarging a button or changing colours can make a huge difference.

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