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dos Santos Lonsdale, M orcid.org/0000-0003-0315-6169, Qin, X, Chen, Y et al. (3 more authors) (Cover date: Dec 2022) The power of information design in enhancing the organization of information and course material in an online Virtual Learning Environment (VLE). Information Design Journal, 27 (3). pp. 235-277. ISSN 1876-486X

<https://doi.org/10.1075/idj.22001.lon>

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The power of information design in enhancing the organization of information and course material in an online Virtual Learning Environment (VLE)

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Funding details

This work was supported by LITE – Leeds Institute for Teaching Excellence, University of Leeds, UK.

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Abstract

The way information is organized and designed on virtual learning environments (VLEs) is poor (e.g., unclear, unattractive and overwhelmingly dense). This study evaluates and redesigns a VLE platform to enhance access to information and course material. A three-stage user-centred mixed-methods research approach was used with students taking part as co-creators of education, researchers, designers and end-users. Results show that performance was significantly better with two layouts designed following information design principles and a user-centred research process, than with the existing layout. Participants' opinion also reflected this same trend. A set of guidelines to improve the design of VLEs is provided.

Key words: Information Design, Co-Design, Eye-tracking, Performance Testing, Virtual Learning Environment

1. Introduction

Virtual Learning Environment (VLE) is “a collection of integrated tools enabling the management of online learning” (McAvinia, 2016). It is widely used in higher education institutions for teaching support, administration, communication and assessment (Hanrahan et al., 2009; Blackboard, 2019). The Covid-19 pandemic has made the need for online teaching and learning even more prominent, with higher education institutions around the world resorting to VLEs as their main teaching tool. This immediate change to fully online teaching practice at a time of crisis also meant that educators and students finally accepted and adopted online tools that until then had been available but not fully embraced. More importantly, it unveiled the many benefits of online teaching and learning as a complement to standard face to face delivery, such as accessible materials to all and innovative teaching approaches that have the student learning experience (i.e., an experience that adds value to the learner) at the centre.

A well-designed VLE platform should therefore equip students with a fundamental learning tool that can be used to support learning outside the physical classroom through the use of various learning resources and course-related information (Al-Badowi, 2006; Parsons, 2017). A well-

designed VLE platform should also provide a flexible teaching tool for educators to easily create and administer course content, provide reading lists, make announcements, assess and examine students, and track student performance (i.e., learning and academic achievement) (Green et al. 2006; Khlaisang and Songkram, 2019). As Oakman (2016) interestingly puts it, “educators are encouraged to consider the VLE as an abbreviation of ‘valuable learning experience’ to reinforce its primary purpose”.

A VLE platform also enables access to online learning materials in distance education (Peng *et al.*, 2015). With Covid-19 still very much present in our lives, universities with international student cohorts continue to offer dual teaching, i.e., teaching delivery where some students are on campus and some are online. This same advantage can apply to students living close to universities who, for example, might be taken ill or are unable to attend classes for reasons beyond their control. In normal circumstances, a VLE platform also creates opportunities for students to stay engaged after class and access learning materials at any time and in any place (D’silva and Reeder, 2005).

However, previous research has shown several problems with the way information is presented and structured on the VLE in terms, for example, of accessibility and efficiency. A study conducted by Dyson et al. (2006) evaluated tutors and student use of Blackboard VLE. One of the areas researched was design, i.e., the way information is designed and course material is organized. Findings were clear in showing problems with: 1) Accessibility – not enough levels of hierarchy; 2) Orientation – large range of colors, a lack of consistency and a poor relationship between the color of folders and files, all creating visual confusion and disorientation; 3) Consistency – color, typeface, type styles and type size not used consistently; 4) Legibility – extravagances in the use of colors and patterns leading to illegibility.

Unfortunately, a decade and a half later this scenario and design problems still exist. The focus has been mostly on the improvement of technology and content, while information design and its power to enhance the student journey and learning experience has been neglected. When quickly surveying some VLE courses, it is clear that educators continue to have little initiative or knowledge regarding how to structure and organize information in a clear, accessible and efficient way. Moreover, as also identified by Oakman in 2016, many times learning materials are out of date, inappropriately labelled, and interactivity is low. Such factors are essential to enhance user engagement (i.e., how learners interact with the information and course material) and learner experience (i.e., how meaningful and relevant the experience is to the learner). Therefore, while the VLE has much potential as a teaching and learning tool, its success and effectiveness depend on whether users engage with it or not (Oakman, 2016). Furthermore, the inefficiency of VLEs leads to frustrated students and a failure to assure teaching and learning quality. While there have been attempts to address criticisms regarding VLEs being old-fashioned and hard to use (Lapowsky, 2015), little has been done to address this problem from an information design angle and provide practical and sustainable solutions. This is worrying, considering that currently the VLE is the main tool of communication, management, and assessment used by educators on a daily basis. Moreover, it is a tool with great potential to offer a high-quality learning experience to students at a time when hybrid and online teaching are required and will remain common practice for the foreseeable future.

The fact that information design has been neglected in the design of VLEs is, in our opinion, mainly due to the lack of awareness and research in this area. Studies looking at VLEs through the lense of information design do not exist as far as the authors are aware, and there are only a few studies and/or evidence-based guidelines on the visual design of information on VLEs, as exemplified next. Richardson et al.'s (2014) study investigated specifically how good choice of color for text and backgrounds of e-learning tools can increase readability of text while also reducing extraneous cognitive load and consequently boosting learning retention. In Wongpornprateep and Boonmoh's (2019) study examining students' perceptions towards the use of the VLE, the importance of color was also emphasized in the design of VLE websites (together with making websites attractive) in order to keep learners engaged and motivated. Kuzu and Ceylan (2010), on the other hand, identified content, expressions, activities, graphics, and text as components used in a VLE that have to be designed according to the perceptions and the needs of the target user. However, their focus was specifically on typographical properties and how text design is one of the most important components when designing VLEs to enable content to be read more comfortably and faster. In her 12 tips for health profession educators regarding online course design, Schlegel (2020) expands from text to page design by listing, as tip 8, the need to strive for a clear course layout. As argued by Schlegel (2020), clear and attractive page design and layout promotes communication, facilitates navigation, increases accessibility of a course, is conducive to course completion (especially important when courses are voluntary), etc. Istrate (2009) expands a little bit further to give detailed guidelines on the visual and pedagogical design of eLearning content. Istrate (2009) discusses and lists principles for text design and use of color, but also discusses in detail how to develop materials for the web by considering navigation, accessibility, and other features.

Another reason why information design might have been neglected in the design of VLEs is as follows. Although some educators might be fully aware of the importance of VLE as a teaching and learning tool, they are not sufficiently aware of the importance of designing their courses around student needs and following good information and instructional design. Instead of considering student needs, educators seem to "rely heavily on their intuitive teaching directions and past experience" (Lee and Kim, 2014). This then leads to poor student satisfaction and poor engagement (Liaw, 2008). Student satisfaction is here interpreted as the student pleasure or displeasure of the processes that take place during the learning experience. Therefore, information design principles and guidelines should be followed when the aim is to communicate effectively with students and help them engage with the information they are given and that they have to access on a regular basis (Bodemer et al., 2004; Lee and Kim, 2014; Peters, 2014). Following established information design principles and guidelines also avoids overburdening students with unnecessary information that only contributes to cognitive overload and slows down information processing, learning and retention. Student ability is limited to processing a certain amount of information at any one time (Grunwald and Corsbie-Massay, 2006). This also applies to misuse as well as overuse of visual design elements, such as colors, graphic elements and fonts.

Low technical ability and lack of training on how to use a VLE platform efficiently are other barriers to the good use of VLE as a tool (Rogers, 2000; Limniou, 2010; Abbad and Albarghouthi, 2011; Umore, 2012). However, technical ability and respective training are not the focus of this

study. In fact, according to Reiser (1994), the structure and design of a course can have a higher impact on the way students process information than the technology itself. Therefore, the hypothesis put forward in our study is that the application of information design principles and guidelines, together with a mixed methods and user-centered design approach, has sufficient power on its own to enhance accessibility of course material in VLEs, i.e., improve speed and accuracy of finding information, as well as lead to positive feedback from students.

With a clear lack of research in the area of information design for VLEs, and to test our hypothesis, we used the University of Leeds in the UK as a case study. The platforms used were Minerva and Blackboard. The aim of this research, therefore, was to follow a user-centered and information design approach to enhance accessibility of course material on the VLE at the University of Leeds. To achieve this aim, the main objectives of the study were:

- To involve students as co-creators of education: as designers and researchers, as well as end users participating in any development and testing conducted.
- To identify information design guidelines that can be applied and extend to the design of VLEs;
- To identify how tutors organize and display course information, as well as student usage, views, and expectations of using a VLE.
- To develop new design solutions using information design principles and guidelines, as well as user-centered research methods.

To meet these objectives a research and design process framework was devised that consisted of three core stages to facilitate: 1) the identification of design problems; 2) the development of design solutions; 3) and the validation that a design solution is fit for purpose (Figure 1).

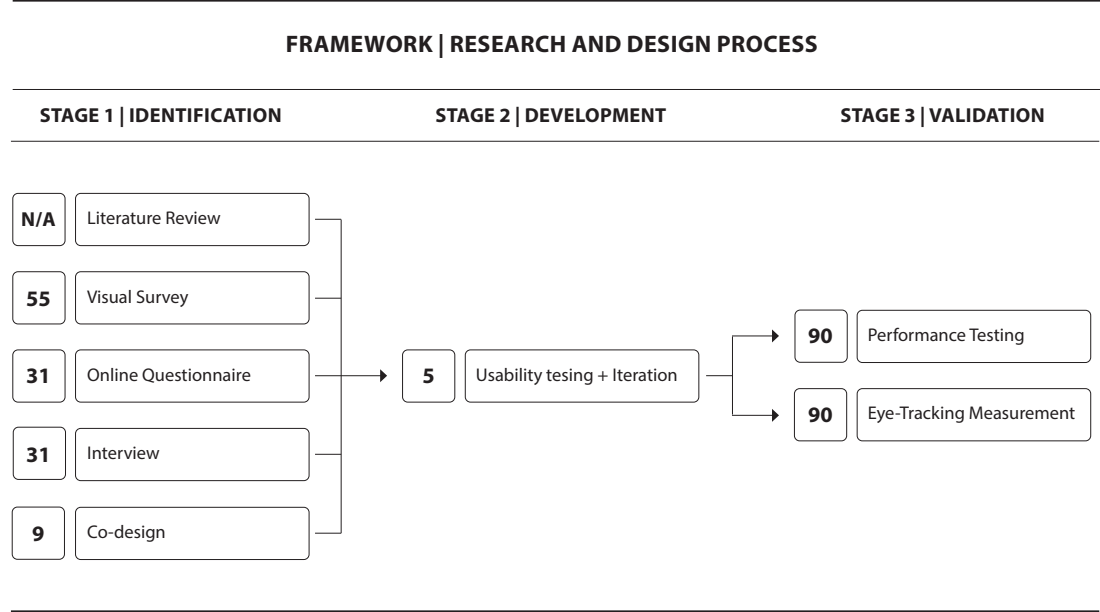


Figure 1. Research and design framework followed in the study.

2. Stage 1 | Identification

2.1. Survey of existing material

In the first stage of the framework, design problems with existing VLE courses, as well as user needs, were identified. To this end, a school in the university was selected as a case study, and all 55 modules in that school were surveyed. The school in question was selected because it covered a wide spectrum of specialisms that represent quite different areas of study: arts, humanities, technology, science, etc. Each course contained a number of subject-specific modules; for example, in an MA course, 'Research Methods' can be one of the modules. The survey was conducted to examine current information design practice on the VLE and identify how educators organize and display course information, as well as good and bad information design practice. Specifically, the survey looked at content, design, and visualization of information. The 55 modules were as follows: 11 modules from Bachelor (BA) Year 1, 12 modules from BA Year 2, 12 modules from BA Year 3, and 20 modules from Master programmes.

The majority of modules:

- Provided no or very little information on tutors teaching in the module.
- Used fonts, font size and colors inconsistently in the announcements.
- Had important information missing or located under the wrong tab.
- Had a high number of learning materials randomly arranged rather than arranged by folders, themes, or chronologically.
- Had no description of what folders and files contain.
- Had some sections that were left empty.

2.2. Online questionnaire with tutors

An online questionnaire was then conducted with 31 tutors: 17 female and 14 male; between 32 and 63 years old; 14 native English speakers and 17 non-native English speakers. The objective was to understand tutors' usage of the VLE and possible interventions that might help them use it more efficiently. Since educators play a significant role in delivering information and instruction to students, understanding their practices and views is vital to the identification of potential VLE design problems. The questionnaire consisted of 51 questions that were divided into 2 main sections: 1) Minerva VLE (online portal via which Blackboard VLE modules are accessed), specifically the 'Teach' page (tutors and students have a dedicated page; the 'Teach' page is for tutors and the 'Learn' page is for students). 2) Blackboard VLE (this is where the various modules in a course and respective information, materials and assessment are accessed). The Minerva VLE section included questions on functions, navigation, color and icons, and on design features in general. The Blackboard VLE section included questions on usage and navigation, organization of information, color and icons, and design in general.

Overall results were as follows:

- 81% of tutors believed that Blackboard VLE is an essential tool to use regularly to help deliver their teaching effectively.

- 84% of tutors said that they were given no training when they arrived at the University of Leeds.
- 71% of tutors believed that it is very important to receive training, and 26% believed it is somewhat important. So, only 3% believed it is not important.
- 84% of tutors used blackboard VLE regularly.
- 55% of tutors believed that it would be useful and 32% that it might be useful, to have a set of design guidelines (dos and don'ts) to help tutors use Blackboard VLE more efficiently and keep consistency across modules.
- 65% of tutors believed that it would be useful and 29% that it might be useful, to have short video tutorials available in the help section of Blackboard VLE.

2.3. Interviews with students

Interviews were also conducted with 31 students to understand student usage and expectations of using the VLE: 24 female and 7 male; between 18 to 26 years old; 17 were native English speakers and 14 non-English native speakers; 6 students were from BA Year 1, 9 from BA Year 2, 6 from BA Year 3, and 10 were Master students. The reason for choosing to interview students instead of just conducting an online questionnaire as was done with tutors, was to gather more in-depth information as students were the primary target audience in this study. A similar set of 51 questions to the ones asked to tutors were asked to students but from a student perspective using a VLE course. In addition, most answers required further comments and explanation to gather both quantitative and qualitative data on user behavior, needs and difficulties using the Minerva VLE 'Learn' page and the modules on the Blackboard VLE.

Overall results from the interview with students were as follows:

- 87% of students thought that Blackboard VLE is an essential tool to use regularly to help them learn effectively.
- 61% of students believed that it is very important for students and tutors to receive training, and 36% believed it is somewhat important. So, only 3% believed it is not important.
- 97% of students said they used Blackboard VLE regularly.
- 48% of students believed that it would be useful, 36% that it might be useful, to have short video tutorials available in the help section of the Blackboard VLE.
- 100% of students said they used Blackboard VLE for assessment and 90% to access lecture slides.
- Although this is a generation familiar with reading online, 45% of students said that they always download the materials, and another 45% said that they do it most times.
- 90% of students said they used a computer to access Blackboard VLE, while 10% used a tablet.
- Additional functions that students would like to have on Blackboard VLE included: timetable with deadlines, academic year calendar, assignment deadlines.
- 61% of students did not think it was very easy to find information on Blackboard VLE.
- 71% of students did not think information was very well organized on Blackboard VLE.

2.3.1. Specific problems and improvements

Table 1 compiles a list of problems identified by students during the interviews and suggested improvements. These improvements range from better organization and clarity of content to visual display of information and clear structure and hierarchy.

PROBLEM	EXAMPLES OF PROBLEMS IDENTIFIED	IMPROVEMENTS NEEDED
Information missing	<ul style="list-style-type: none"> • The handbook is missing from the 'Module Information' menu tab. • The assessment briefs cannot be found under the 'Assessment' menu tab. • Sections are often found empty under tabs such as 'Reading Lists', 'Collaborate' and 'Media'. 	<ul style="list-style-type: none"> • Make sure the information is located under the designated tab. • Delete tabs that have no content.
Incomplete content	<ul style="list-style-type: none"> • Information provided is not complete. For example, staff information without email, office hours, contact number. • Lecture slides are missing in the 'Lecture Materials' folder. 	<ul style="list-style-type: none"> • Make sure full information is provided.
Unclear information structure	<ul style="list-style-type: none"> • The main menu should be flexible to adapt to the focus of different modules. • The name of the menu tabs is confusing (e.g., Module 'Information' and 'Module Catalogue' sound very similar. • Information is hidden in folders without descriptions, which is very difficult to find. • Different type of files (PPT, Word, Pdf) are randomly organized inside folders. • Important information is not highlighted. 	<ul style="list-style-type: none"> • Establish a standard menu. • Establish a hierarchy of information. • Organise information by folders in a chronological way. • Provide description for each folder so that the user sees what is inside the folder without having to click on it. • Highlight important information with bold type or color.
Visual display inconsistency	<ul style="list-style-type: none"> • The use of font, size, color, and images can be very different between modules, which creates some confusion. • Icons for multimedia and documents are confusing. 	<ul style="list-style-type: none"> • Establish standards for visual design and legibility. • Keep as much design consistency between modules as possible. • Redesign icons that are confusing.
Information overload	<ul style="list-style-type: none"> • Excessive use of announcements. • The Minerva 'Learn' page is overcrowded with functions. Some are irrelevant to students. • Too many colors on the Minerva 'Learn' page, which is distracting. 	<ul style="list-style-type: none"> • Delete announcements that are out of date. • Remove functions on the Minerva 'Learn' page that are not relevant to students. • Reduce the color scheme on the Minerva 'Learn' page to 3 colors.

Table 1. VLE problems identified by students during the interview and suggested improvements.

2.4. Co-design with students as co-creators of education

A co-design session was conducted in Stage 1 to further identify student needs and expectations. A co-design approach usually involves all stakeholders in the design process to help make sure that the design solution will meet all users' needs (Spinuzzi, 2005). In this study, the main focus was to meet student needs with co-design being a critical research strategy because at its core was the co-creation of education with students as researchers, creative designers and end users. Therefore, the co-design session included 7 students from all four levels of study (all three undergraduate BA levels and Masters level). Furthermore, 2 additional MA Design students took on the role of designers.

The main objective of the co-design session and respective tasks was to give students the opportunity to change the design of the VLE and understand how they would do it, i.e., how information and educational materials would be organized, what color scheme they would choose, what icons they would prefer (color, shape, size) and what they would add, change or remove from the main menu. Towards this end, the session included three tasks.

In Task 1, students were asked to simply look at the existing module menu and write their thoughts, any improvements that could be made to each individual tab, and what they would expect to find under that tab respectively. In Task 2, each year group was given a selection of different menu section options that they could cut out. In total there were four 4 groups: Group 1 – BA Level 1; Group 2 – BA Level 2; Group 3 – BA Level 3; Group 4 – MA. They were then asked to sort the cards into a logical organization of information. They were asked to act as a VLE module tutor and choose the best organization of information that would result in the most effective solution to aid student learning and engagement with the course material. In the last task, Task 3, and building upon the students work in Task 2, each group was given a set of icons and a set of menu options with different typefaces, in different weights and sizes. On a large sheet of paper, students were asked to stick down their preferred menu options and icons. Figure 2 shows participants in action during the co-design session, and respective toolkit.

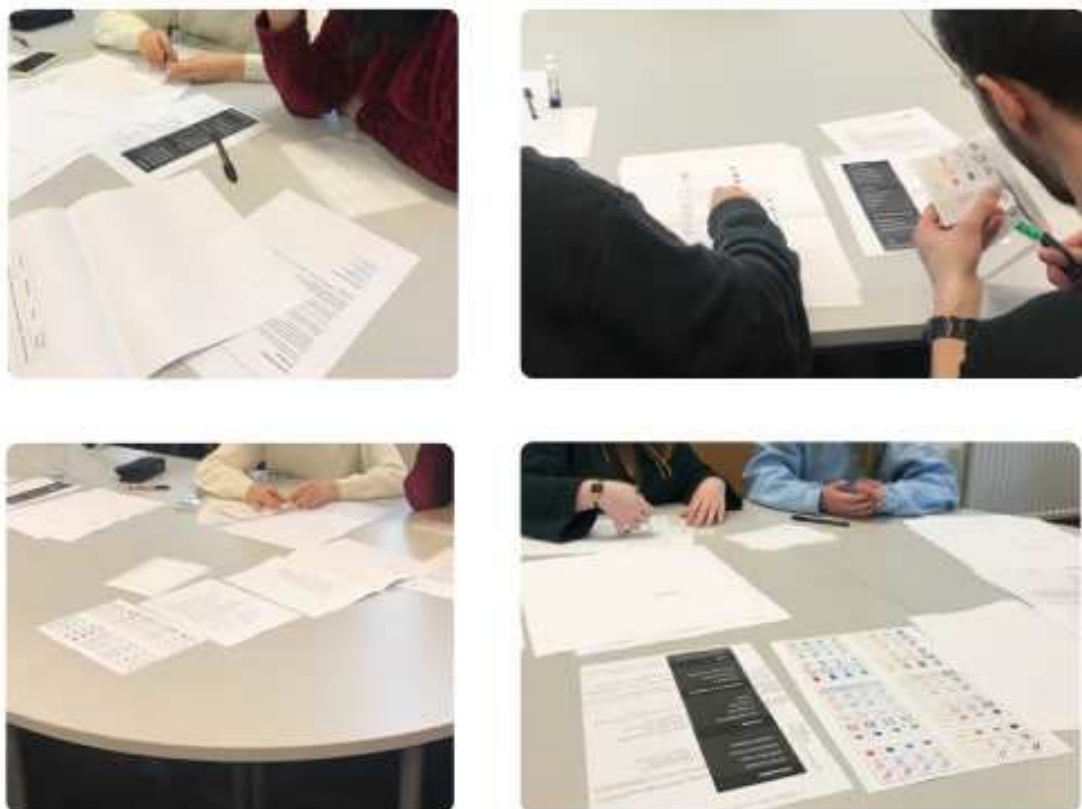


Figure 2. Students acting as co-creators of education during the co-design session.

The overall results, going through the main menu tabs, were as follows (also visualized in Figure 3).

Announcements – All groups agreed that this should only be updated with important information, with announcements removed as soon as they become irrelevant to avoid confusion. Most also thought that there should be a split between the different types of announcements. For example, general and important announcements, or course and school announcements. This could be defined by the having a layout with more obvious sectioning.

Staff Information – All groups wanted to see this section always filled in as a mandatory action for tutors. With full staff profiles for every tutor that contributed to the module, including: a picture, email, work phone number, office hours, office location, modules they teach and areas of expertise. One suggestion was to personalise this section by renaming it 'Your Tutors' or 'Personal Tutors' as the name 'Staff Information' could be confused as an area meant for staff.

Module Information – Three out of four groups wanted the Module Handbook to be under this tab. A good suggestion from the Masters group was to have timetables under this section split into assessment and course related activities. This would allow students to see at a glance what was happening during the period of the course. Some students also wanted to see the reading list and lecture information under this tab, despite there being individual 'Learning Information' and 'Reading List' tabs.

Module Catalogue – Three out of four groups thought that the 'Module Catalogue' tab should be removed completely as they were unsure what it was meant to contain and was too similar to the 'Module Information' section. The word 'catalogue' in particular is vague and could be especially confusing to international students and non-native English speakers. The suggestion from the other group was to rename the tab to 'Key Documents' in order to make it less confusing.

Learning Resources – All groups wanted to see lectures in this tab in a chronological order, as this is the most logical structure. They also expected information from seminars, workshops and tutorials to be here. The kind of documents they wanted were lecture slides and notes and word/pdf documents of any handouts. This meant that if a student missed anything they still had all the necessary information available on the VLE. They would have also liked to see links to useful papers and documents.

Reading List – All groups were keen to see better distinction between reading lists. For example: Essential or Core, Recommended or Extended, E-books, Journals, etc. Another idea was to display information differently depending on the number of items or number of reading lists. If the reading list was fairly short, it would be viable to have all the sources directly under the tab. However, if it was extensive or if there was more than one list, an external link may be preferable.

Assessment – The main things the students wished to see under this tab was information regarding their assessment and a link to submit their work. Other desired features were folders containing past examples of student work and perhaps organized according to the awarded grade so they knew what to aim for. They would also like to see an area with their grades and feedback to better track their progress and know how they could improve.

Media – The only thing students had encountered in this tab was Lecture Capture, and therefore it seemed logical that this should be the tab's name. Other suggestions were that tutors could upload different kinds of media or links to those media as this would be useful for learning.

Other overall outcomes and feedback also included:

- Students rearranged the Blackboard VLE by changing the order of the menu, renaming some menu sections and functions and selecting the appropriate icons for different file types.
- Students removed some functions from the main menu as they reported that they never used them (e.g., module catalogue).
- Interestingly, students did not fill any blank cards with new features as they wanted the menu to be minimal and less distracting.
- Students also determined 3 clicks as being the highest number of clicks desired to navigate on the VLE in order to get the materials needed. So, again, simplicity and minimal effort was the choice.

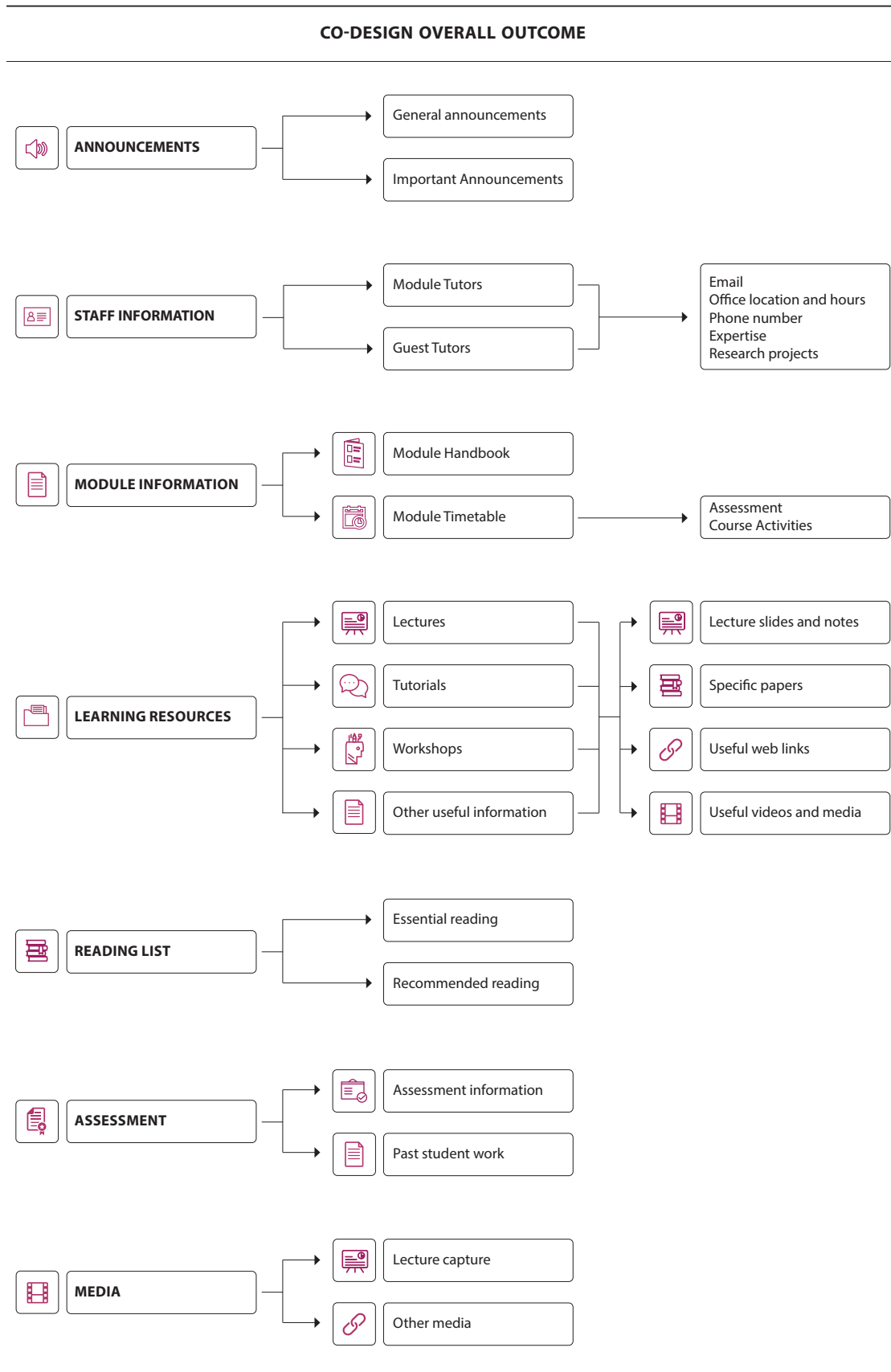


Figure 3. Compilation of menus developed by students during the Co-Design session into one reflecting the most common suggestions.

2.5. Design guidelines

Lastly, literature on well-established principles of information design was conducted looking at theories on cognition and Gestalt principles on visual perception (e.g., Moore and Fitz, 1993; Knafllic, 2015; Lonsdale and Lonsdale, 2019). Research was also analysed that focused on infographics, color, typography, layout and structure in general (e.g., Koyani et al. 2006; Pettersson, 2010; Lonsdale, 2014). Information design principles and guidelines, specifically for teaching and learning (as proposed, for example, by Pettersson and Avgerinou, 2016) were analysed as well. Principles and guidelines on interactive design were also collated to support the design of the ideal layout, as the objective was to make this layout more interactive than the existing layout (e.g., Lidwell et al., 2003; Norman, 2013; Lonsdale et al., 2018 and 2019). The top guidelines of most relevance to inform the Stage 2 (integration of research findings and design development) are shown in Table 2.

TOP DESIGN GUIDELINES USED	
Information Design	<ul style="list-style-type: none">• Provide content that is engaging, relevant and appropriate to the audience.• Visually align page elements, vertically and/or horizontally.• Use typefaces designed for screen display.• Avoid the use of all-capitals for body text, but all-capitals can be used for headings.• Set text in bold when it has to be placed over a picture or image.• Use a light or dark background color that is appropriate to the content, and then use a color with good contrast for the text and/or visuals.• Make sure the difference between colors in the color palette selected, are clear and obvious.• Use variants like complexity, directionality, exaggerated features, isolation, motion, etc. to emphasize information.
Interactive Design	<ul style="list-style-type: none">• The design should be aesthetically pleasing because it is perceived as being more usable.• 80% of the effects in interactive design should be caused by only 20% of the variables.• Clues on object affordance should be provided by the object itself or the context.• User level of control over a system should be proportional to their level of expertise.• Buttons for common tasks should be bigger than buttons for less common tasks.• The system should be designed to prevent and recover from errors.• Consider the number of options given to the user as the time needed for the user to make a decision increases with the number of options.• To increase usability, inform the users of the status of the system and/or their progress.• Decide how users will navigate to best find information: a) users can be guided through set pathways; b) users can be allowed to navigate at their leisure.

Table 2. Top design guidelines selected from the literature that informed the design of the Re-Designed and Ideal layout.

3. Stage 2 | Integration and Development

3.1. Rationale for design solutions

In the second stage of the research and design framework devised for this study, findings from the research conducted in Stage 1 were taken into account in order to redesign the existing structure and respective information on the VLE. An interview with the staff from the Learning Technology Team at the University of Leeds was also conducted to find out how much design

freedom the VLE as a teaching tool allowed. The outcome was that design features of the VLE platform used cannot be changed due to technical limitations. It was therefore decided to create two new designs: Design 1 | Redesigned Layout – a feasible redesign solution that can be implemented under the current VLE technical limitations; Design 2 | Ideal Layout – a redesign solution where no design limits were imposed, and the aim was to find the ideal/optimum VLE design solution.

Initial design concepts were therefore developed based on: a) the information design principles and guidelines identified through the literature review; b) good practice identified through the survey; c) user design preferences identified through the questionnaire and interviews; d) the results from the co-design sessions; and e) and insight gathered through the interview with the Learning Technology Team.

3.1.1. Design 1 | Redesigned Layout

Due to restricted visual options, the Redesigned Layout of the VLE focused on improving information structure of existing modules so that students could easily navigate the information accurately and efficiently. A clear menu was also defined to avoid misunderstanding and ambiguity. All materials were organized by folders with descriptions of topics or in a chronological order, while levels of information were reduced to maximize information accessibility. Bold typeface and color were used to create a clear hierarchy of information and to call attention to important notifications. Elaborated typefaces and overuse of color were avoided to achieve good legibility and consistency.

3.1.2. Design 2 | Ideal Layout

Regarding the Ideal Layout, the major consideration was to design an interactive interface that motivates learning but causes minimal cognitive load on users (Stoney and Wild, 2008). It is recognized that the nature of information design for twenty-first century learners has changed to “digital, networked, overwhelming, immediate, manipulatable, participatory and visual” (Jakes and Brennan, 2006, cited in Pettersson and Avgerinou, 2016, p.263). When used effectively, interactive software has the potential to improve learning and retention of knowledge (Simoni, 2011). With this in mind, design features that resemble social media networks were applied to learning resources to encourage students to explore and share the information. Such interactive learning experience, together with visualization of information, help learners process and retain information more easily. As research shows, people can remember up to 80% of what they see and do, but only 30% of what they read (Lester, 2006; Bursi-Amba et al., 2016). Functions (e.g., module schedule and assignment reminder) that the students wished to have (as found in Stage 1 of this study), but were difficult to implement in the existing VLE platform, were now included in the Ideal Layout.

3.2. Usability testing and iteration

3.2.1. Initial design concepts

Usability testing was conducted to assess and iterate the two layouts: 1) Redesigned Layout; and 2) Ideal Layout. A total of 5 students were shown three concepts for the Redesigned Layout. Participants were asked to compare the design concepts with one another and then compare them with the existing VLE platform in terms of information organization, functionality, usability, and aesthetics. Results were as follows: 3 out of 5 participants preferred information to be organized via a side menu instead of folders; 3 out of 5 participants considered it to be more helpful to access information efficiently if information is grouped by folders in a chronological order with detailed file names listed in the file description. Compared with the existing VLE platform, participants thought the redesigned concepts were more user-friendly and more effective.

Regarding the three concepts for the Ideal Layout, 4 out of 5 participants preferred information to be organized by increasing user interaction and that priority is given to the most updated information. The interactive design features were considered to be more personal and more interesting than in the existing VLE platform. All 5 participants chose the color scheme to be predominantly lime green. Participants also agreed that the Ideal Layout concepts were in general more user-friendly, more effective, and more attractive than the existing VLE platform.

3.2.2. Final design outputs

The new layouts were finalized based on the usability test results. Design features which were highlighted and/or suggested by participants were considered in the final concepts, together with information design theories, principles, and guidelines that were used to develop final design solutions. Moreover, in the co-design session preceding the usability testing, participants were given the opportunity to thoroughly define the design of the layouts. This meant that there was no need to conduct more than one usability test and iteration because all the data gathered in Stage 1 was very informative and clear, and therefore allowed the production of the first prototypes to be of high-fidelity and very responsive at meeting user needs. Essentially the usability test confirmed that the designs developed and tested represented well what was required and requested by participants in Stage 1.

In order to compare the existing design with the Redesigned Layout and the Ideal Layout during the evaluation stage, a Typical Layout (Figure 4 and Appendix 1) that represented the most common current design practice of the VLE was created in light of the results from the visual survey of 55 modules described in Stage 5. The Redesigned Layout (Figure 5 and Appendix 2) and the Ideal Layout (Figures 7.1, 7.2., 9, and 10; Appendices 3 to 14) were further developed to make sure that all three layouts had the same structure and the same content.

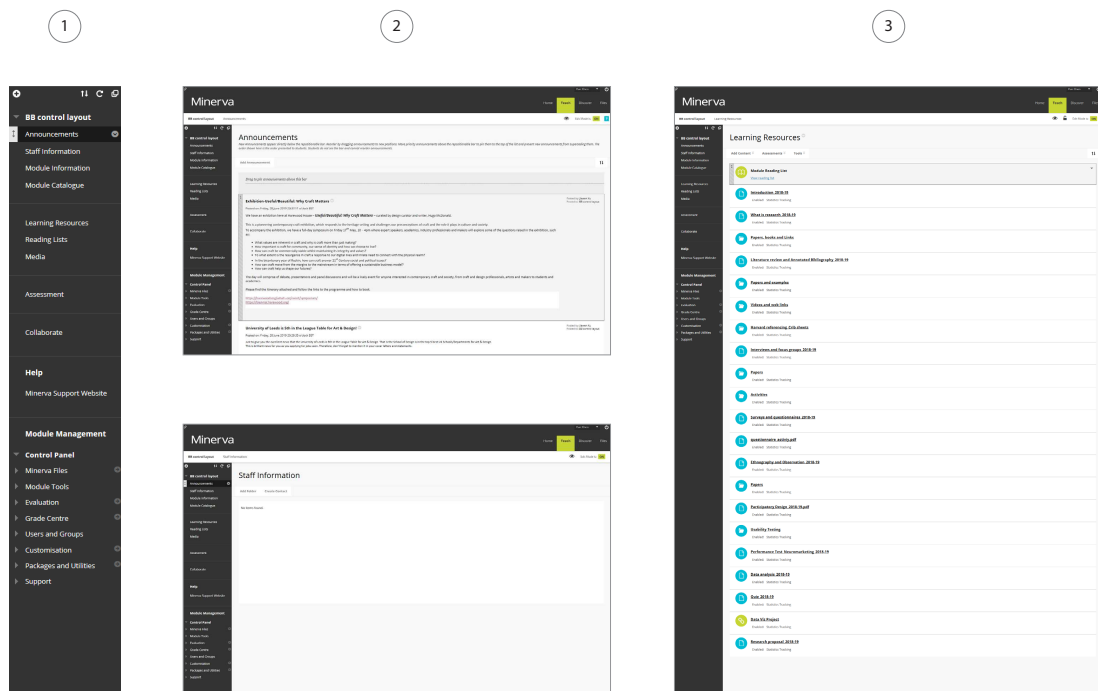


Figure 4. Typical VLE Layout. From left to right: 1) Menu; 2) Announcements and Staff Information pages; 3) Learning Resources pages (equivalent to ‘Lectures and Materials’ used for the Redesigned Layout and ‘Lectures’ used for the Ideal Layout). Appendix 1 shows a bigger size of item 3: Learning Resources.

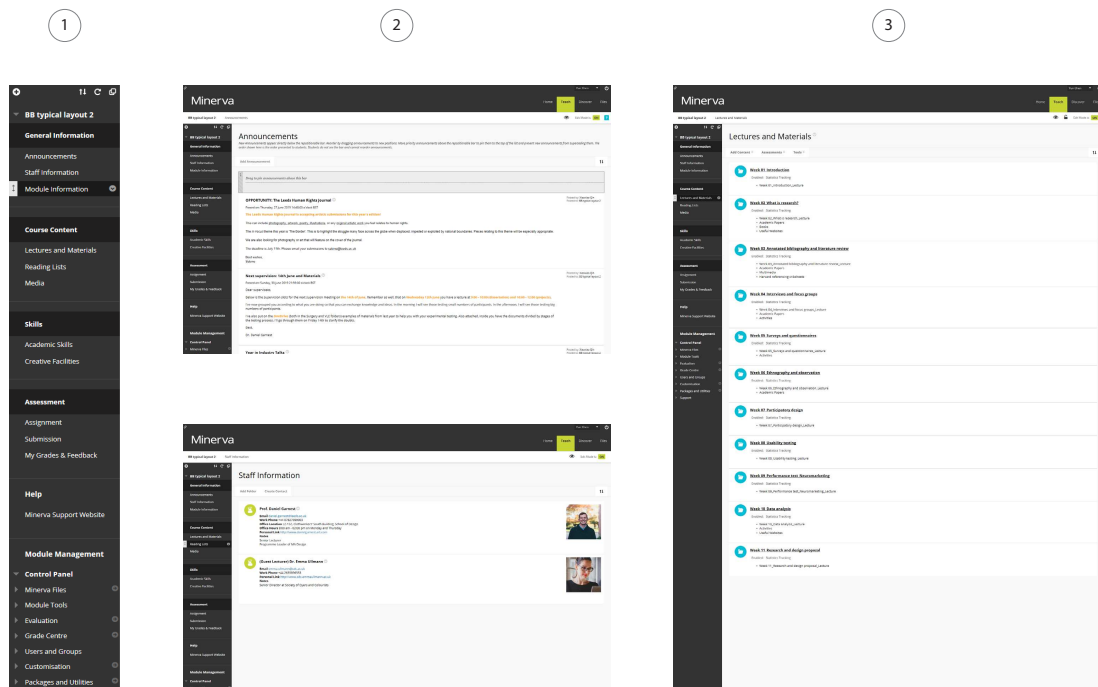


Figure 5. Redesigned VLE layout. From left to right: 1) Menu; 2) Announcements and Staff Information pages; 3) Lectures and Materials pages (equivalent to ‘Learning Resources’ used for the Typical Layout and ‘Lectures’ used for the Ideal Layout). Appendix 2 shows a bigger size of item 3: Lectures and Materials.

Figures 6.1 and 6.2 show the differences between the Typical Layout and the Redesigned Layout. As already discussed, there are limitations with the VLE platform in terms of how much is possible to create and innovate when it comes to interactivity and visualization. Nevertheless, based on previous research and feedback from users during Stage 1, our hypothesis is that good organization of information and clear structure and hierarchy alone (if following good information design theories, principles and guidelines) should be powerful enough to improve students' performance and lead to more positive feedback about the VLE platform. Towards this end, as seen in Figure 6.1, the menu for the Redesigned Layout has a clear division of sections both in terms of content and design, where the main headings have a darker background to make them stand out. In Figure 6.2 we can see how the page containing the lecture materials is better organized by following a chronological order and having clear descriptions for what is included in each week's folder. This in itself should save students time from randomly clicking on folder after folder to find the content they need. This should also reduce their frustration when navigating the VLE. Furthermore, it should help with recall, i.e., clearly knowing where to go when returning at a later stage to the VLE to find the same information.

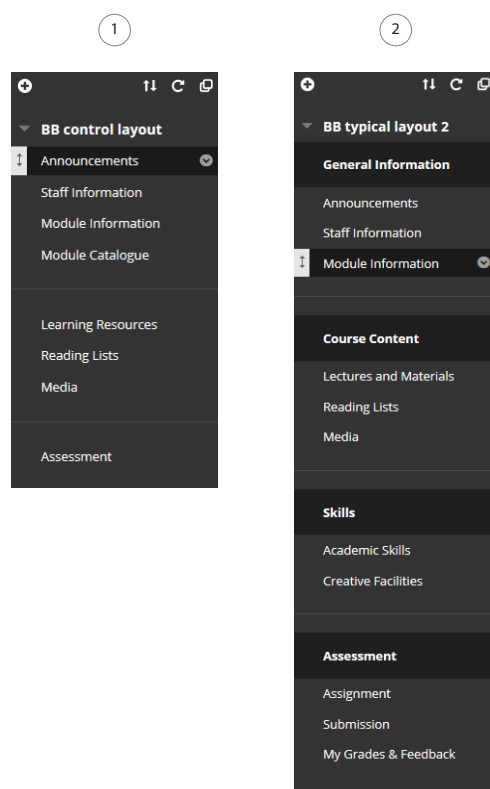


Figure 6.1. Typical Layout versus Redesigned Layout. Comparison between menus: 1) Typical Layout menu with very basic information and little hierarchy; 2) Redesigned Layout menu with better structured content and more detailed).

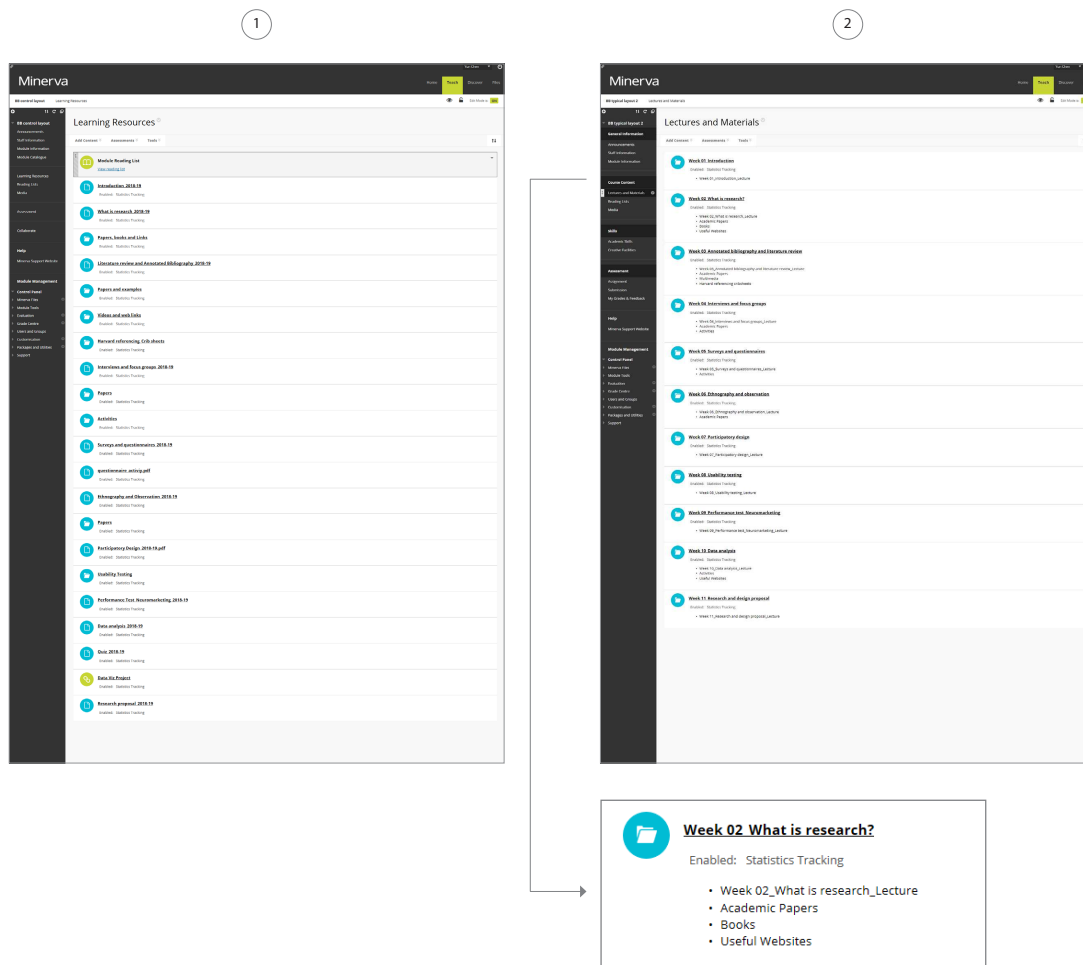


Figure 6.2. Typical Layout versus Redesigned Layout. Comparison between the pages holding the lecture materials: 1) Typical Layout page with folders randomly distributed; 2) Redesigned Layout page with weeks in chronological order and with a description of content).

Figures 7.1 and 7.2 show a series of important additions in the Ideal Layout, together with an innovative approach. The Minerva page now includes a personalized schedule and notice board for course work submissions. The menu adopts the same structure and design as the Redesigned Layout, but also includes an orange dot to highlight the most important folders. For each module there is now a Blackboard VLE homepage with bespoke information that is updated by the tutor as needed. The Staff Information page now includes more information about each tutor that is of relevance to students and that goes beyond the standard profile, i.e., it includes the tutor's research and publications, ongoing and current research projects, and any external websites that they might have. A calendar has also been added so that students can see at a glance all that is scheduled for that module for the entire semester, including submissions, guest speaker talks, etc. Finally, the Reading List page has changed from just a list of names, to actually showing the cover of the book, which is more engaging and can help with recall as well.

1

Minerva

Wednesday 6 May 2019 17:29 (Leeds, UK)

Learn

Modules

Organisation

Show 10 entries from

This year (18/19)

Search...

Year	Semester	Code	Module	Reading List	Assignment	Avail
18/19 (2)	Semester 2	DESN1989	Design for Textiles			✓
18/19 (2)	Semester 2	DESN155M	Information and Instructional Design			✓
18/19 (2)	Semester 2	DESN154M	Design Research and Integration			✓
18/19 (1)	Semester 1	DESN153M	Design Principles and Application			✓
18/19 (1)	Semester 1	DESN152M	Design Thinking			✓
18/19 (1)	Semester 1	DESN150M	Research Methods for Design			✓
18/19 (1)	Semester 1	DESN100M	Digital Design Practice			✓

Library

My Account

Library

Due

Graphic Design Process

Laidlaw Library

17 June 2019

Sustainable Package Design

Brotherton Library

21 July 2019

Quick search

Advanced Search

Help

Brotherton Library

Laidlaw Library

Edward Boyle

Health Science

St James's

IT Services

Search...

My Print

Connection

IT Support

Desktop Anywhere

Software

Security

Study Support

Leeds for Life

Skills@Leeds

Minerva Help

Student Reps

Key Dates

Timetables

Students Calendar

Term Dates

Graduation

Assessment

Exams

Plagiarism

Tutoring

eAssessment Survival Guide

Access

Registration

Module Enrolment

Browse Other Modules

Changing Modules

Changing Programme

About Us

Campus Map

Our Heritage

Facilities

Governance

Executive Team

News

Events

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Twitter

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YouTube

Instagram

2

18/19(1) DESN5150M
Research Methods
for Design (34851)

General Information

Announcements

Staff Information

Module Information

Module Schedule

Course Content

Lectures and Materials

Reading Lists

Media

My Skills

Academic Skills

Creative Facilities

Assessment

Assignment

Submission

My Grades & Feedback

Figure 7.1. Ideal VLE layout: 1) Portal page; 2) Menu.



Figure 7.2. Ideal VLE layout: 1) Module homepage; 2) Staff information page; 3) Module schedule page; 4) Reading list page.

Figure 8 compares the pages containing the lecture materials between all three layouts. Seeing all three layouts side by side makes it very clear that there is a big jump from the Typical and Redesigned layouts to the Ideal Layout in terms of innovation when it comes to user experience, interactivity and visualization of information as a complement to text. Icons are used to identify sections alongside the heading, which should help with recall and quicker access when returning to the information. This is in addition to a clear structure and hierarchy, as shown in detail in Figure 9. Color coding is also used to distinguish levels of information in a section that can be considered the most complex of all as it should contain the biggest number of learning materials, and also the most varied range of learning materials, for students to access. This same color coding follows through to the content inside that section, as also shown in Figure 9. The color of the tiles then alternates between the respective color for that section and black to clearly indicate when a different week of content starts and make it easy to spot the different weeks.

The lecture materials section is also the most personalised with its own homepage, where most important content is highlighted and updated as if it was a live news page. This homepage also contains a chat box for group discussion so that students can keep up to date with what their peers are communicating.

All other sections (Figure 10 as an example) follow a simpler design with one color only (the core color in the scheme – lime green), as these are less complex sections in terms of content and do not need color coding to help distinguish the information.

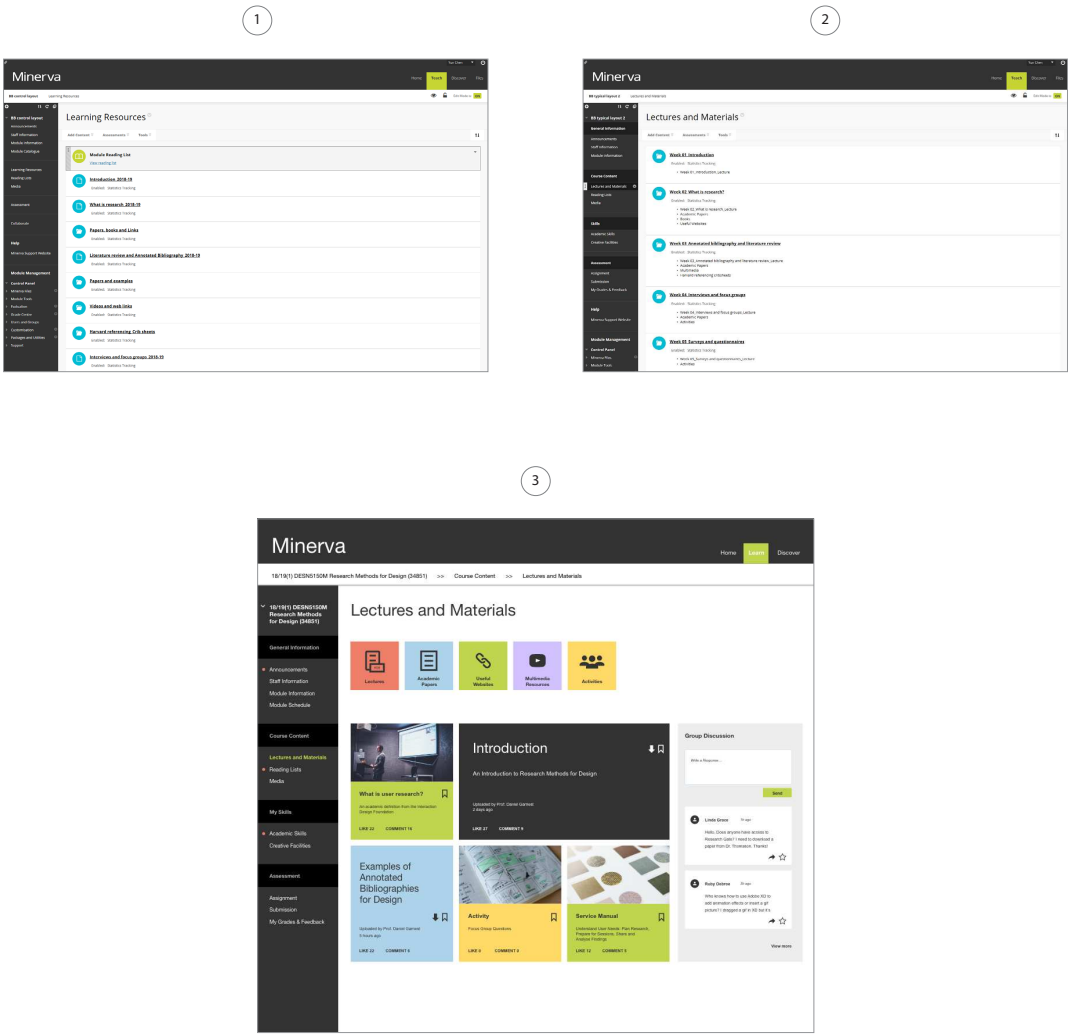


Figure 8. Comparison between all three layouts for the pages containing the lecture materials. The Ideal Layout shows an innovative approach, having at its core learner experience, interactivity and information visualization (serving as a complement to text).

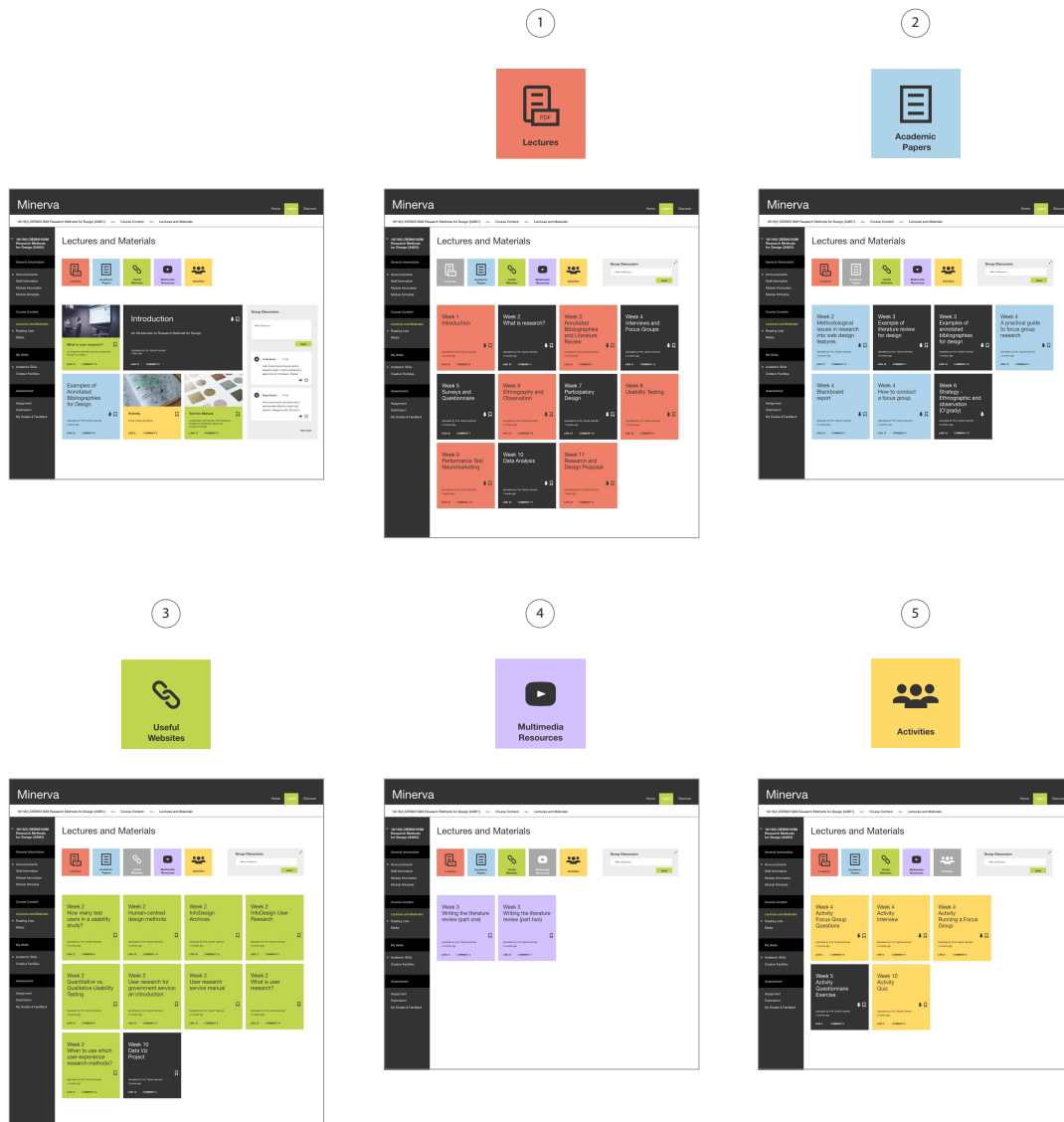


Figure 9. Ideal VLE layout – Lectures and Materials pages only (equivalent to ‘Learning Resources’ used for the Typical Layout and ‘Lectures and Materials’ used for the Redesigned Layout): 1) Lectures sub-page; 2) Academic Papers sub-page; 3) Useful Websites sub-page; 4) Multimedia Resources sub-page; 5) Activities sub-page.

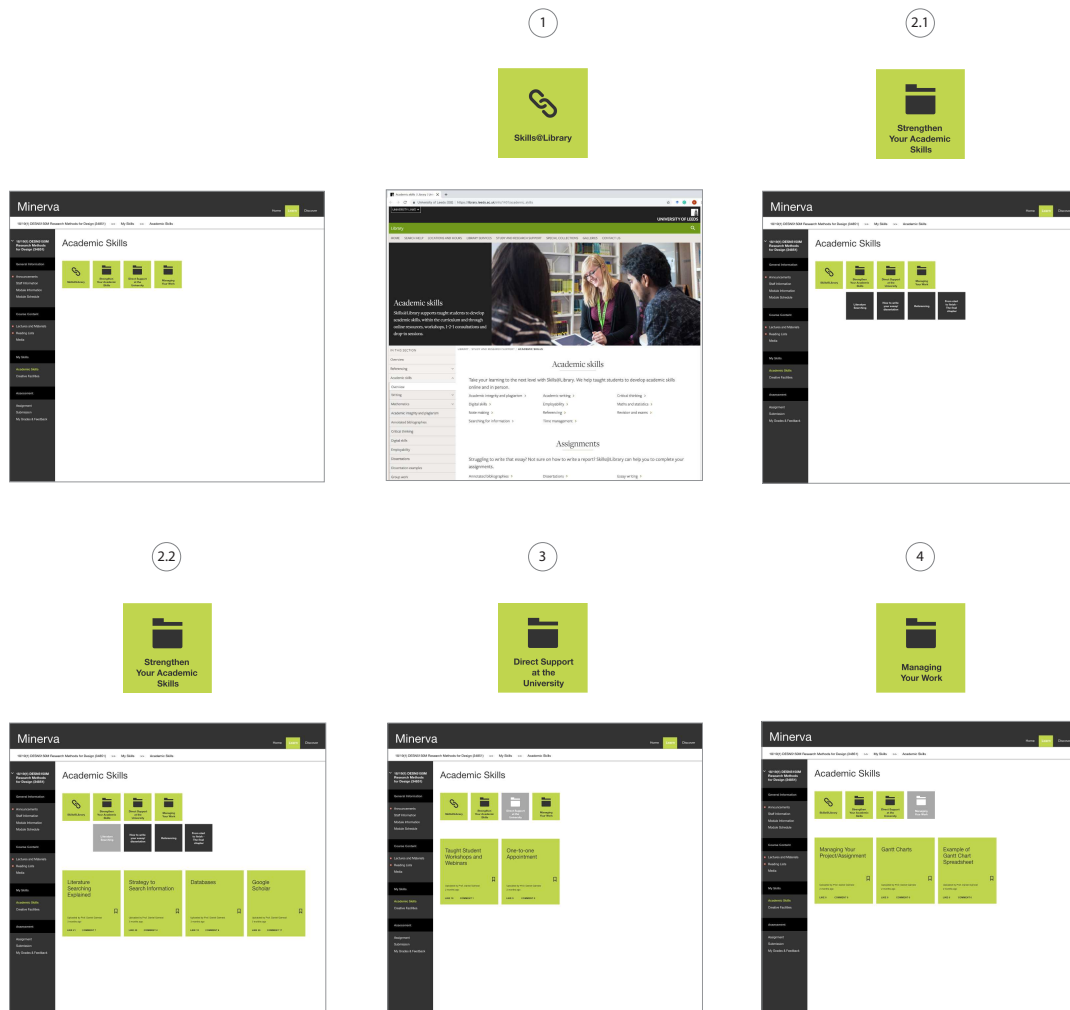


Figure 10. Ideal VLE layout – Academic Skills pages only: 1) Skills@Library sub-page; 2.1) Strengthen Your Academic Skills sub-page; 2.2) under Strengthen Your Academic Skills sub-page, and example of how other information appears when clicking on the respective icon; 3) Direct Support at the University sub-page; 4) Multimedia Resources sub-page; Managing Your Work sub-page.

4. Stage 3 | Evaluation and Validity

In the third and final stage of the design and research framework, the final design output was implemented in a real-life scenario and tested for final evaluation and validation. Performance testing and eye-tracking measurement were conducted to ascertain which design is most effective at allowing students to find information faster and more accurately.

4.1. Participants

A total of 90 participants from the University of Leeds were recruited for the test. Recruitment was done by sending an email out through university mailing lists and by directly approaching

students in community areas in the university: libraries, language centre, PhD offices, etc. Purposive sampling, i.e., selective recruitment of participants, was followed to include a balanced mix (50% each) between experienced students, i.e., students who had used Minerva and Blackboard VLE during their studies; and non-experienced students, i.e., students who had no or very little knowledge of Minerva and Blackboard VLE. The latter included PhD students or students who had just arrived for their pre-session English course before the start of the academic year. PhD students do not normally use Blackboard VLE unless they work as Teaching Assistants. As for new students, especially international students who are studying in the UK for the first time, they usually have no understanding of Blackboard VLE.

This therefore means that the vast majority of participants in this study are international and non-native English speakers. However, there is also a benefit of having such cohort as participants in the study. If we devise a new layout that is easy to access and navigate by non-native English speakers and students who come from a different educational background, then we are offering accessibility for all.

The 90 participants were divided in 3 groups, a group for each layout tested, as follows. Group 1 included 30 participants to test the Typical Layout. Student age ranged between 21 and 33 years old. 73% were female and 27% male students. 10% were British students and 90% international students. 60% were PhD students, 27% Master students and 13% Bachelor students.

Group 2 included 30 participants to test the Redesigned Layout. Student age ranged between 20 and 37 years old. 50% were female and 50% male students. All students were international students. 43% were PhD students, 37% Master students and 20% Bachelor students.

Group 3 included 30 participants to test the Ideal Layout. Student age ranged between 22 and 42 years old. 60% were female and 40% male students. All students were international students. 27% were PhD students, 40% Master students and 33% Bachelor students.

4.2. Procedure and materials

The Typical Layout, the Redesigned Layout and the Ideal Layout were designed with the same content and learning materials from the same dummy module. Each layout was tested with 30 participants individually using eye tracking measurement. As already explained, the Typical Layout was tested with Group 1; the Redesigned layout was tested with Group 2; and the Ideal Layout was tested with Group 3.

Each layout was presented to the respective participants via a desktop computer in the eye-tracking laboratory that was set as an office space. During the first part of the session, participants were asked to perform 9 tasks to find various learning-related information from different locations:

- **MODULE INFORMATION:** Task 1) Please find the handbook for this module; Task 2) Please find the lecture schedule for this module.
- **ASSESSMENT:** Task 3) Please find Assignment 1 and the deadline.

- LECTURE MATERIALS: Task 4) Please find the Lecture for week 7; Task 5) Please find the paper 'How to conduct a focus group'; Task 6) Please find the Lecture slides for 'Interviews and Focus Groups'; Task 7) Please find the link 'InfoDesign User Research'; Task 8) Please find the activity 'Questionnaire'.
- ACADEMIC SKILLS: Task 9) Please find information on the following academic skills: How to write your essay and dissertation.

Participants were given as much time as they needed and were also allowed to give up the tasks if they could not find the information. During the second part of the session, qualitative data was collected to gather participants' opinion on the design of the Layout tested. This was done by asking participants their opinion through a set of questions focusing on: organization of information; distinction of functions; description of content; color scheme; and icons.

4.3. Performance Results

Empirical testing was conducted to validate the effectiveness of the three VLE Layouts in supporting student performance when accessing information on Minerva portal and Blackboard VLE modules. Student performance was measured by time, i.e., the time taken to find the information as requested in each task; and by accuracy, i.e., the accuracy of the information found. An Independent Two Samples t-test was used to compare performance between the groups

4.3.1. Time

In terms of time taken to find the information, results show a significant difference between groups (Figure 11, left). Participants spent significantly less time to find information with the Redesigned Layout design ($M = 857.13$) than with the Typical Layout design ($M = 1240.17$) ($p < 0.001$). Participants also spent significantly less time to find information with the Ideal Layout design ($M = 507.43$) than with the Typical Layout design ($M = 1240.17$) ($p < 0.001$), as well as significantly less time to find information with the Ideal Layout design ($M = 507.43$) than with the Redesigned Layout design ($M = 857.13$) ($p < 0.001$).

4.3.2. Accuracy

In terms of accuracy of the information found, results show a significant difference between the groups (Figure 11, right). The information found by participants was significantly more accurate with the Redesigned Layout design ($M = 7.83$) than with the Typical Layout design ($M = 5.57$) ($p < 0.001$). Information found by participants was also significantly more accurate with the Ideal Layout design ($M = 9.00$) than with the Typical Layout design ($M = 5.57$) ($p < 0.001$), as well as significantly more accurate with the Ideal Layout design ($M = 9.00$) than with the Redesigned Layout design ($M = 7.83$) ($p < 0.001$).

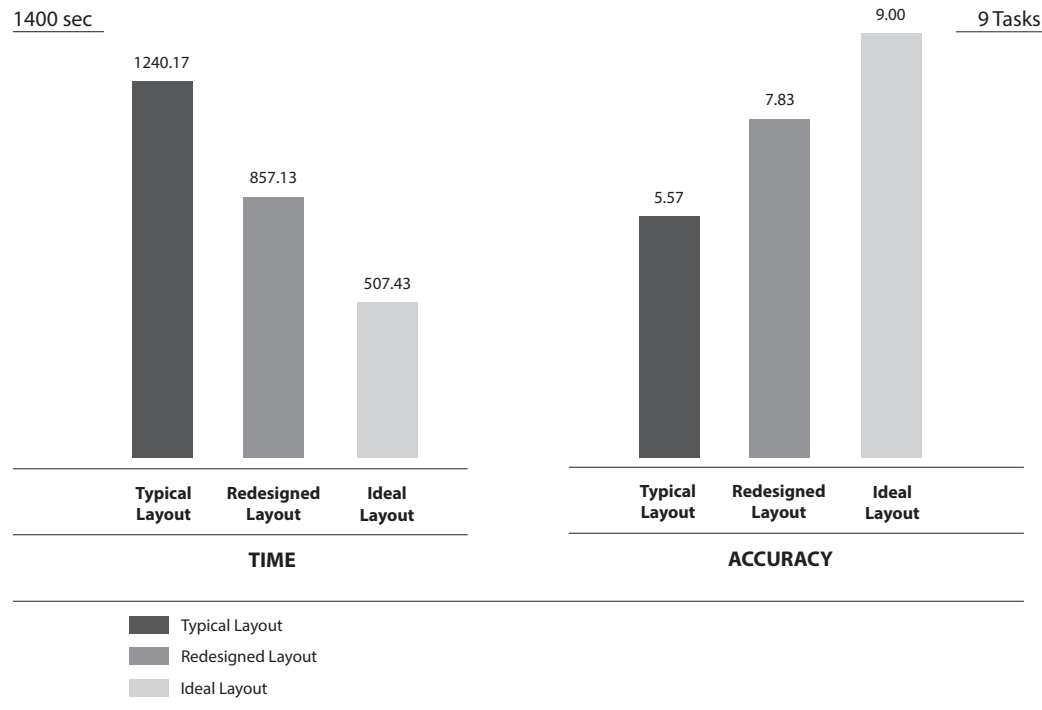


Figure 11. Mean Time (time in seconds to find information as requested) and Mean Accuracy (number of correct tasks completed) for all 3 layouts.

4.3.3. Eye-tracking

In addition to time and accuracy measurement, eye-tracking measurement was also conducted looking at scan path data, heat map data, and gaze plots data. The videos recording the scan path were analysed to identify exactly where participants struggled. Heat map and gaze plots data was created as these are data visualizations that clearly communicate important aspects of visual behavior and complement and reinforce the findings for accuracy, time and participant opinion. Heat maps show how what participants are looking at is distributed over the design output. Gaze plots show where, in what order and for how long participants looked at the design output.

Let us take again the page containing the lecture materials as an example and Task 4 asking participants to find the lecture for week 7.

The most common path taken by participants and respective number of main steps taken when using each layout was as follows. For the Typical Layout, the number of main steps taken is six times higher than for the other two layouts; a total of 18 main steps. This is because the materials related to the lectures were uploaded as the classes were taught but without identifying which week they belonged to. The folders were also all uploaded to the same page and therefore lecture folders and single files were all mixed with each other and with all other folder such as folders containing papers, media, etc. Therefore, although the materials were

uploaded in the sequence that they were delivered to students, the lack of clear chronological identification of what belongs to what week; the lack of structure and hierarchy to help navigate through the information in a sequential order; and the high number of folders and files on one single page (as many as 22) – that only increases cognitive load; were all likely to impair performance and lead to confusion and frustration. A typical path was to:

- scroll up and down the 'Learning Resources' section;
- keep checking the information at the top of the page in the 'Learning Resources' section, not knowing where to go next;
- go back and forth between sections to try to find the information in another section;
- eventually click on the 'Introduction' lecture at the top of the page (or module handbook in the 'Module Information' section) and find a list of lectures and respective week;
- with this information found elsewhere, they could then identify in the 'Learning Resources' section the lecture for week 7 as being 'Ethnography and Observation'.

With the Redesigned Layout and the Ideal Layout, the simple design solution to have all weeks identified chronologically with respective subfolders inside each week, meant lower cognitive load and ease of finding the information in only 3 steps.

Figure 12 and 13 show the heat map and gaze plots for all three layouts and for all 30 participants per layout. This data visualization validates what was described for the scan path data. The heat maps (Figure 12) were generated on the basis of absolute fixation durations. For the Typical Layout it shows an increased and more concentrated heat over the information at the top of the page. For the Redesigned Layout it shows a reduced and more broadly distributed heat over the information that precedes the Week 7 folder, with highest heat density stopping at Week 7 and very little heat beyond that (the latter showing that some participants wanted to check all the information on the page to make sure they found the right folder before making a final decision). As for the Ideal Layout, the data actually adds another layer of validity as to why this is the closest layout to an optimum VLE design solution. The heat map for the Ideal Layout shows the least and more broadly distributed heat over the information. This validates the following. Participants, as a whole, spent very little time on this page because they could find the information very quickly. It also suggests reduced cognitive load, increased understanding, and deeper engagement with the information.

The gaze plots (Figure 13) show that there are more gaze plots with the Typical Layout, i.e., more time spent finding information; as well as more gaze plots outside the area where the main information is, which suggests that participants were wondering around not knowing where to go. The number of gaze plots decreases with the Redesigned layout and sharply decreases with the Ideal Layout, once again validating that the Ideal Layout is the closest to an optimum design solution for the VLE.

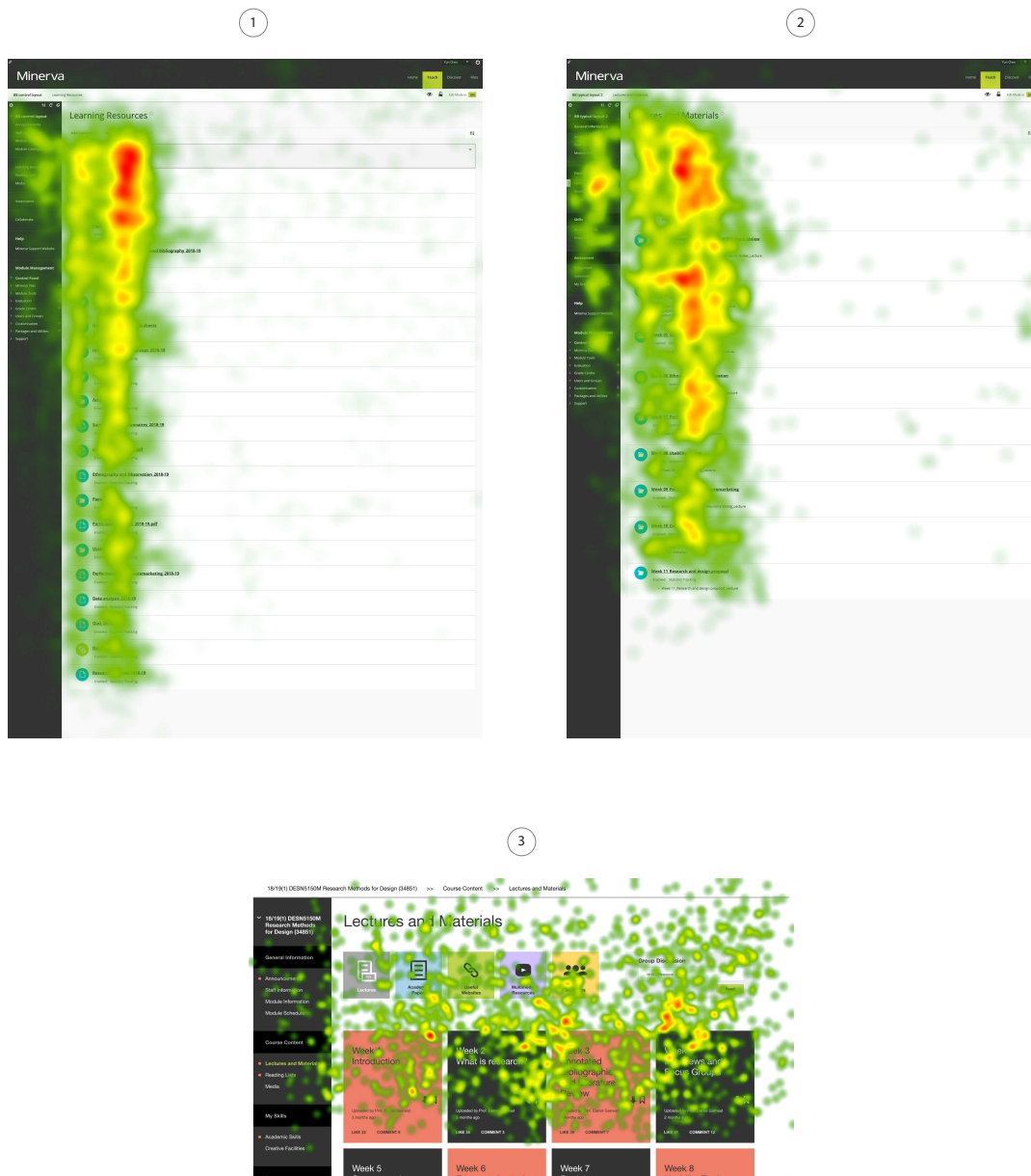


Figure 12. Heat map comparison for the three layouts using Task 4 (find the lecture for week 7) as an example. Data for all 30 participants included: 1) Typical Layout; 2) Re-Designed Layout; 3) Ideal Layout.

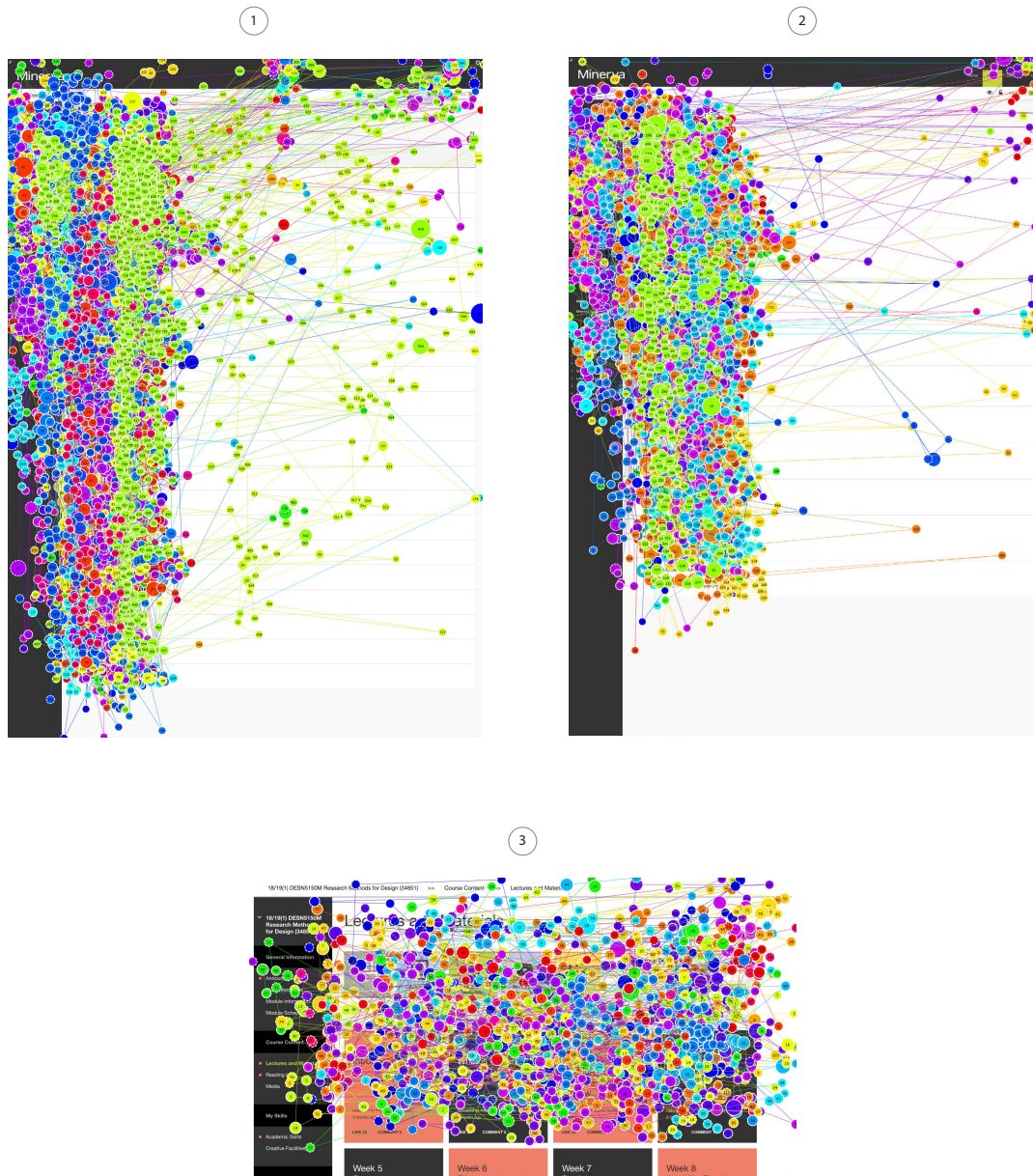


Figure 13. Gaze plots comparison for the three layouts using Task 4 (find the lecture for week 7) as an example. Data for all 30 participants included: 1) Typical Layout; 2) Re-Designed Layout; 3) Ideal Layout.

4.4. Opinion results

Participant opinion is extremely important in a user-centered research and design process, because it helps validate the quantitative data further and it also helps understand in more detail where and why participants struggled (or not) to find the information. It also gives additional data in terms of design choices that in turn validate the findings from Stage 1 of the research process and Stage 2 of the design development. With this aim in mind, after completing all performance tasks, participants were asked to give their opinion about the layout they used in terms of: organization of information; distinction of functions; description of content; color scheme; and icons.

As shown in Table 3, the majority of participants from Group 1 did not agree that the Typical Layout had: well organized and clear information (83%); enough distinction and clarity between the names of the different functions (87%); descriptions of the content in each file that were useful to help find what was needed (93%); a clear color scheme (70%); a set of icons capable of communicating clearly what they represent (83%). Participants also disagreed that overall, the design of the module with the Typical Layout was effective (83%).

Compared with Group 1 (Typical Layout), less participants in Group 2 (Redesigned Layout) chose 'Neutral' and the choice of 'Agree' increased from as little as 7% to as much as 77%. In Group 3 (Ideal Layout), the choice 'Disagree' dropped significantly to as little as 3% in most cases, while in contrast the choice 'Agree' increased to as high as 90% in some cases.

These results in Table 3 further confirm that the Redesigned Layout is more efficient at communicating information and supporting learning experience on the VLE than the Typical Layout. It also further confirms that the Ideal Layout is more efficient than both the Typical Layout and the Redesigned Layout. When asked which Minerva homepage the participant preferred, 97% of participants from Group 3 chose the Ideal Layout. All these results are also supported by participants' feedback during the performance test (Table 4 right-hand column). Table 4 (left-hand column) also includes the feedback given by participants on the design of the different layouts during Stage 1 and 2, to see how the feedback was similar throughout the entire research and design process followed in this study.

	TYPICAL LAYOUT				REDESIGNED LAYOUT				IDEAL LAYOUT			
	N	Agree	Neutral	Disagree	N	Agree	Neutral	Disagree	N	Agree	Neutral	Disagree
Q1 Information organization	30	17%	17%	66%	30	67%	10%	23%	30	77%	20%	3%
Q2 Distinction	30	13%	27%	60%	30	77%	10%	13%	30	74%	23%	3%
Q3 Written description	30	7%	33%	60%	30	77%	6%	17%	30	90%	0%	10%
Q4 Color scheme	30	30%	23%	47%	30	64%	13%	23%	30	87%	10%	3%
Q5 Icons	30	17%	17%	66%	30	60%	20%	20%	30	84%	13%	3%
Q6 Effectiveness	30	17%	17%	66%	30	70%	7%	23%	30	80%	13%	7%
Question 1. The information organised on this module is clear. Question 2. There is enough distinction and clarity between the names of the different functions. Question 3. Written descriptions of the content in each file is useful to help find what you need. Question 4. The colour scheme used on this module is clear. Question 5. The icons used on this module are clear at communicating what they represent. Question 6. Overall the design of this module is effective												

Table 3. Participants opinion on organization of information; distinction of functions; description of content; color scheme; and icons

	BEFORE PERFORMANCE TEST	AFTER PERFORMANCE TEST
Typical Layout	<ul style="list-style-type: none"> • Poorly organized and there are multiple overlaps. • Some icons are quite similar and it is difficult to distinguish them. • It is difficult to find some specific functions; the classification is not clear enough. • The order of information is not clear and and it is not structured in a way that allows you to intuitively find your way around. 	<ul style="list-style-type: none"> • Icons help to me to somehow find the exact information, but the organization is a bit confusing. • Not user friendly. • The color scheme could be more attractive. • It is completely disorganized and I really dislike using it. It feels like there has been absolutely no thought to how a user would interact with the website.
Redesigned Layout	<ul style="list-style-type: none"> • Much better than the previous design. • Although information is distinguished by specific icons, it would be better to use items with more detail and that can illustrate the information content better. The use of the same color palette as in the existing design does not help to identify the information very well. • Only two colors are used and some parts need to be highlighted. 	<ul style="list-style-type: none"> • The main menu is clear and easy to use. • In the menu, the white font on a darker background color for the title of the main sections, makes it easy to distinguish the corresponding sub-sections. • The description for each folder helps me to identify the content in that folder and saves me time when looking for something specific. • It is quick and easy to find the documents and material.
Ideal Layout	<ul style="list-style-type: none"> • Information is clear and easy to find. • Information is easy to find and the color scheme is nice and easy on the eyes. • Icons are simple and easy to understand. 	<ul style="list-style-type: none"> • Colors are generally easier to see than text, but the text in large font helps to identify the content of the information. • Descriptions of the content are easy to understand. • Generally convenient, but some sections have too many parts. • Useful information as it is large and easy to find.
Ideal Layout Minerva page	<ul style="list-style-type: none"> • There is a calendar in the new design and it seems clearer and cleaner. • The layout is clearer and more informative. • The arrangement and clarity of the page is much better than the original. The original layout presents information in a rather chaotic way. 	

Table 4. Participants general feedback before and after the performance test.

5. Information design guidance for courses on a VLE

The findings from this user-centered research study, together with well-established principles and guidelines of information design, are compiled in this section. This guidance aims to assist educators with the design of course modules in a VLE platform. It should contribute to the success of the learning and teaching process by enabling tutors to provide well-designed information for students and to enhance student engagement with the learning materials, which in turn will contribute to the success of their studies.

To avoid repetition of sources, all the sources used to identify these guidelines are listed here as follows: Moore and Fitz, 1993; Conrad, 2002; Lidwell et al., 2003; Knafllic, 2015; Muilenburg and Berge, 2005; Koyani et al. 2006; Visocky O’Grady, 2008; Pettersson, 2010; Hazlett et al., 2013; Norman, 2013; Jansen, 2014; Lonsdale, 2014; Peters, 2014; Dirksen, 2016; Pettersson and Avgerinou, 2016; Dyson and Beier, 2016; Gibeault, 2018; Lonsdale et al., 2018; Maybee et al., 2018; Lonsdale and Lonsdale, 2019; Lonsdale et al., 2019.

5.1. How to design the main menu?

Guidelines:

- Choose accurate and clear labels.
- Use categories to clearly divide the menu.
- Use design features to establish a hierarchy.
- Use a capital for the first letter of each label.
- Simplify the menu by removing unnecessary or overlapping sections.
- Avoid leaving empty sections.
- Avoid changing the default order of the main sections.

Rationale:

In order to allow easy access to the information in each section of the VLE, it is important to design a clear and simple navigation menu. This can be achieved by applying clear information design principles and guidelines. Based on results from this research study, students find the current menu too complex and with too many items. Therefore, the menu should be simplified by categorising its sections based on their function. Design features should also be used to establish a hierarchy with categories and sub-categories (e.g., background color of black for main category versus grey for sub-categories). This should also contribute to reducing the cognitive load of information. Furthermore, the results from this research also show that students believe that the module catalogue is unnecessary, and it should be removed. Similarly, students have reported that they become confused when empty sections are left in the menu. Therefore, module tutors should not keep sections unless they have a specific purpose.

5.2. How to design an announcement?

Guidelines:

- Use announcements purposefully.
- Use fonts and color consistently.
- Use a legible type size (10-, 11-, and 12- point).
- Highlight key words using bold.
- Provide enough information to make sure the announcement is clear.
- Use bullet points where suitable to make the announcement more legible to the reader.

Rationale:

To make it more accessible for the reader, it is more effective to apply a single font for all the announcements. Also, bold and/or color could be used sparingly to emphasise important information. In terms of number of announcements, the results of this study show that students tend to ignore reading all the information when a tutor uploads too many announcements. Therefore, module tutors should try not to overuse it, and use bullet points and short sentences instead of long sentences.

5.3. How to design the staff information page?

Guidelines:

- Provide detailed information (Email; Work phone; Office location; Office hours) about yourself.
- Provide the same detailed information if there are other tutors and/or guest tutors.
- Make sure to add a professional photo of yourself and other tutors.
- Ideally, provide information about your field of expertise and research or scholarship projects.

Rationale:

Based on the results of our research, a number of students expressed a wish for the module tutor to provide their contact details such as: email address, work phone, office location and office hours, resulting in more effective communication. In this case, when students have questions, they can find this information quickly without having to access the School/Department webpage to find the staff page and their contact information. Also, adding a professional photo with detailed information about your research or scholarship was found to be helpful for students, and it could also increase their engagement with the course being taught.

5.4. How to design the module information page?

Guidelines:

- Place the module handbook and a separate module schedule here.
- The handbook should be in pdf format.
- Module handbook and module schedule should be well-designed.

Rationale:

Based on the results of our research, 84% students usually log in to Blackboard VLE to check the handbook, and some students report that locating the module handbook could be a frustrating and difficult task due to the lack of consistency as different tutors tend to place the handbook in different places. It would be more straightforward to place the module handbook in a place where students would expect to find it. According to our findings, students expect to find the handbook in the module information section. In terms of file, pdf format is advisable as it avoids content moving out of place if students do not have the same fonts as the ones used in the document. But, most importantly, the handbook should be well designed and aim for 100% accessibility in the way information is structured.

5.5. How to design the learning resources page?

Guidelines:

- Update recycled materials before uploading them to the VLE.

- Structure lectures thematically and chronologically by folders.
- Label folders by week numbers and the theme of the lecture.
- Provide a brief description of each folder content in bullet points if needed.

Rationale:

The results from our research show that structuring the learning materials thematically and chronologically by folders is the best design practice to organize information on the VLE. Hence, the clear labelling of folders is essential to help students locate information easily. Furthermore, adding a brief description of the content will provide students with enough information without having to open the folder themselves, which in terms reduces the number of clicks and the time needed to get to the information.

5.6. How to design the assignment page?

Guidelines:

- Have a different folder for each assignment.
- Label folders with the name of the assignment.
- Add a brief description of the assignment and use bullet points if needed.
- Emphasise important information by using bold or highlighted text.
- In each folder it is important to include:
 - Assignment instructions;
 - Examples from last year (if useful);
 - Marking criteria;

Rationale:

The results from the student interviews indicate that 94% of students believe that having a description of the content in each folder is helpful for them to find the information. Also, 90% of students think that highlighting key words in the description could make locating information more effective. This is of great importance when it comes to assignments, because it is where students always have more doubts and want to be absolutely sure that they are completing the assignment as requested and by the right deadline. Therefore, adding a brief description to each assignment folder and emphasising key information (deadline, key instructions, etc.) is very helpful and reassuring to students.

6. Discussion and Conclusion

Difficulties and challenges in using the VLE as an effective teaching and learning tool have existed since its origin. Problems with information accessibility and visual presentation were identified as early as 2006 by Dyson et al. However, not enough attention has been drawn to this issue and the same problems still exist. Until the Covid-19 pandemic, VLEs have been used more as

repositories and optional supporting tools. However, with Covid-19 hitting higher education institutions across the world, online teaching and learning environments are no longer an option but a real need. Moreover, the many benefits of online delivery of teaching and learning have been finally brought to the surface out of need, and now adopted and valued by educators and students alike. To adapt to a new and dominant online delivery, institutions have put in place training and ongoing IT support, also looking at best practice in using the technology and developing activities. Challenges still exist, however, for both educators and students, with frustration now less likely to be caused by uncertainty on how to use the VLE platform to teach and learn; but more likely to be connected to the way Information on the VLE is designed, available and communicated to our generation of students.

With a lack of research and guidance on how information design can enhance accessibility of course material in VLEs, the present study helps to fill in that gap. The findings of this study have helped to produce easy to follow research-based guidance on how to best design, organize and communicate information to students on the VLE to facilitate accessibility and prevent cognitive overload. To this end, the Redesigned Layout developed and tested in our study can serve as an example of good practice for situations where VLE platforms are limited in what they can offer in terms of information visualization and interactivity, while still enabling good organization and communication of information. These findings are more directly relevant to educators, as they focus solely on good organization of information using available platform tools. The Ideal Layout, on the other hand, can serve as an example of how VLEs can be further explored in terms of interactive design and visual presentation for optimum student learning experience and engagement, and consequently enhance student performance and success with their studies. These findings are of great relevance to LMS developers and higher education institutions, as well other educational institutions using Minerva or Blackboard VLE platforms or sister platforms.

The results from the performance testing and eye-tracking measurement clearly show that performance (measured by time and accuracy) was significantly better with the Redesigned Layout than with the Typical Layout, and performance was also significantly better with the Ideal Layout than with both the Typical Layout and the Redesigned Layout. Participants' opinion also reflected this same trend. Participants commented that information was clear and easy to navigate with the Redesigned and Ideal Layout and the design was also more attractive and engaging with the ideal layout. With the Typical Layout, participants felt that information was presented in a chaotic and overwhelming manner, with accuracy dropping and the time needed to find the information increasing.

This study also shows that data for all stages of the design and research process is similar, which increases the reliability of the findings. Moreover, having tested new students and a high percentage being international students, means that a design solution was successfully developed for those who might encounter more difficulties using a VLE and studying in an educational system that is new to them. Therefore, if a design solution is successful at this level, it is capable of meeting the needs of the majority of users.

Another contribution that this research study makes is to provide a well-constructed methodology where students themselves are co-creators of education having acted as researchers, designers, end users and participants. The solutions presented in this study for a more efficient and engaging VLE capable of enhancing user experience were investigated, developed and tested by students, with students and for students as the ultimate end user. To achieve an optimum result, the research and design process framework included three core stages, as many as 8 different research methods (with 6 being user-centered) and over 170 participants (with over 130 being students). In Stage 1 – Identification – literature was reviewed; 55 modules were surveyed; 31 tutors completed a detailed online questionnaire with 51 questions; 31 students were interviewed; and 7 students representing all levels were part of a co-design session. In Stage 2 – Integration and Development – design solutions were developed based on the findings of Stage 1, and usability testing and iteration was conducted. In Stage 3 – Evaluation and Validation – final outputs were tested for comparison in terms of performance measured by time to complete the task of finding information and the accuracy of the information found. Qualitative data was also gathered to reinforce the quantitative data and to understand in more depth what actually works and does not work for students in a VLE platform.

This research study has therefore validated that student performance, experience, engagement and satisfaction improve when VLE modules are well designed following research-based information design guidelines. That is, such guidelines should be informed by user-centered research involving students from start to finish of the research and design process, i.e., place students as co-creators of education. Moreover, understandably tutors in higher education institutions are very busy juggling the many responsibilities they have beyond teaching (research, admin, knowledge transfer, etc.). It is therefore vital that higher education institutions invest in setting up platforms and ready-made templates informed by these guidelines. It is by facilitating the use and application of best information design practice that both tutors and students will benefit from a conducive environment for teaching and learning excellence. Lastly, creativity and good practice should not be limited nor dictated by technology. Technology should enable and nurture creativity and good practice, and ways around any limitations should be pursued.

Overall, this study gives clear evidence of the power of information design in enhancing accessibility of course material in VLEs.

References

- Abbad, M. M. and M. Albarghouthi. 2011. Evaluate Students' Perceptions of the Virtual Learning Environment at Paisley University. *International Journal of Emerging Technologies in Learning (IJET)*. 6 (3), pp.28–34.
- Al-Badowi, A. 2010. *The Design of E-learning Services on Blackboard*. IEEE. pp.186-193.
- Blackboard United Kingdom. 2019. *Blackboard for Higher Education*.
- Bodemer, D., Ploetzner, R. Feuerlein, I. and Spada, H. 2004. The active integration of information during learning with dynamic and interactive visualisations. *Learning and Instruction*. 14(3), pp.325-341.

- Bursi-Amba, A., Gaullier, A. and Santidrian, M. 2016. *Infographics: A toolbox for technical writers?* Paris: Diderot University.
- Conrad, D. L. 2002. Engagement, Excitement, Anxiety, and Fear: Learners' Experiences of Starting an Online Course. *The American Journal of Distance Education*. 16(4), pp.205-226.
- Dirksen, J. 2016. *Design for how people learn*. Berkeley, Calif: New Riders.
- D'Silva, R. and Reeder, K. 2005. Factors that influence faculty members' uptake and continued use of course management systems. *British Journal of Educational Technology*. 36(6), pp.1071-1073.
- Dyson, M. and Beier, S. 2016. Investigating typographic differentiation. *Information Design Journal*. 22(1), pp.3-18.
- Dyson, M., Lonsdale, M., Papaefthimiou, M. 2006. Student perspectives on a Virtual Learning Environment: lessons for instructors. Proceedings of the First Annual Blended Learning Unit's Conference: *Blended Learning – Promoting Dialogue in Innovation and Practice*.
- Gibeault, M. 2018. Organization of Materials and Accessing the Library in Blackboard: A Learner-centered Usability Study. *The Journal of Academic Librarianship*. 44(2), pp.190-195.
- Green, M. S., Weaver, M., Voegeli, D., Fitzsimmons, D., Knowles, J., Harrison, M. and Shephard, K. 2006. The development and evaluation of the use of a virtual learning environment (Blackboard 5) to support the learning of pre-qualifying nursing students undertaking a human anatomy and physiology module. *Nurse Education Today*. 26(5), pp.388-395.
- Grunwald, T. and Corsbie-Massay, C. 2006. Guidelines for Cognitively Efficient Multimedia Learning Tools: Educational Strategies, Cognitive Load, and Interface Design. *Academic Medicine*. 81(3), pp.213-223.
- Hanrahan, S., de Pietro, P., Brown, L.H., Haw, A., Malins, J., Milojevic, M., Raevaara, M., Sonvilla, B. and Weckman, J.K. 2009. Interface: Virtual Environments in Art, Design and Education: A report on a conference exploring VLEs in art and design education. *Arts and Humanities in Higher Education*. 8(1), pp.99-128.
- Hazlett, R. L., Larson, K., Shaikh, A. D. and Chaparro, C. B. 2013. Two studies on how a typeface congruent with content can enhance onscreen communication. *Information Design Journal*. 20(3), pp. 207--219.
- Istrate, O. 2009. Visual and pedagogical design of eLearning content. Centre for Innovation in Education. *E-Learning papers*. 17, pp.1-12.
- Jansen, F. 2014. How bulleted lists and enumerations in formatted paragraphs affect recall and evaluation of functional text. *Information Design Journal*. 21(2), pp. 146--162.
- Khlaisang, J. and Songkram, N. 2019. Designing a Virtual Learning Environment System for Teaching Twenty-First Century Skills to Higher Education Students I ASEAN.(Report). *Technology, Knowledge and Learning*. 24(1), p.41.
- Knaflic, C. N. 2015. *Storytelling with data: A data visualization guide for business professionals*. Hoboken, New Jersey: John Wiley & Sons, Inc.
- Koyani, et al. 2006. *Research-Based Web Design & Usability Guidelines*. Washington, D. C.: U.S. Department of Health and Human Services.
- Kuzu, E. B. and Ceyla, B. 2010. Typographic properties of online learning environments for adults. *Procedia Social and Behavioral Sciences*. 9, pp.879–883.

- Lapowsky, I. 2015. The Reeducation of Blackboard, Everyone's Classroom Pariah. *Wired* [Online]. [Accessed 27 December 2021]. Available from: <https://www.wired.com/2015/07/blackboard-reinvention/>
- Lee, K.H. and Kim, D.Y. 2014. A Study of Students' Perceptions of Course Management Systems in Hospitality Programs: A Case of Blackboard System in the United States. *Journal of Hospitality & Tourism Education*. 26(2), pp.45-54.
- Lester, P. M. 2006. *Syntactic Theory of Visual Communication*. California State University at Fullerton.
- Liaw, S.S. 2008. Investigating students' perceived satisfaction, behavioral intention, and effectiveness of e-learning: A case study of Blackboard system. *Computers & Education*. 51(2), pp.864-873.
- Lidwell, W., Holden, K. and Butler, J. 2003. *Universal principles of design*. Gloucester: Rockport.
- Lonsdale, M. dS. 2014. Typographic features of text: Outcomes from research and practice. *Visible Language*. 48(3), pp.29-67.
- Lonsdale, M., Lonsdale, D. J., Baxter, M., Graham, R., Kanafani, A. Li, A. and Peng, C. 2019. Visualising the terror threat: The impact of communicating security information to the general public using infographics and motion graphics. *Visible Language*. 53(2), pp.36-71.
- Lonsdale M. dS. and Lonsdale D. J. 2019. *Design2Inform: Information visualisation*. The Office of the Chief Scientific Advisor, Gov UK.
- Lonsdale, M. dS., Lonsdale, D. J. and Lim, H. 2018. The impact of neglecting user-centered information design principles when delivering online information: Cyber security awareness websites as a case study. *Information Design Journal*. 24(2), pp.151-177.
- Limniou, M., M. 2010. Teachers' and students' perspectives on teaching and learning through virtual learning environments. *European Journal of Engineering Education*, 35(6), pp.645-653.
- Maybee, C., Bruce, C., Lupton, M. and Pang, M. 2019. Informed learning design: Teaching and learning through engagement with information. *Higher Education Research & Development*, 38(3), pp.579-583.
- McAvinia, C. 2016. *Online Learning and Its Users: Lessons for Higher Education*. London: Elsevier.
- Moore, P. and Fitz, C. 1993. Gestalt theory and instructional design. *Journal of Technical Writing and Communication*, 23(2), pp.137-157.
- Muilenburg, L. and Berge, Z. 2005. Student barriers to online learning: A factor analytic study. *Distance Education*. 26(1), pp.29-48.
- Norman, D. 2013. *The Design of Everyday Things*. Massachusetts: MIT Press.
- Oakman, H. 2016. The next generation VLE. *Educational Technology*, [Online]. [Accessed 28 December 2021]. Available from: <https://edtechnology.co.uk/latest-news/the-next-generation-vle/>
- Parsons, A. 2017. Accessibility and use of VLEs by students in further education. *Research in Post-Compulsory Education*. 22(2), pp.271-288.
- Peng, J. Tan, W. and Liu, G. 2015. Virtual Experiment in distance education: based on 3D virtual learning environment. *2015 International conference of educational innovation through technology (EITT)*. pp.81-84.
- Peters, D. 2014. *Interface design for learning: design strategies for learning experiences*. Pearson Education.

- Pettersson, R. 2010. Information Design – Principles and Guidelines. *Journal of Visual Literacy*. 29(2), pp.167-182.
- Pettersson, R. and Avgerinou, M. D. 2016. Information Design with Teaching and Learning in Mind. *Journal of Visual Literacy*. 35(4), pp.253-267.
- Reiser, R. 1994. Clark's invitation to the dance: An instructional Designer's response. *Educational Technology Research and Development*. 42(2), pp.45-48.
- Richardson, R. T., Drexler, T. L. and Delparte, D. M. 2014. Color and Contrast in E-Learning Design: A Review of the Literature and Recommendations for Instructional Designers and Web Developers. *MERLOT Journal of Online Learning and Teaching*. 10(4), pp.657-670.
- Rogers, P. L. 2000. Barriers to adopting emerging technologies in education. *Journal of Computing Research*. 22(4), pp.455-472.
- Schlegel, E. 2020. Designing Online Courses: 12 Tips for Health Professions Educators. *MedEdPublish*. pp.1-11
- Simoni, M. 2011. Using Tablet PCs and Interactive Software in IC Design Courses to Improve Learning. *IEEE Transactions on Education*. 54(2), pp.216-221.
- Spinuzzi, C. 2005. The Methodology of Participatory Design. *Technical Communication*. 52(2), pp.163-174.
- Stoney, S. and Wild, M. 2008. Motivation and Interface Design: Maximising Learning Opportunities. *Journal of Computer Assisted Learning*. 14(1), pp.40-50.
- Umoru, T. A. 2012. Barriers to the Use of Information and Communication Technologies in Teaching and Learning Business Education. *American Journal of Business Education*. 5(5), pp.575-580.
- Visocky O'Grady, J. and Visocky O'Grady, K. 2008. *The Information Design Handbook*. Cincinnati, Ohio: How Books.
- Wongpornprateep, P. and Boonmoh, A. 2019. Students' Perceptions towards the Use of VLE in a Fundamental English Course: A review of Smart Choice Online Practice and Smart Choice on the Move. *Journal of Studies in the English Language (JSEL)*. 14(2), pp. 91-131.

Appendices

Appendix 1 | Typical Layout – Learning Resources page

Appendix 2 | Re-designed Layout – Lectures and Materials

Minerva

HomeTeachDiscoverFiles

Yun Chan

BB typical layout 2Lectures and Materials

BB typical layout 2

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Minerva Support Website

Module Management

Control Panel

Minerva Files

Module Tools

Evaluation

Grade Centre

Users and Groups

Customisation

Packages and Utilities

Support

Lectures and Materials

Add ContentAssessmentsTools

Week 01 Introduction

Enabled: Statistics Tracking

Week 01_Introduction_Lecture

Week 02 What is research?

Enabled: Statistics Tracking

Week 02_What is research_Lecture

Books

Useful Websites

Week 03 Annotated bibliography and literature review

Enabled: Statistics Tracking

Week 03_Annotated bibliography and literature review_Lecture

Academic Papers

Multimedia

Harvard referencing crib sheets

Week 04 Interviews and focus groups

Enabled: Statistics Tracking

Week 04_Interviews and focus groups_Lecture

Academic Papers

Activities

Week 05 Surveys and questionnaires

Enabled: Statistics Tracking

Week 05_Surveys and questionnaires_Lecture

Activities

Week 06 Ethnography and observation

Enabled: Statistics Tracking

Week 06_Ethnography and observation_Lecture

Academic Papers

Week 07 Participatory design

Enabled: Statistics Tracking

Week 07_Participatory design_Lecture

Week 08 Usability testing

Enabled: Statistics Tracking

Week 08_Usability testing_Lecture

Week 09 Performance test Neuromarketing

Enabled: Statistics Tracking

Week 09_Performance test_Neuromarketing_Lecture

Week 10 Data analysis

Enabled: Statistics Tracking

Week 10_Data analysis_Lecture

Activities

Useful Websites

Week 11 Research and design proposal

Enabled: Statistics Tracking

Week 11_Research and design proposal_Lecture

Appendix 3 | Ideal Layout – Minerva ‘Learn’ page

Minerva

Wednesday 6 May 2019 17:29 (Leeds, UK)

Learn

Modules

Organisation

Show 10 entries from

This year (18/19)

Search...

Year	Semester	Code	Module	Reading List	Assignment	Avail
18/19 (2)	Semester 2	DESN1989	Design for Textiles			✓
18/19 (2)	Semester 2	DESN5155M	Information and Instructional Design			✓
18/19 (2)	Semester 2	DESN5154M	Design Research and Integration			✓
18/19 (1)	Semester 1	DESN5153M	Design Principles and Application			✓
18/19 (1)	Semester 1	DESN5152M	Design Thinking			✓
18/19 (1)	Semester 1	DESN5150M	Research Methods for Design			✓
18/19 (1)	Semester 1	DESN5109M	Digital Design Practice			✓

May 2019

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			01	02	03	04
05	06	07	08	09	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

16 May

21 May

Submission of APP Design Portfolio

Submission of Sketch Book

Library

My Account

Library

Due

Graphic Design Process	Laidlaw Library	17 June 2019
Sustainable Package Design	Brotherton Library	21 July 2019

Quick search...

Advanced Search

Help

Brotherton Library

Sun - Mon 08:00 - 19:00

Book a room

Laidlaw Library

Sun - Mon 08:00 - 24:00

Book a room

Edward Boyle

Sun - Mon 08:00 - 24:00

Health Science

Sun - Mon 08:00 - 15:00

St Jame's

Sun - Mon 08:00 - 15:00

Schedule

10:00 am - Digital Design Lecture

12:00 pm

G32 Clothworkers Central Building

15:00 pm - Group Discussion

16:00 pm

Student's Common Room

16:30 pm - Badminton Competition

19:00 pm

The Edge

20:30 pm - Webinar: How to make illustrations in Photoshop

21:30 pm

Online Forum

22:00 pm - Send workshop information to Lina

22:05 pm

Email

IT Services

Search...

My Print

Connection

IT Support

Desktop Anywhere

Software

Safety

Study Support

Leeds for Life

Skills@Library

Minerva Help

Student Reps

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eAssessment Survival Guide

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Changing Modules

Changing Programme

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Campus Map

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Events

f

t

in

YouTube

Instagram

Appendix 4 | Ideal Layout – Homepage

Minerva

HomeLearnDiscover

18/19(1) DESN5150M Research Methods for Design (34851)

18/19(1) DESN5150M
Research Methods
for Design (34851)

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Date	From	Subject
28JUN2019	Sarah Drew	Summer Opening Hours
27JUN2019	Sabine Agace	OPPORTUNITY: The Leeds Human Rights Journal
07JUN2019	Daniel Garnest	Next supervision: 14th June and Materials
05JUN2019	John Davidson	Year in Industry Talks

View all

Recent Visits

PDF

Week 00 Lecture:
Performance Test
Neuromarketing

Video

Getting Started in
Screen Printing - How
It Works and More!

Document

Methodological issues
in research into web
design features

Link

Library Skills: Leeds
Harvard Referencing
Examples

To-Do List

☒ Download lecture from last week

☐ Set up an appointment with
Dr. Thomason

☐ Go to library to pick up
Digital Design Solutions

☐ Finish reading papers before next
class on Thursday

☐ Go to PC Clusters to check Adobe
Creative Cloud availability for
students

🕒 +

27

Days until

Submission of
Annotated Bibliography
on 4th December

View Assignment

Reading List
25% Finished

Keep It Up

Appendix 5 | Ideal Layout – Staff Information

Minerva

HomeLearnDiscover

18/19(1) DESN5150M Research Methods for Design (34851) >> General Information >> Staff Information

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Staff Information



Dr. Emma Wilmann
Guest Lecturer


Senior Director at Society of Dyers and Colourists



Prof. Daniel Garnest
Senior Lecturer
Programme Leader of MA Design


Email: d.garnest@leeds.ac.uk
Work Phone: +44 (0)7627 699003
Office Location: L2-152, Link Building
Office Hour: 9:00am – 14:00pm on Monday and Thursday

[Contact](#)




Tim Becker
Assistant Lecturer


Email: t.becker@leeds.ac.uk




Online Profile



Research and Publication



Personal Website



Ongoing Research Projects

Appendix 6 | Ideal Layout – Module Schedule

Minerva

HomeLearnDiscover

18/19(1) DESN5150M Research Methods for Design (34851) >> General Information >> Module Schedule

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Module Schedule

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
26	27 1:00 pm Lecture	28	29	30	31 3:00 pm Year In Industry Talk	1 May
2	3	4	5 9:00 am Individual Supervision	6	7	8
9	10 1:00 pm Lecture	11	12	13	14	15
16	17	18 9:00 am Individual Supervision	19	20	21	22
23	24	25	26	27 2:00 pm Portfolio Submission	28	29

Appendix 7 | Ideal Layout – Reading Lists

Minerva

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18/19(1) DESN5150M Research Methods for Design (34851) >> Course Content >> Reading Lists

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Research Methods for Design (34851)

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Reading Lists




Research Design (5th ed) 

John W. Creswell, J. David Creswell
London: Sage Publications


LIKE 160 COMMENT 58




Digital Textile Design 

Melanie Bowles, Ceri Isaac
London: Laurence King Publishing


LIKE 72 COMMENT 49




Textile Nature 

Anne Kelly
London: Batsford Ltd


LIKE 216 COMMENT 55




Practice-based Design Research 

Laurens Vaughan
London: Bloomsbury Visual Arts


LIKE 27 COMMENT 16




Research Design 

Patricia Leavy
New York: Guilford Press


LIKE 63 COMMENT 8



Digital Design Essentials 

Raj Lal
Beverly: Rockport Publishers

LIKE 67 COMMENT 34



Check the Library

Research Design (5th ed)

Author: Creswell, J. and Creswell, J. D.
Edition: 5th
Published: Sage Publications
Year: 2019

Location:
Brotherton West Floor 2

Shelf mark:
Textiles F-1 LAN

Loan:
Standard

Status:
Available

Reserve the Item

Appendix 8 | Ideal Layout – Lectures and Materials

Minerva

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Lectures

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Useful Websites

Multimedia Resources


Activities



What is user research?

An academic definition from the Interaction Design Foundation


LIKE 22 COMMENT 16



Examples of Annotated Bibliographies for Design

Uploaded by Prof. Daniel Garment 9 hours ago


LIKE 22 COMMENT 6



Activity

Focus Group Questions

LIKE 9 COMMENT 0



Service Manual

Understand User Needs: Plan Research, Prepare for Sessions, Share and Analyse Findings

LIKE 12 COMMENT 5

Group Discussion

Write a Response...

Send

Linda Grace 7h ago

Hello, Does anyone have access to Research Gate? I need to download a paper from Dr. Thomason. Thanks!

↩ ☆

Ruby Debroe 3h ago

Who knows how to use Adobe XD to add animation effects or insert a gif picture? I dragged a gif in XD but it's

↩ ☆

View more

Appendix 9 | Ideal Layout – Lectures and Materials: Lectures

Minerva

HomeLearnDiscover

18/19(1) DESN5150M Research Methods for Design (34851) >> Course Content >> Lectures and Materials

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Lectures and Materials

Lectures

Academic Papers

Useful Websites

Multimedia Resources

Activities

Group Discussion

Week 1
Introduction

Uploaded by Prof. Daniel Garneat
3 months ago

LIKE 22 COMMENT 6

Week 2
What is research?

Uploaded by Prof. Daniel Garneat
3 months ago

LIKE 35 COMMENT 3

Week 3
Annotated Bibliographies and Literature Review

Uploaded by Prof. Daniel Garneat
2 months ago

LIKE 39 COMMENT 7

Week 4
Interviews and Focus Groups

Uploaded by Prof. Daniel Garneat
2 months ago

LIKE 41 COMMENT 12

Week 5
Surveys and Questionnaire

Uploaded by Prof. Daniel Garneat
2 months ago

LIKE 28 COMMENT 7

Week 6
Ethnography and Observation

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Week 7
Participatory Design

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Week 8
Usability Testing

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Data Analysis

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Week 11
Research and Design Proposal

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Appendix 10 | Ideal Layout – Lectures and Materials: Academic Papers

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Week 2
Methodological issues in research into web design features

↓

↑

Uploaded by Prof. Daniel Garneal
3 months ago

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Week 3
Example of literature review for design

↓

↑

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Week 3
Examples of annotated bibliographies for design

↓

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Week 4
A practical guide to focus group research

↓

↑

Uploaded by Prof. Daniel Garneal
2 months ago

LIKE 19 COMMENT 5

Week 4
Blackboard report

↓

↑

Uploaded by Prof. Daniel Garneal
2 months ago

LIKE 24 COMMENT 6

Week 4
How to conduct a focus group

↓

↑

Uploaded by Prof. Daniel Garneal
2 months ago

LIKE 13 COMMENT 8

Week 6
Strategy - Ethnographic and observation (O'grady)

↓

↑

Uploaded by Prof. Daniel Garneal
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Appendix 11 | Ideal Layout – Lectures and Materials: Useful Websites

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Week 2

How many test users in a usability study?

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Week 2

Human-centred design methods

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LIKE 36 COMMENT 12

Week 2

InfoDesign Archives

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Week 2

InfoDesign User Research

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Week 2

Quantitative vs. Qualitative Usability Testing

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Week 2

User research for government service: an introduction

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Week 2

User research service manual

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Week 2

What is user research?

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Week 2

When to use which user-experience research methods?

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Week 10

Data Viz Project

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Appendix 12 | Ideal Layout – Lectures and Materials: Multimedia Resources

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Week 3

Writing the literature review (part one)

Uploaded by Prof. Daniel Garner

2 months ago

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Week 3

Writing the literature review (part two)

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Appendix 13 | Ideal Layout – Lectures and Materials: Activities

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Week 4 Activity Focus Group Questions

Updated by Prof. Daniel Garneal 2 months ago

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Week 4 Activity Interview

Updated by Prof. Daniel Garneal 2 months ago

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Week 4 Activity Running a Focus Group

Updated by Prof. Daniel Garneal 2 months ago

LIKE 0 COMMENT 0

Week 5 Activity Questionnaire Exercise

Updated by Prof. Daniel Garneal 2 months ago

LIKE 0 COMMENT 0

Week 10 Activity Quiz

Updated by Prof. Daniel Garneal 2 weeks ago

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Appendix 14 | Ideal Layout – Academic Skills: Strengthen your academic work - Literature Searching

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From start to finish - The final chapter

Literature Searching Explained

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3 months ago

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Strategy to Search Information

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3 months ago

LIKE 28 COMMENT 2

Databases

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3 months ago

LIKE 15 COMMENT 6

Google Scholar

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3 months ago

LIKE 38 COMMENT 17