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OpenDesignStudio: virtual studio development over a decade

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Abstract:

This paper presents a case study on OpenDesignStudio (ODS), an online, virtual design studio used to support a Design and Innovation qualification at The Open University (UK). The case presents the main design and development iterations ODS over a period of nearly 15 years and presents recent usage data of large-scale student populations (3000+ students). As such it is one of the largest and longest online, distance design studios, representing a unique longitudinal study of Virtual Design Studio use. The case highlights the importance of learning design, social learning mechanisms, and induction into studio culture.

Keywords: *Virtual Design Studio; Online Design Studio; Studio Pedagogy; Alternative design studio;*

1 Introduction

Over the last 10 years, the development of a Virtual Design Studio (VDS) at the largest distance higher education institution in the UK has generated an interesting question: Can we create a distance design studio that, whilst different in terms of modes of learning design, student behaviour and use, could still be considered to embody the signature pedagogy of a 'traditional' design studio (Crowther, 2013)? And following from that, is the same tool adequate to support learning at different levels of study or even across different subjects?

Since the late 90's, scholars have written about the development and use of virtual design studios for education (Maher, M. L., & Simoff, 1999; Broadfoot and Bennett, 2003; Arvola and Artman, 2008; Robbie, D., & Zeeng, 2012). Many of the early virtual design studios were experimental and have long since ceased to exist (Lotz et al., 2015; Broadfoot and Bennett, 2003). Nowadays increasing numbers of virtual studios are used alongside physical design studios (Bradford, 1995; Richburg, 2013; Rodriguez et al., 2018; Elisa Navarro Morales and Londoño, 2018). Studios might be employed to teach a specific course, or to run collaborative projects with partner universities in distant countries (Nicole Schadewitz, 2009). Very few bespoke studios have been developed since the first few attempts and many of these were only used for short periods of time or have been replaced completely. In more recent years, the shift in focus has been towards peer and social aspects of studio pedagogy, aligned to the rise of social networking tools and services and their direct applicability to studio practices (Schadewitz and Zamenopoulos, 2009; Schnabel and Ham, 2012; Robbie, D., & Zeeng, 2012; McCarthy, 2013).

This case is unique in reporting the longitudinal development, over 15 years, of a bespoke virtual design studio for students who study design at a distance learning institution, The Open University (OU) in the UK. Studying at a distance offers few opportunities for face to face tuition and the student demographic can be very different to

traditional universities: students tend to be employed (and have less time for study) and the policy of open entry at the OU means there are higher percentages of students with particular learning support needs. OU design modules present and teach general design skills, processes, and behaviours rather than any specific subdiscipline of design and this is reflected in the mix of qualifications OU design students take. Students study modules, each of which is about a semester's worth of learning material (60 CAT/REF (UK) points of study) and three design modules can be completed as part of the OU Design and Innovation BSc/BA Qualification. The other modules studied come from a range of pathways, such as Business, Computing, Art History, Sustainability or Engineering (Lloyd, 2013).

There have been several papers on aspects of this studio (Holden, 2009; Hart et al., 2011; Jones and Lloyd, 2013; Lloyd, 2013; Lotz et al., 2015, 2018) but none has described the development of the studio in its entirety, the focus of this case study paper. The case follows the development of an online design studio tool called OpenDesignStudio (ODS) – from the creation of the studio to provide a safe environment for novice photographers to share and critique their work, to a tool used across a Design and Innovation Qualification and in over 20 modules in other disciplines across the University, used by tens of thousands of students. The case is built from observational and interview data, as well as statistical analyses of its use over several years. It attempts to summarise the decisions and learnings from developing the possibly largest virtual design studio in higher education.

2 The case: developing a virtual design studio at the Open University

OpenDesignStudio is part of a suite of learning tools developed for students studying at The Open University in the UK (OU). Lloyd (Lloyd, 2013) describes the OU's teaching model in which students study module material independently at a distance, consisting of readings, activities and assessments structured to support incremental learning. This is hosted on, or supported by, a Virtual Learning Environment (VLE). Figure 1 shows a collage of one of the main VLE student website, where learning tools and additional resources can be found. The materials are studied independently by the students at a distance. Learning is supported by tutors in small tutor groups (about 20 students) using a range of different communications and support systems in a model called Open Supported Learning (Ison, 2000). Tuition and support takes the form of asynchronous (written and audio) feedback on assignments, in tutorials, and peer-peer or peer-tutor interactions, as well as email, phone and other communications contact. Learning is also supported by a variety of other social, communication and collaboration tools, central to which is ODS, highlighted in Figure 1.

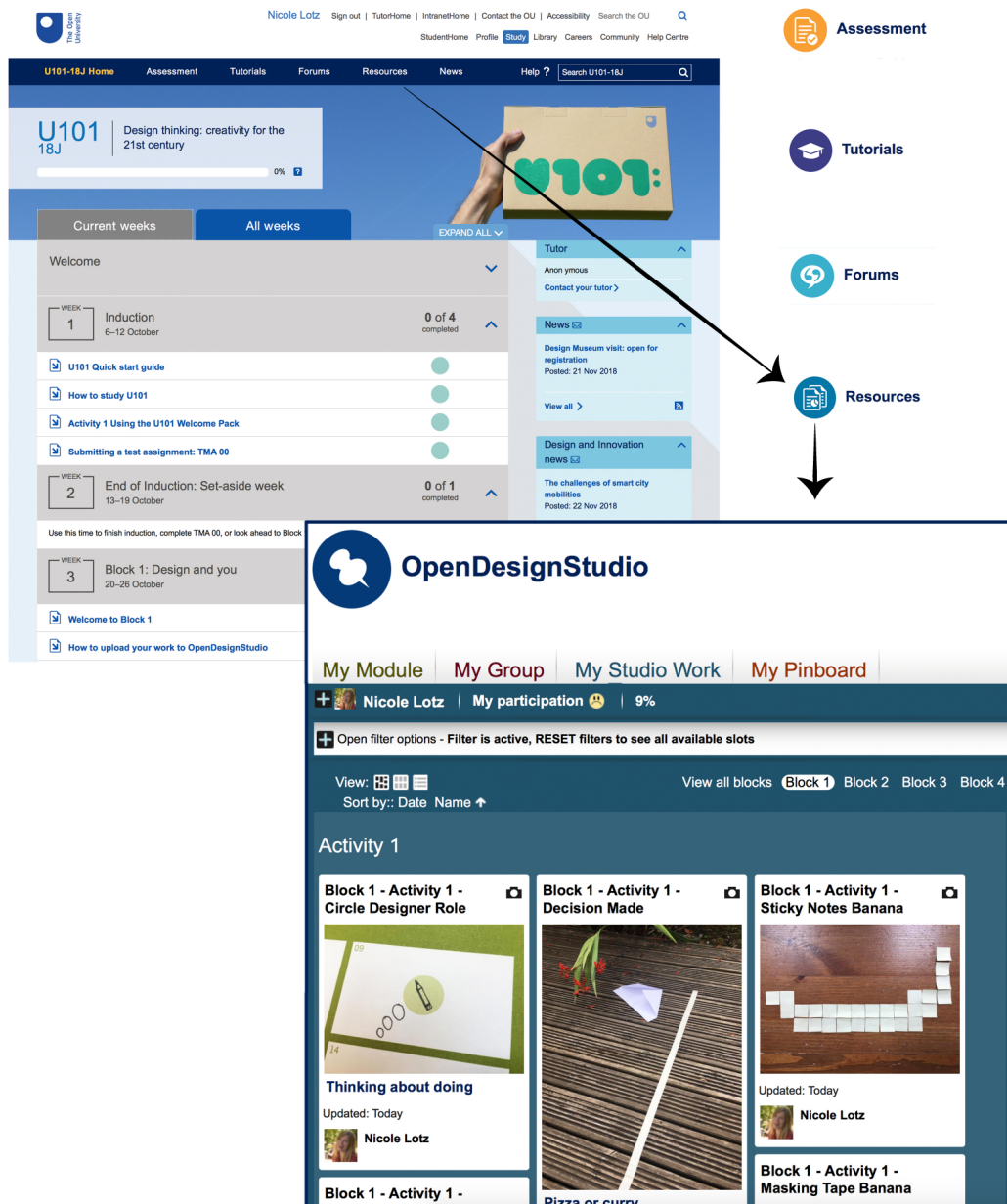


Figure 1 The Open University UK's Virtual Learning Environment showing a first level undergraduate Design Thinking module website, and its Virtual Design Studio called OpenDesignStudio

The 'traditional' studio has always been conceptualised as a hybrid spatial, pedagogical and social environment (Crowther, 2013). This is no different in distance design education – the OU's Virtual Learning Environment, OpenDesignStudio and the Supported Open Learning model, all contribute to what makes the studio at the OU.

The learning materials and bespoke tools, such as ODS, are designed by a team of academic and support staff over a period of years before use by students. A typical module designed in this way can be in use for about 8 years. User feedback, technologies, policies and practices do change over time which influences the decisions to adapt some of the learning designs and tools. Between 2010 and 2017, ODS underwent a series of changes, the learning from which is discussed in this case.

2.1 The first studio

OpenStudio was first developed along the lines of the original Flickr API in 2004, with the aim to develop an in-house social networking environment for photo sharing for a Digital Photography module (Figure 2). The University felt the need to be independent of commercial tools, which can change dramatically over a short period or even cease to exist.

It was recognised that student photographers required a safe and closed environment to post their work and learn to give helpful critique.

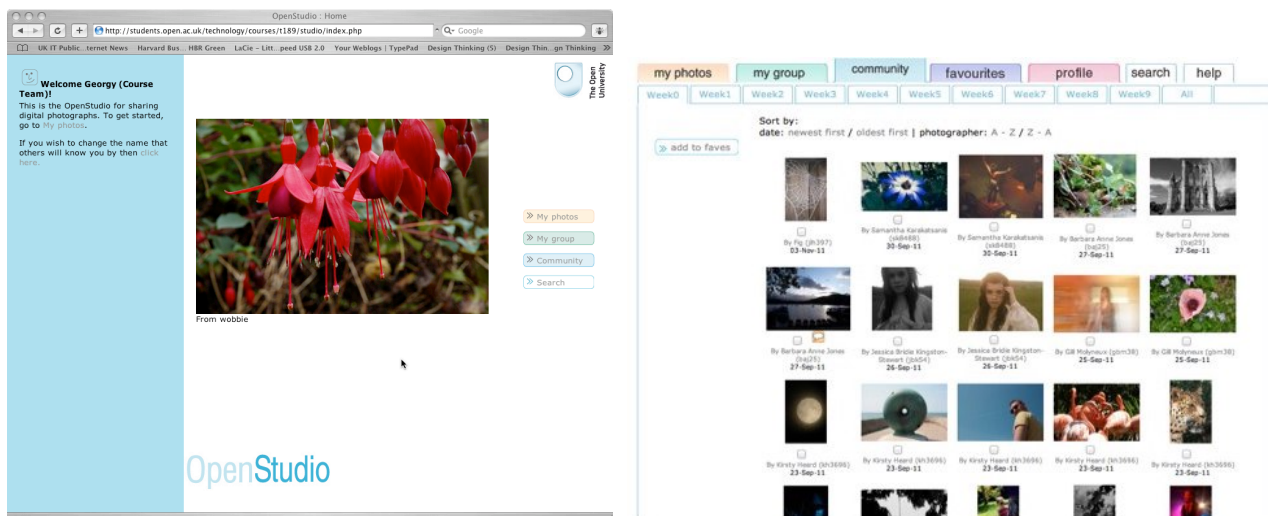


Figure 2 The first version of OpenStudio as a Digital Photography studio 2008

The learning design for this module supported by the OpenStudio tool divided a typically large cohort of around 1000 students into smaller groups with a weekly photography task. Students were asked to share work with their group and comment on others work, but they were also free to look at and comment on other groups' work. Students could also save their favourite images in a virtual album (Kear and Jones, 2011). Immediately, the advantages to using OpenStudio were obvious, offering increased engagement, socialisation, collaboration, community building, awareness of learning and skill development, among others (Minocha, 2009). These factors highlight a critical affordance of the tool – its ability to initiate, support and develop social learning in a distance education context.

In 2010, a new level 1 module on Design thinking was being offered for the first time. During the production of the module, the OpenStudio used in the Digital Photography module was developed as a core social learning tool and renamed OpenDesignStudio (Figure 3). The core requirement for the new OpenDesignStudio was to support a more active and social learning akin to the traditional design studio spaces. It was developed for a single module but also to be used across a qualification and to support an increased complexity of works shared. It needed to represent more students, tutors and tutor groups. The tools also needed to allow the learning designers to structure learning into manageable and easily identifiable blocks and 'chunks'. Consideration was given to allow users to find and view other students' work in order to comment on it. The issue of scalability and technical robustness was seen as a key challenge for the University as student populations frequently exceed 500 per module (Hart et al., 2011).

Figure 3 Version 1 of OpenDesignStudio in 2010, the first studio used across the Design and Innovation Qualification

In its design and development phase, the OpenDesignStudio underwent several iterations, each tested by the module and technical development teams and potential users. During its first presentation, students and tutors further contributed to its development, providing feedback in use. Lloyd (2013) reported that two-thirds of the student population of the 1st level module were satisfied with OpenDesignStudio during its first presentation, a figure that reflected early problems in making the tool operational at scale. This improved significantly after this first presentation and currently regularly exceeds 95% satisfaction, demonstrating the maturation of the tools use through improved learning design and tuition approaches. Feedback (and data) in early presentations indicated that students used ODS far more than predicted and that they did so to support their study by comparing themselves to peers, checking progress, and validate their learning. In other words, it worked because students recognised an intrinsic value in using the tool.

Initially, when users joined OpenDesignStudio they created a personal profile where they added information about themselves and uploaded a profile picture, similar to other social networking websites. Engagement with ODS was structured into predetermined uploads of activities students were asked to do in the module materials to the Portfolio area, while unstructured, student-determined uploads went onto the Pinboard. Figure 3 shows the Portfolio of a student on U101 and their uploads in the first few weeks of study in Level 1. The module materials encourage exploration of others' work in ODS using the Group (tutor group) and Community (whole module) space. A tagging facility was provided to find students who have approached the task in similar ways. Student participation, the number of uploads and commenting on the work of others, is tracked and rewarded. A green progress light appears for a completed upload (top right in Figure 3). Interacting with other students' work more than their own was rewarded with a smiley and a comment on an upload was indicate by a coloured speech balloon.

Each of these features was designed in order to facilitate and encourage interaction and engagement with the tool. On their own these features do not necessarily do this but, as noted later, in combination with a learning design and alignment with student goals, they can be particularly successful in initiating social interaction and engagement.

In 2011, the module team received an award for Innovation in Training Services from Institute for IT Training for the 'Design Thinking' module and its tools, including ODS. This innovation in teaching and learning diffused quickly in the university. Other modules, such as in Engineering and Computing, were interested in using ODS (Thomas et al., 2016). Three years after its first use in the first level design module, the second level design module was rewritten and ODS was included in its learning design in 2012. Due to its rising popularity across the university, the studio tool underwent a significant re-design in 2013.

2.2 OpenDesignStudio 2.0

A major limitation of the first version was its lack of integration within the main Virtual Learning Environment (VLE) – at The Open University. The OU VLE (Figure 1 top) is a heavily adapted version of Moodle, the underlying platform for which bespoke tools are developed in-house. These are added around this central organising core as seen in Figure 1. When version 1 of ODS was created, full integration was not possible and this required a technical environment independent of the main VLE. This resulted in students having to navigate and use a separate site, losing other links and tools available to them in the VLE, as well as any cognitive or conceptual links. For example, the profile creation feature noted above was a consequence of this separation, requiring a duplication of student data, and a repetition of student activity. The consequences of this separation created a series of small barriers, reducing the ease with which students could engage with the studio. This observation came to be a condition of future development – that any design decision should make student interaction as 'frictionless' as possible, essential in supporting student engagement with any software environment (Wang et al., 2013). Briefing the design team using these types of 'conceptual metaphor' became a useful practice in the design process, allowing discussions to take place that defocused from specific (software) actions and concentrated on the qualitative experience required (Jornet and Jahreie, 2011).

The removal of these barriers through the technical integration of the studio became the highest priority for version 2 of ODS. It was recognised that this would be a significant institutional investment but the case for support was argued by having a successful proof of concept and working prototype. By this time, ODS was also beginning to be used successfully in other subject areas (e.g. Education, Technology, Computing, and Arts) and at all undergraduate study levels.

In addition to developing responses to limitations of the first version, two further design drivers were identified: 1) a refresh to the User Interface, User Experience/Interaction, and 2) a desire to further develop the pedagogical potential of the studio, primarily the exceptionally high levels of student engagement and how these might be improved. The development team, including the 'client' side, was initially comprised entirely of experienced designers, meaning that working in the intersection between interface, experience, technical and pedagogical design was possible. This allowed key decisions to be planned appropriately by ensuring that the timing of implementation of features did not force solutions without some genuine design decision-making taking place. For example, early pressure to create a fully detailed Functional Requirements Document were resisted to ensure that design and prototyping processes could be applied.

An example of using a conceptual approach was in the development of the structure and navigation in the studio. This is a 'slightly wicked' design problem since it can be arranged along several different dimensions of information (type, intent, author type, time, etc.). The first version of ODS established the habit of referring to parts of the studio using terms such as 'portfolio', 'groups', and 'pinboard' – physical concepts used in a virtual setting – so development of the second version continued this and developed it further. Figure 4 shows an early sketch layout setting out the spatial arrangement of a student's work according to architectural concepts of private, semi-private, semi-public, public, which proved to be a useful way to communicate requirements the learning designers identified to technical designers in a way that both parties could relate to.

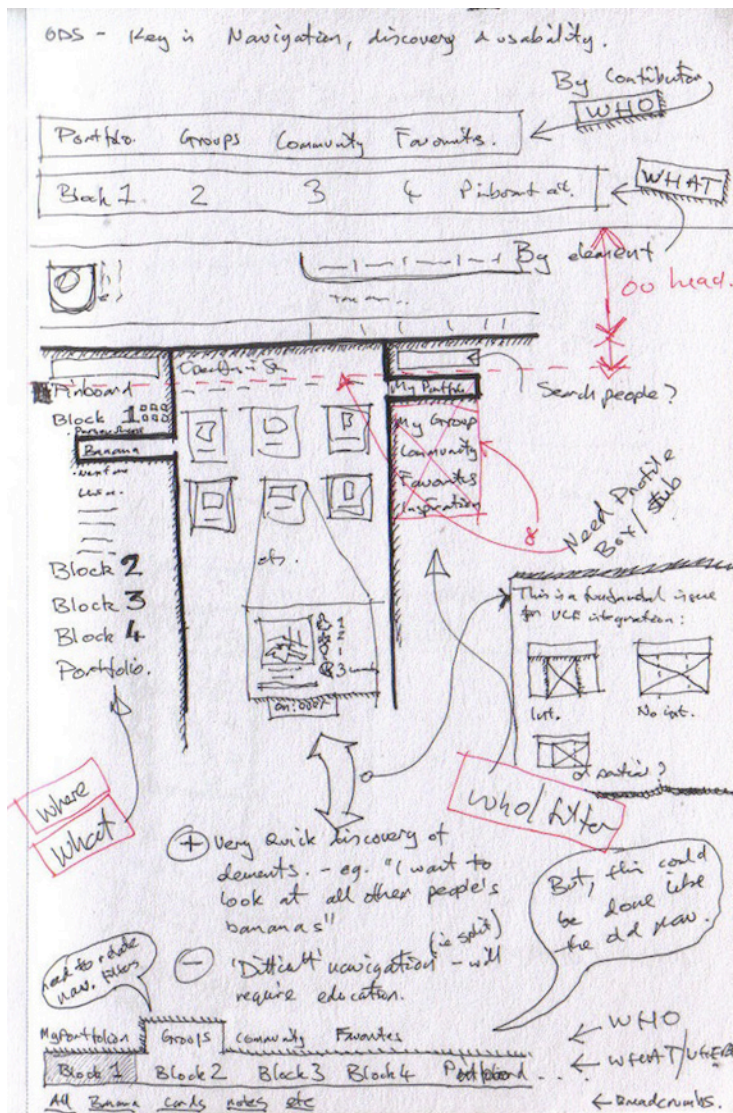


Figure 4 – An early concept sketch using architectural metaphors to design example of

The other major design decision made was around the social networks and connection opportunities. Again, this is a 'slightly more wicked' problem in that predicting what will enable, support and create a successful social network is effectively impossible. We can bring to mind many examples of successful online social networks but rarely consider the thousands of failures that are a necessary accompaniment to this. Similarly, students had reported finding the social functions of the first version exceptionally limiting and difficult to use, so we knew there was a problem to resolve and it was clear that there was significant demand, which we could now link to engagement and student success, meaning this was also a significant opportunity.

Once again, we used conceptual metaphors to brief this work and decided very early on to use simple, iterative prototypes to create a responsive design solution, rather than try to predict everything and hoping it works. We planned to support as many easy ways to connect with other students and then maintain those connections in ways that students would find useful. Figure 5 shows an early mockup sketch to explore different interactions and ideas, in particular the different levels of interaction considered early to encourage student engagement with the environment.

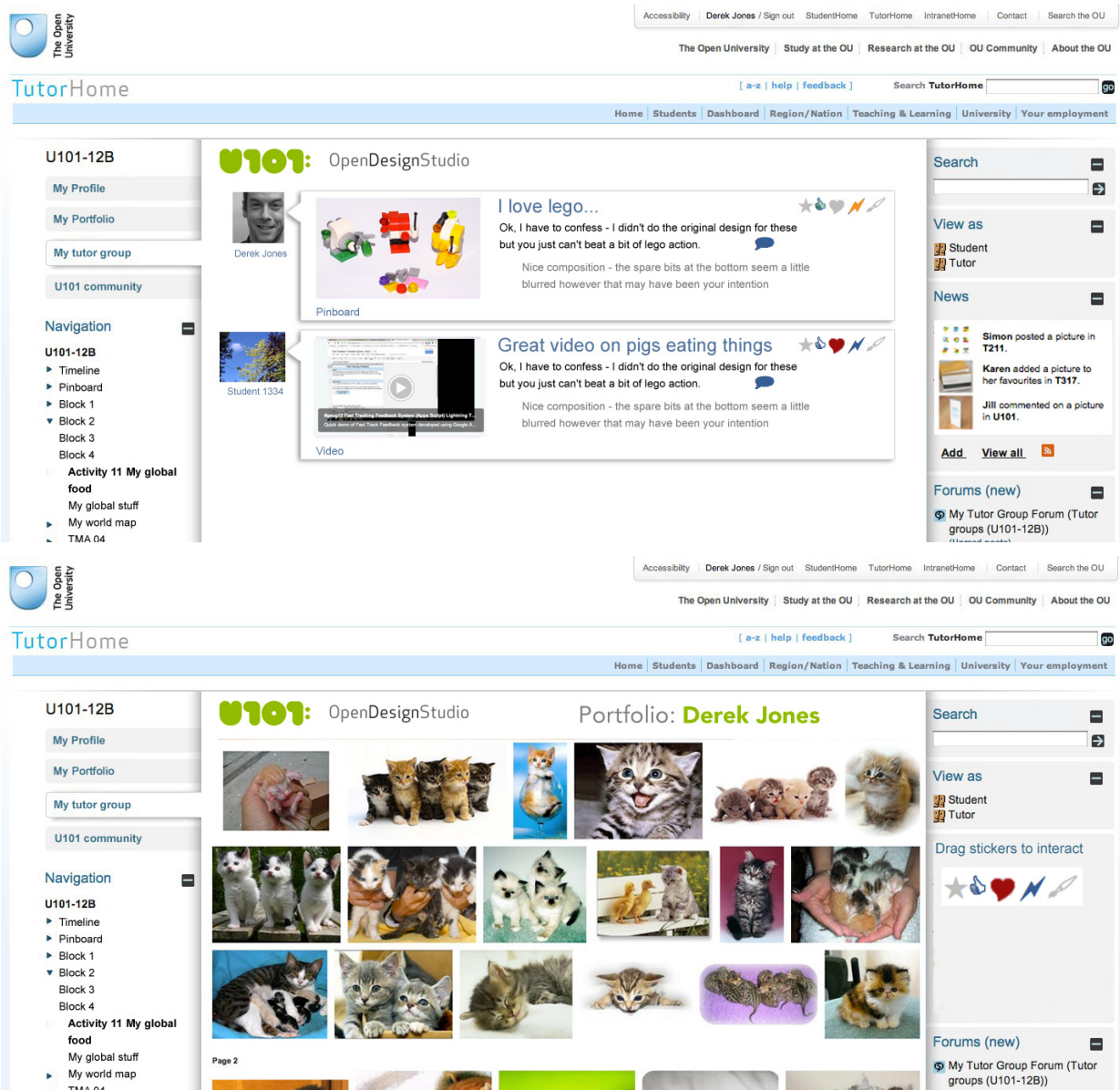


Figure 5 – Early Version 2 prototype sketches exploring social networking and interaction functions.

As the project developed, the large technical team reduced in size once a stable product was available (when the majority of the larger technical challenges had been resolved). Continuity was maintained by retaining a smaller core design team, which helped respond to the iterative process used to confirm and then further develop the final solution. As with version 1, testing and development continued through live student use, where it could be carefully monitored and problems resolved quickly. The team had experience of working in this way both technically and professionally as well as acting as designers and educators.

This type of student feedback and testing was a vital part of responding to the social networking problem identified above. Using student feedback, the team were able to identify specific studio activities students found most useful socially and educationally. For example, notifications of interaction are a common feature in many social networks but being able to return to particular instances of interaction easily to refer to them for an educational purpose is not. Hence, a focus on search and filtering as well as social interactions was required – all developed responsively to student feedback. Figure 6 shows an example of activity notifications developed in version 2.

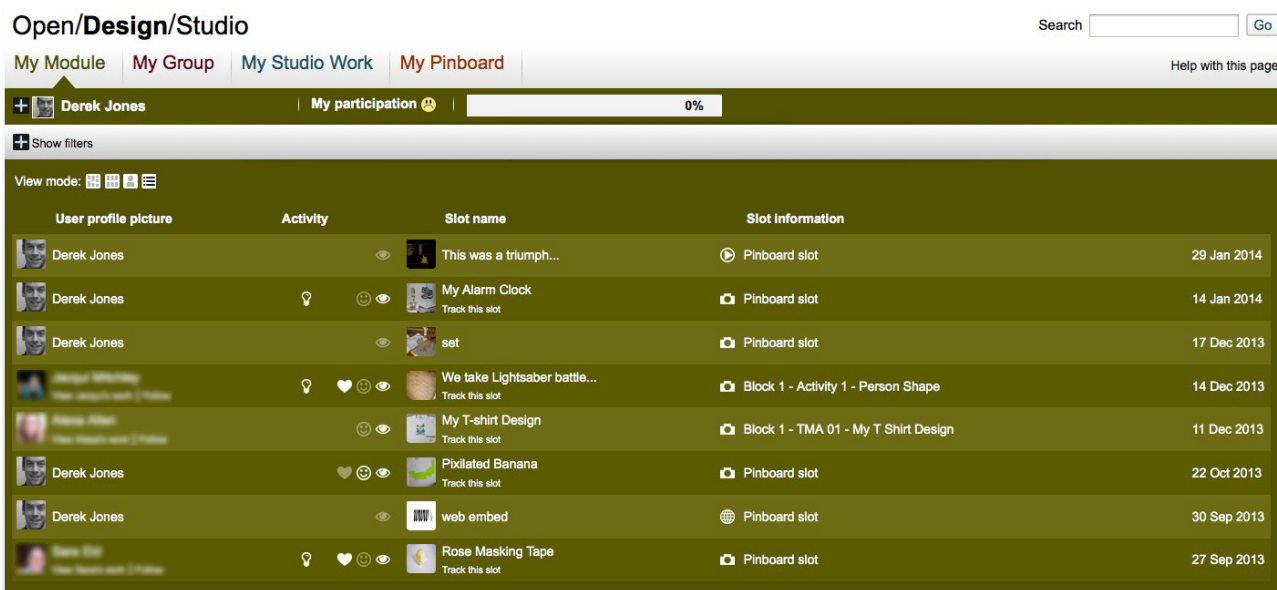


Figure 6 Activity notifications developed in ODS version 2.

The final stage of the development project was the integration of ODS into the core modules in the Design and Innovation qualification. Each of the three core Design and Innovation modules has a bespoke learning design. While the first and third level module are entirely online, the second level has printed module books with supporting online activities. The third level module is integrated into a wider number of qualifications, hence the population on this module differs to levels 1 and 2. Some level 3 students might not have used the virtual studio before starting this module. These differences at different study levels have a significant influence on the success (or otherwise) of the online studio.

2.3 Engagement and progression in ODS

In 2015, a quantitative and qualitative study of ODS on Level 1 revealed a correlation between engagement and students’ success, and identified that some form of social learning through peer comparison is taking place in ODS. The qualification team wanted to understand if this finding was replicated across the qualification and a large-scale study to investigate how students’ progress through the qualification in ODS was instigated in 2015 and ran for 2 years. The full details and results of this study are available elsewhere (Jones, Lotz, Holden, 2019 (in review)) and the following results are presented as summary points.

The analysis of engagement data from five Level 1, three Level 2 and one Level 3 presentations suggested that ODS is indeed used differently across the Qualification. All modules run for roughly 30 weeks and carry 60 credits and the numbers of students on each level vary. Level 1 usually attracts between 300 – 600 students (it is presented twice a year), Level 2 has around 300, and Level 3 up to 600 students. Engagement with ODS varies by level, too, as can be seen in Table 1.

Table 1 Average numbers of engagements per student by level of study (** no data available)

	Studio slots completed (Number of slots required)	Slot Views	Comments (own)	Comments (other)	Feedback Requests	Pinboard Slots
Level 1	25 (34)	255.8	10.66	32.24	3.68	22.50
Level 2	35 (82)	**	6.00	12.95	3.05	3.15
Level 3	14 (88)	14.0	4.50	10.90	3.90	2.60

Table 1 (column 1 Studio Slots Completed) shows the number of uploads students are required to complete for the module materials and the average actual uploads per student. It can be seen that that the engagement students are instructed to show increases, while the actual engagement decreases. Not only does the number of uploads increase, the kinds of work that are uploaded change too. Level 1 tends to ask student to upload the outcomes of mainly quick, fun, and meaningful activities, where students can show their work, compare it to and with others’, and gain confidence in knowing that they are not alone and are making progress. Over two-thirds of level 1 students complete

the majority of uploads that they are asked to do (a high proportion given the distance education context). The uploads in Level 2 demonstrate the student’s skills in sketching and modelling and may take longer to produce. Half of the students share the work as instructed. The use of ODS in the third level module changes yet again; the work shared is visually less interesting, with more text-based activities uploaded to the studio space. Due to their complexity, these uploads require more time to engage with appropriately. Only about one sixth of students do as instructed. At Level 3, students view and comment on fewer uploads compared to lower levels, but the ratio is as such that nearly every uploaded work is commented on in Level 3.

Overall, there were reasonable correlations of students’ success in Level 1 across all presentations for different measures of engagement, such as numbers of slots completed, viewed, and commented on, and pinboard slots created. The study confirmed that, at Level 1, the single strongest correlation is between Views of uploads of other’s work and Student success (Jones et al., 2017; Lotz et al., 2015). This indicates that the seemingly passive activity of ‘lurking’ in the studio is an important social learning mechanism for students that are successful in their studies at Level 1. We consider this to be analogous to the activity of ‘listening in’ (Carruthers et al., 2014) in a traditional, proximate studio environment.

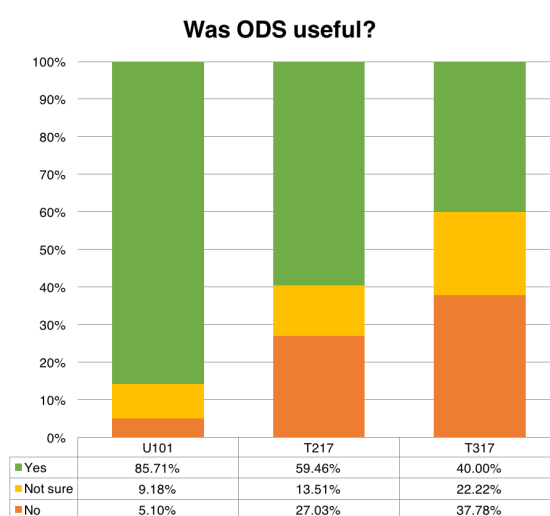


Figure 7 Perceived value of OpenStudio across the Qualification

We could not find such a correlation in any measure of student engagement with ODS and student success at higher levels of study. Also, the perceived value of ODS decreases with increasing levels of study (Figure 7), with students at level 3 not seeing the value of the tool or activities around it. Given that the tool itself is identical across all study levels, it is clearly the learning design of modules and how the studio is integrated into each that is particularly critical in supporting (or not) student engagement.

An analysis of the rated quality of posts by expert and the conversations around these uploaded artefacts revealed surprising findings (Lotz et al., 2018). Commenting behaviour for students on the entry level module was positively related to the aesthetic qualities of the artefact. Comments like ‘looks good’ or ‘professional looking’ were frequent (Figure 8). For more experienced, higher level students the behaviour seems to be the opposite. At Level 2, students comment on content that is not of the highest quality as assessed by experts, but their comments are more critical and draw on learning and content for the module. Comments interwove positive feedback with critique, for example, ‘lovely drawing, but I wonder if ...’. The data from this study were not sufficient to make any consistent observations about Level 3 commenting behaviour. Students feedback suggested that the ODS integration currently does not support the social learning need at this level of study. Students carry out longer and more complex specialised innovation projects, which need time to engage with in detail. A project-topic-based or peer-review approach at level 3 might be a more appropriate ODS learning design. However, this is currently not well-supported by the learning design and tool integration.

The screenshot displays the OpenDesignStudio web interface. At the top, there is a navigation bar with the OpenDesignStudio logo, a search bar containing 'My Pinboard', and a 'Go' button. Below the navigation bar, there are tabs for 'My Module', 'My Group', 'My Studio Work', and 'My Pinboard'. The main content area is titled 'Testing, testing' and features a large image of the Mona Lisa with a person's face superimposed on it. To the right of the image, there is a profile card for the 'Owner of this slot' with a 'View my work' button. Below the image, there are several interactive elements: a 'Visibility setting: Module' dropdown, a 'Maximize' button, an 'Archive current slot' button, and a timestamp 'Updated: Friday, 19 Jan 2018, 20:34'. There are also icons for '13 Views', 'Edit', 'Delete', and 'Request feedback'. At the bottom of the image area, there are icons for '0 Favourites', '5 Smiles', and '0 Inspired', along with a 'Permanent link to this page' button. Below the image area, there is a 'Comments' section with two comments. The first comment reads: 'Admittedly not the best Donald trumpesque Mona Lisa mash up I've seen, but epitomises his personality well.' and has 3 replies. The second comment reads: 'She really is a bonnie lass haha!' and has 1 like. At the bottom of the page, there is a 'Subscribe to this slot' button and a message: 'You have no email subscription from this page.'

Figure 8 – An example of informal and social comments in a Level 1 slot, typical of interaction at this level.

3 Discussion

If we attempted to characterise the different inflections of OpenDesignStudio at each level of study, one could argue that at Level 1, a social engagement and 'listening in' promotes social learning (social comparison, social presence

development, engagement, etc.) and the building of a 'sense of community'. It provides room for enculturation into design education at a distance. The decreasing quantity, but increasing quality, in engagement with ODS at Level 2 creates room for comparison of specific skills and more of a focus on a larger design process and effort. At level 3, the social learning need, which is demanded at lower levels, seems not to be desired at all, judging by the reduced engagement with ODS and student comments. Some of the reasons for this are discussed in Jones, Lotz and Holden (2019, in review), but it is very likely that distance design students mature as they make progress and that this does have to be fully reflected in the maturation of the studio, just as it is in a proximate studio.

ODS works well by relying on social aspects of learning and practice to draw students into enjoyable activity they then make meaningful and valuable in their learning. When introduced to this habit in early levels of study it has demonstrated significant success. But, with the exception of a strong stable core of users in each cohort, the level of interaction remains social and doesn't develop as fully into design dialogue as it could do. There are a number of possibilities for this.

Firstly, there is currently no space for workshops using specific design tools in that space. The use is primarily a social media model applied to a design cohort and it works really well in supporting this. But to augment and build on the social aspects it may require additional tools and affordance not currently provided (for example: markup tools, more advanced communications, synchronous discussion and interaction tools, digital prototyping spaces (e.g. BIMs), etc.).

Secondly, the equivalent of the design (or desk) crit and end of term crit are currently conducted 'outside' of the studio. None of the design modules assesses student interaction within ODS, and assessment is still direct between student and tutor. This has significant advantages, particularly in terms of personalising student learning (Jones, 2014), but it does mean that a valuable learning event is isolated, reducing contact with experts or expert dialogue, both of which are identified as key aspects of any design studio. This is also a feature regularly requested by students in any feedback on ODS – to have regular, expert feedback.

Thirdly, there are structural issues around the development of communities of practice (Lave and Wenger, 1991). Each OU module is a self-contained unit of learning, meaning students develop a strong network and then often study another module on their own, leaving their network behind. Similarly, on the Level 3 module, many of the students entering it have had no experience of a studio of any kind, meaning they have to make sense of, and find value in it very quickly (and without the benefit from the enculturation that takes place at lower levels of study). These discontinuities of studio engagement are specific to the OU and how we currently organise teaching material. In a 'traditional' studio this effect might still exist but it would be far less obvious and spread over a much shorter period of time.

A fourth and final reason is that there may be a limit to what can be achieved in this type of alternative studio. Different levels of study seem to require different types of studios. We are increasingly doubtful that one tool could cater for all social learning needs as students develop their individual needs as learners. And there seems to be some sensitivity to subject-specific needs and demands, although these are very often perceptions of discipline rather than actual needs. For example, the use of the studio in design engineering subjects has had mixed results with some students not accepting its relevance to what they view their specific sub-discipline to require. Conversely, the use of OpenStudio in other subjects, such as Arts and Languages, has seen good responses from students and been successful in allowing active learning to take place (and at all study levels. What this suggests is that we do not yet know what might be achieved with these modes of learning; that the limit does not necessarily lie with the tool but with the ways in which we are using it.

It is in these boundary questions that we hope future research is conducted. The track for LearnXdesign 2019 was titled 'alternative studios' for a reason – the term 'virtual studio' suggests there is some 'real' studio upon which the virtual one is based. Similarly, 'online studio' suggests a static place that only exists online – as if there is no offline practice involved. But, just as with a physical studio, the contents and boundaries of an alternative studio are at least as complex – providing they are designed and allowed to be. That starts with a much higher expectation of what the alternative studio can do. If it is seen as an addition to something else, it will always be such an adjunct. If it is considered to have a limitation in some subject, then it will never be tested beyond these starting assumptions.

But if we consider the alternative studio to be an idea – a conceptual metaphor with all the complexity of a socially, professionally and personally enriched traditional studio – then we change our expectations as well of those of our students. The conception of the studio becomes what it needs to be in order to meet the needs we identify for it, just as it does in a 'real' studio.

4 Conclusions

We end with a summary of the lessons we have taken from developing ODS and we think might be useful for learning designers

1. **The studio is not just the ‘thing’** (the tool, the software, or the place). The success of a studio is due to the complexity of interaction and behaviour it allows to emerge, an implicit property of the studio we can take for granted sometimes as design educators. The success of ODS at Level 1 is due to the learning design, tuition support, and student engagement as much as it is the software tool itself.
2. **Induction and enculturation is critical.** Students have to learn to use a studio, just as they do any other mode of learning or working. Very often this learning is assumed and implicit in traditional design education where enculturation can take place synchronously and contiguously. But in alternative studios such continuity may not be possible and studio enculturation may have to be considered explicitly in the learning design.
3. **Designing the design studio is essential.** Design processes involving users, iterative prototyping, and conceptual briefing allow more responsive and emergent solutions and our findings suggest that they are a necessary condition for the successful implementation of any socially-mediated tool. Similarly, realising that a single solution is not possible to such a complex design problem is essential – there may be *instances* of solutions, but these must continually change and develop just as both the curriculum and the studio do.
4. **Learning is only represented by interactions and behaviours.** It’s human nature to focus on what we can measure but in doing so, sometimes we miss other valuable activity taking place (see Jones, Lotz and Holden (2017), for more on this). In all our studies, simply ‘listening in’ (being in the studio) was shown to be the single, strongest predictor of student success. Then question here is: what else are we not measuring?

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