Social engagement in online design pedagogies

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Abstract: *Design studio education has been a leading pedagogical principle in design learning for over 100 years. Initially, the studio environment was seen as a collaborative environment in which students follow the work of their peers' through formal presentations, critiques and informal conversations. In the recent past, research on design studios has lost sight of the social component in studio education in favour of concentrating on the tutor-students relationship. As the delivery of design education has moved into online environments, scholars have begun to recognise that social engagement with peers may be of a greater importance to students' design learning than previously acknowledged. This paper explores the gap in our understanding of engagement and interaction by analysing quantitative and qualitative data from 317 students who were studying an online module in design thinking. The module facilitates learning akin to the design studio experience. An online environment allows students to share and discuss design work, asynchronously, with peers at a distance. The results of the analysis show a correlation between engagement and students success, and further analysis of the kinds of interactions suggest six themes of social engagement that have a positive effect on students' outcomes. These findings add to our understanding of successful online design pedagogies.*
Keywords*: design studio; social engagement; online learning; peer learning*

Introduction

The move to studio teaching in specialist educational environments in the 20th century (Kuhn, 2001; Webster, 2005) has been described as a 'signature' pedagogy in design education (Crowther, 2013), offering students opportunities to practice skills without 'real world' risks (Schön, 1987). The studio model, unlike the atelier model it replaced, relies on the expert tutor as central arbiter of quality, and was a response to increasing numbers of design students, the development of the design professions and the need for enculturation in professional practice.

A key benefit of studio enculturation is that it enables students to adopt a professional approach and develop the skills and confidence to *behave* like designers. It also allows students to take advantage of the 'institution' of a designer's profession – the embodied knowledge and practice that is genuinely valuable and worth knowing (Kimbell, 2011). In traditional studios this is provided by the tutor 'expert', often a practitioner themselves. However, the model of the expert as the central arbiter of quality can be difficult – the asymmetrical power relationships created can cause problems (e.g. Mewburn, 2011; Sidawi, 2012) and focusing on the expert and enculturation ignores another key studio learning mechanism.

The studio has always been a social space as well as a place for professional training and, although recent research has started to investigate social interaction in the studio, many authors still call for greater recognition of its importance (eg. Webster (2005), Sidawi (2012), Crowther (2013)). With increasing numbers of design students, the ratio of students per tutor is increasing and the models of tutor-centred studio education are changing. Institutions start to put more emphasis on collaborative projects and engagement with other learners or stakeholders in design.

But how is social engagement altered when design pedagogies move from proximate to online worlds, in which structured learning elements and especially social media conventions influence peer interaction and learning as much, or possibly more, than experts do? As we progress towards alternative and blended modes of design education (online, part time, distance, practice-based, etc.), it is perhaps timely to reconsider the social and peer interactions in design education.

Background

Social interaction in design studio education

Until recently relatively little attention has been given to social interaction in design education. Schön (1987) shows the valuable role of teachers as experts but scarcely considers student peer groups. Miller and Dollard (1950), discussing the social process of modelling, see students learning through emulation of teacher behaviour. However, Ashton and Durling (2000) question whether emulation develops skills of criticism and judgement that can be applied in new situations. Students may come to over-rely on the expert, whether intentionally, encouraged by the tutor or unconsciously, assuming this behaviour themselves. In such a dependent relationship less attention is given to self-assessment or assessment with peers and colleagues (Colomina et al, 2012). Ashton and Durling (2000) describe the studio as a social space in which observation and appraisal allow students to check they are on the right track and 'do the right things'. They also

indicate that the traditional master-oriented studio model requires high levels of contact between individual students and the teacher, which is unrealistic in contemporary educational contexts. Understanding peer relationships is thus crucially important. “The process of becoming a designer is not an individual journey but one where the group in which the learning takes place and the community which students seek to join plays a vital role” (ibid. p 3).

Another tension is seen between the expectations of design in professional practice and education. Professional practice requires cooperation and collaboration whereas, in education these behaviours can be construed as cheating (Robinson, 2010).These social aspects have posed challenges for some time (Cuff, 1991) and are mainly dealt with through simulation and project-based situated learning, where collaborative roles may be enacted or real world scenarios and experiences offered. However, for students competing with peers in this pseudo-social environment, the group result matters far less than individual results.

It would seem though that, despite these tensions, social engagement and interaction are beginning to be seen as valuable aspects of the pedagogy of design. Sidawi (2012) found that the largest positive influence on architecture students was their peers, conversely the dominance of tutor feedback inhibited creativity. McLean and Hourigan (2013) identified both benefits and limitations in design studio peer relationships, noting they were ‘complimentary yet quite distinct to the tutor-student relationship’. Smith (2015) identified that interior design students’ persistence was significantly improved by social interaction with peers.

The concept of peer learning derives from informal learning practices, but scholars have tried to embed peer learning in a more formal curriculum. This is particularly important when education is delivered at a distance and chances for informal encounters are minimal. In the wider literature, peer learning has been described as learning with and from each other (Boud, 2014). Peers may have more or less expertise, but the key is they are in a similar situation and the power balance is equal, unlike the tutor/student relationship (Boud, 2014). The main difference when comparing peer learning to teacher-centred learning is how to ‘judge the accuracy of information we receive instead of being given accurate information by the teacher’ (Boud, 2014, p. 2). The key to success in peer learning could be to offer learners appropriate guidance that enables them to judge the accuracy of information given.

Virtual design studios

Many design programmes are now augmenting (or even replacing) traditional studio environments with virtual studios (Arvola and Artman, 2008; Robbie and Zeeng, 2012). These spaces have mainly been shaped by translation of practice in proximate studios and the affordances of the technologies available (Malins 2003). In these contexts, ‘virtual studio' is used to describe a place for working, i.e. a suite of design tools rather than a space for display and interaction.

The pace of progression of technology and our understanding of the human/social interplay with technology, is such that, although this has been studied previously, constant re-consideration is needed: of the eight virtual studios referred to by Broadfoot and Bennet (2003), only one is still accessible, showing how transient some of these environments can be. Similarly, verification or modification of the characteristics being

translated needs regular review: for example, Kvan's (2011) finding that trust between cooperating design practitioners can be developed in virtual studio environments just as it can in proximate ones.

Maher and Simoff's (1999) early versions of virtual studios have developed significantly in the last fifteen years, with more nuanced views of the relationship between people and technology emerging, offering new perspectives and better alternatives to traditional epistemologies (e.g. Jones, 2013; Grove et al, 2008; Attwell, 2007).

Alternative forms of online spaces are also emerging from other sources; students (and tutors) find and create spaces themselves by utilising social media for a range of peer learning and support activities (Schadewitz and Zamenopoulos, 2009; Hart et al, 2011; McCarthy, 2013). Schadewitz and Zamenopoulos (2009) have suggested that online social media seems able to offer enculturation into the world of design through a mixture of content-focused and social interaction around uploaded artefacts. Robbie and Zeeng (2012) identified that social interaction on Flickr improved learning outcomes in a photography class. McCarthy (2013) argued that online social interaction improved academic performance of design students as a result of constant feedback from a range of sources on Facebook. But the kinds of social interaction contributing to learner success in the online studio remain to be explored.

The literature review on social interactions and virtual design studios led to the question investigated in this paper: What kinds of engagement and social interaction can we observe without an expert being in the online studio and how might this relate to learners' success? The question is addressed here by examining the use of a virtual studio by a large student population in the Open University (UK), U101: Design Thinking online module.

Design education at The Open University

The Open University is the UK's largest distance education institution specialising in providing part time and full time, undergraduate and postgraduate distance education. Individual study modules contribute to chosen qualifications; module populations for design modules are between 300-500 students. Extensive online or printed materials deliver the main teaching supported by a range of online systems, tools and opportunities. Each student is allocated to a tutor, a subject specialist, who grades and feeds back on assessed work. Each tutor is responsible for about 20 students.

The Design and Innovation degree comprises three core modules (each equivalent to half a year of full time study) alongside which student study a pathway of choice (design with engineering, environment, arts or business). The core modules focus on essential design thinking skills, attitudes and approaches that have application across multiple domains. Each module makes extensive use of the research and scholarship into design thinking originating from the institution over the past decades (Cross, 2007).

The module presented in this paper is U101: Design Thinking, the entry-level design module. Over a period of 8 months, for 20 hours a week students are directed to study online materials and engage in activities in a virtual learning environment (VLE). Students' contact with their tutor takes various forms. There are 4 project based design assignments throughout the module ending in the presentation of a portfolio of the students work. Tutors mark and feedback on the assignments after completion. Students also have the

opportunity to meet their tutor and other students in 4 face-to-face tutorials as well as online tutorial opportunities. Students have a dedicated online tutor group forum, which is regularly monitored by the tutor, and other tutorial opportunities are available in the VLE.

Two central pedagogies are:

- Development of individual students' own design reflection in order to establish independent design thinking.
- Social and active learning in the online design studio to learn with and from others.

One of the main VLE tools used in all design modules is OpenDesignStudio (ODS), an online portfolio and communication space that allows students to post, view and discuss artefacts which they create and find. Digital artefacts can be uploaded to predetermined 'slots' (Figure 1) corresponding to activities in the teaching materials, or the pinboard where the student is free to post whatever they wish. All posts are viewable to the student cohort. Tutors are not required to use the tool but many do and report that it provides another opportunity for student-tutor contact in an informal way (i.e. not necessarily as student-expert). The affordances of ODS enable a range of opportunities in learning and teaching to be considered. The tool is simple enough to use so that no significant time is needed for familiarisation. For U101, use is primarily visual (image files).

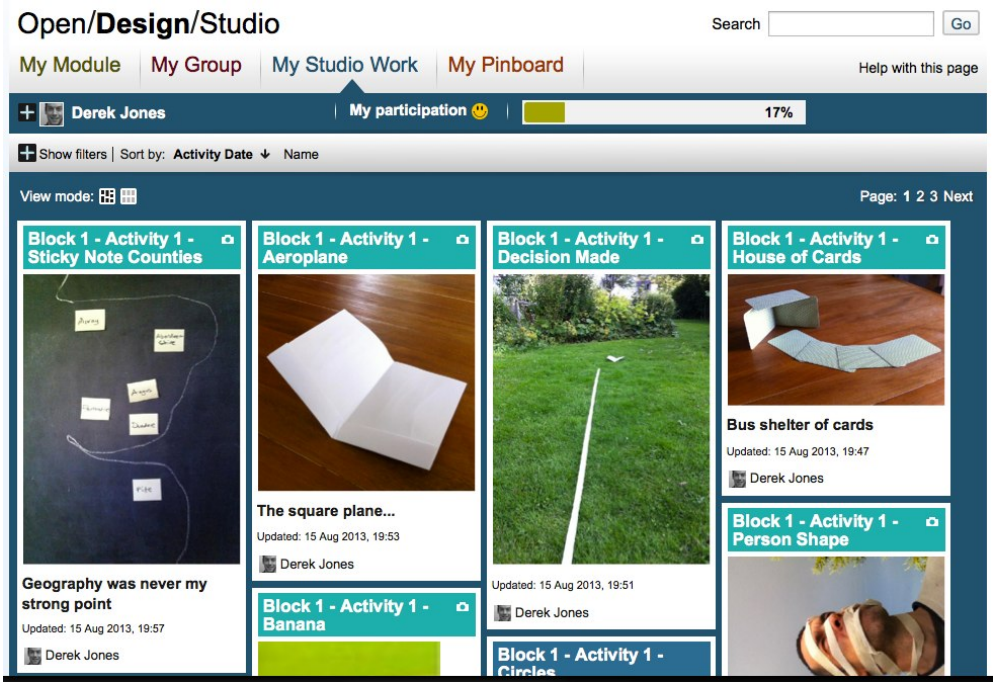

Figure 1 Main interface of OpenDesignStudio online virtual studio tool, showing predetermined 'slots'.

Students comment on each individual post, primarily through text, like forum replies though audio commenting is also possible. Students can also engage in quick interaction by using simple Favourite, Smile and Inspire buttons that avoid placing any barriers in the way of student communication and interaction.

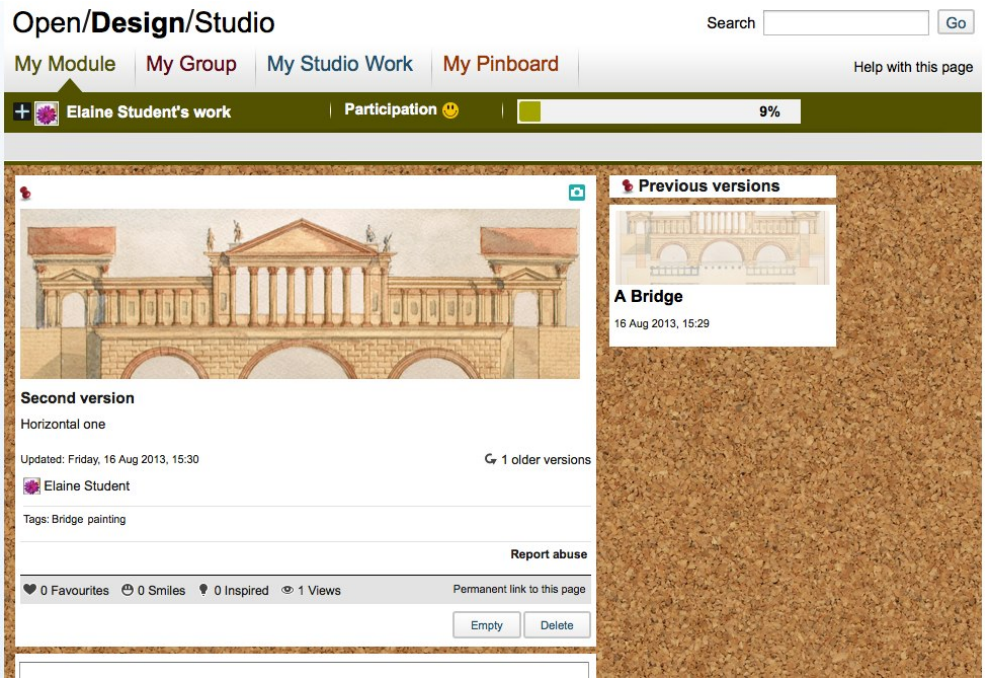

Figure 2 - An ODS slot with image upload in OpenDesignStudio.

ODS provides, a mainly visual space where students can communicate their own work and see the work produced by other students. This apparently simple 'display and observe' activity is far more complex and holds the key to a range of other individual and social learning mechanisms explored in this paper. Students are free to choose to engage with the tool and are also given options to enable them to maintain privacy on posts should they so wish.

ODS is only one part of an overall suite of online spaces within the VLE, including forums, a live chat tool and asynchronous presentation 'rooms'. It is thought that the overall blend of these tools enables the module to be successful as a virtual learning environment for design (Jones and Lloyd, 2013). Student use of ODS has far exceeded expectation from the first presentation (in 2010), hence the main focus of this paper is this virtual studio and what it might tell us about online student engagement and interaction.

Methodology

Data collection, collation and analysis

For this paper, quantitative data from one presentation (October 2013) of U101 were extracted in two main ways: data generated automatically and reported within ODS itself; and data scraped from the online tool manually by the authors. The automated data was used primarily to identify any useful immediate observations requiring further analysis. The scraped data was tabulated, concatenated with student assessment records and cleaned to remove any incomplete entries. The cleaned data set was finalised by removing entries for

students who did not complete the module (132 entries). This allowed a complete student population about whom we could discern a final result status as well as describe their online activity in ODS.

Activities in ODS were used to infer interaction and engagement. The ODS actions of Slot completion (a student uploading to a slot) and Slot views (a student viewing another student's slot) were taken to infer engagement and Slot commenting (a student commenting on another student's slot) and Slot feedback requests (a slot-specific single-click action) were taken to infer interaction. Both inferences and their relation to the module outcome (students results) were investigated in a first quantitative analysis.

In the interpretation and discussion of the quantitative results, qualitative data was consulted. Qualitative data included ODS portfolios and pinboard uploads and associated activities, such as comments and replies to feedback requests. These 'profiles' were viewed to discern patterns of behaviour regarding engagement and interaction. For example, the quantity and quality of uploads and comments, or the kinds of networks and conversations emerging, were of interest. The aim was not to view a certain number of profiles, but to reach a saturation of observations that recurred, along the lines of Glaser's grounded theory approach (1965).

Finally, responses to an end of module survey were consulted to aid discussion of our results. At the end of year students were invited to complete a quantitative and qualitative questionnaire about their learning experience. Of 64 respondents, (20.3% of students who completed the module), 19 students commented on OpenDesignStudio (6.5% of students who completed the module). One researcher read all comments and highlighted any that referred to OpenDesignStudio (directly or indirectly).

All of these methods have limitations. The statistical analysis is broad and only offers a meta-level overview, the qualitative analysis is deep and selective and the survey results have a small return and might introduce some bias. For these reasons and in line with Glaser's (1965) constant comparative approach, all these sources have been brought together in our analysis to gain a deeper understanding.

Findings

In the presentation studied, 317 students completed the module. 143 (45%) of these students were female and 174 (55%) male. The age range of students was 16 to 75 with an average age of 32. Out of these, 276 (87%) students passed, 28 (9%) received distinction and 13 (4%) failed the module. This represents a 'normal' Open University student population although notably different to other universities.

Engagement and interaction

Simple inspection of the quantitative data provided evidence of both engagement and interaction.

In terms of activity engagement (completion of directed activity in ODS), 102 (32%) students completed every slot and two thirds of students had at least 75% of slots filled (Figure 3). Similarly, students each viewed an average of 300 other student slots, confirming that students are engaging with ODS as part of their study.

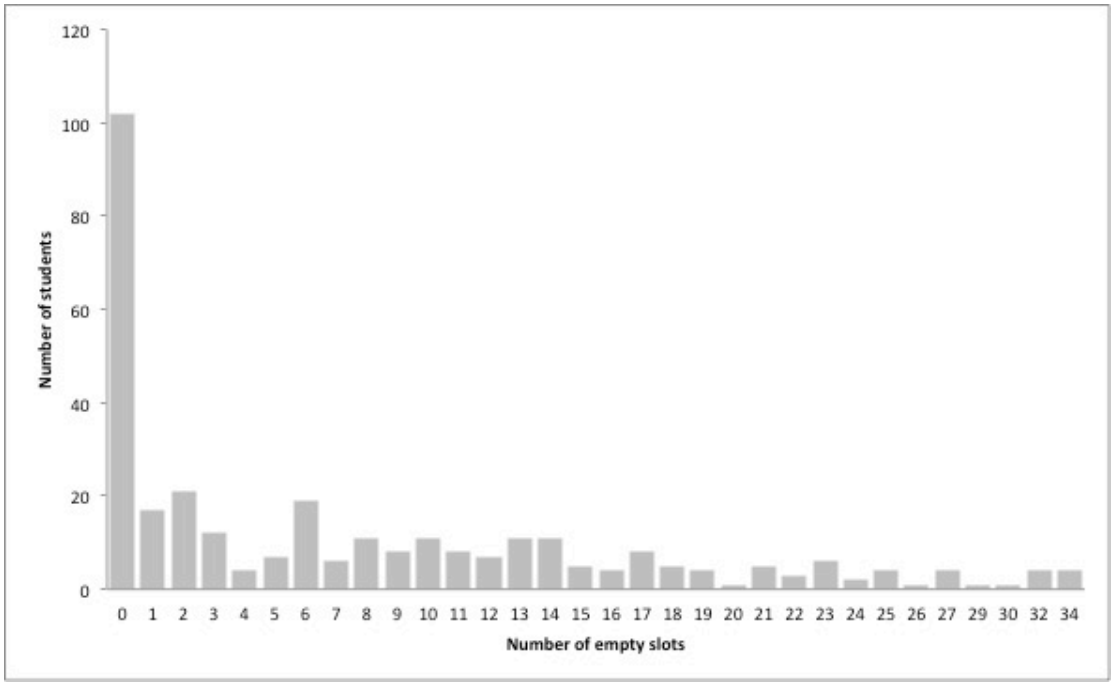

Figure 3 – Histogram of number of empty slots per student.

In terms of interaction, a total of 17,844 comments were made. On average each student made 48 comments on fellow students slots. Students are only directed to comment on other students' work twice in the module but are encouraged to do this as a general (designerly) practice throughout. Indeed, the design of the tool requires a certain momentum of commenting for successful use. The average number of comments made suggests that the original design intent has been met and that students are engaging with one another and, thereby, in undirected learning activity.

In terms of distribution of comments, only 1,430 (7%) of slots had comments attached to them. This clearly indicates that the distribution of comments is very uneven with some slots receiving multiple comments, perhaps suggesting some network reinforcement mechanism. For example, 5% of students (25 who have viewed the most posts), account for 29% of total comments, with one student accounting for 5% of all comments.

Students have the option to set slots to private or semi-private, such that other students may not view their work or only a select group may view it. Only 0.5% of all slots were made private and only 1% made semi-private (visible to tutor group). The default setting is 'public' but students are informed of the privacy settings and the results suggest a willingness to display and 'make visible' work to other students. A more accurate statement might be that there is less of a concern about sharing than might be expected. Though students raise concerns about sharing this is not reflected in their actual behaviour.

Students made, on average, 2 feedback requests each (6% of slots. The module directs students to make one feedback request to familiarise them with this affordance/feature.

The number of students with no requests for feedback (even with the directed activity) is far higher than anticipated (Figure 4) suggesting that this feature is not being used as effectively.

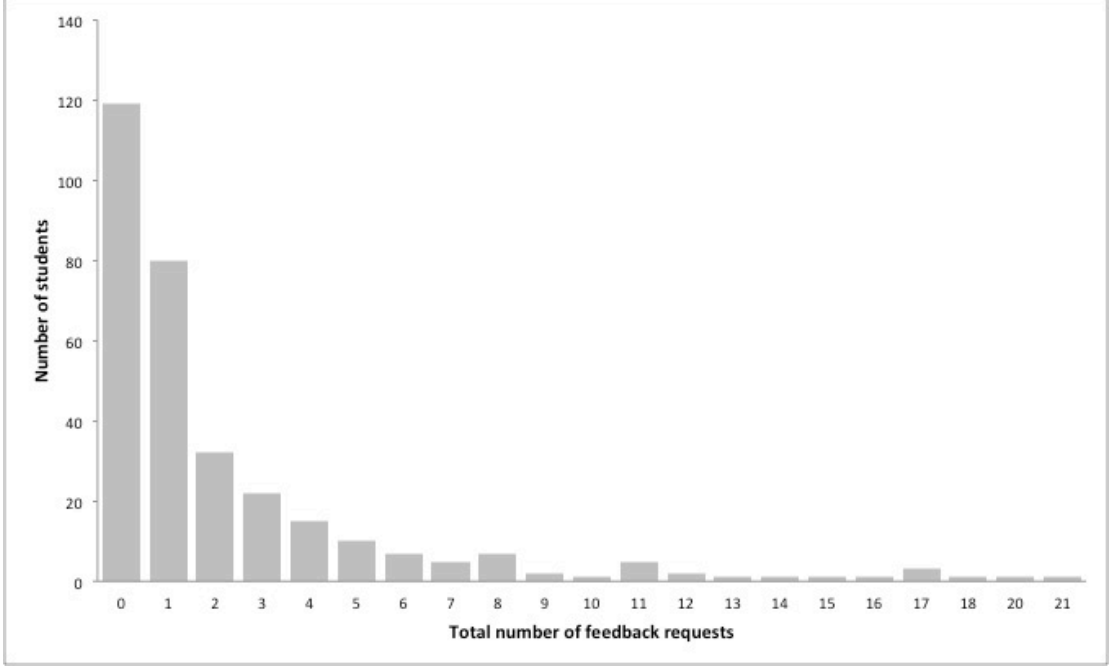

Figure 4 – Histogram of number of feedback requests per student

The other 'quick social' interaction tools have a reasonable usage in comparison to the feedback request tool: 15% of slots had Smiles attached. However, lower usage was seen of the Inspired button (6%), Favourites (4%) and Follow student (4% or 12 students followed a peer).

Relation to student success

Considering the overall population according to result status, we do see a strong correlation between outcome and all four main engagement and interaction indicators.

Outcome	**Average of Views of other student's work**	**Average of Empty slots**	**Average of Comments made**	**Average of Feedback requests**
Distinction (n=28, 9%)	596	4	107	4
Pass (n=276, 87%)	280	8	43	2
Fail (n=13, 4%)	97	16	16	1

Table 1 - Total number of engagement characteristics based on outcome

Generally, these correlations are as might be expected: students at distinction level have higher engagement and interaction characteristics (higher views of other students' work and fewer empty slots). But this method of grouping contains two groups with quite low populations (distinction (n=28) and fail (n=13)).

By further breaking down the student population into quartiles (Q1 representing the least successful quarter and Q4 representing the most successful quarter), we do see the general correlation continuing for engagement (Figure 6) and interaction (Figure 7).

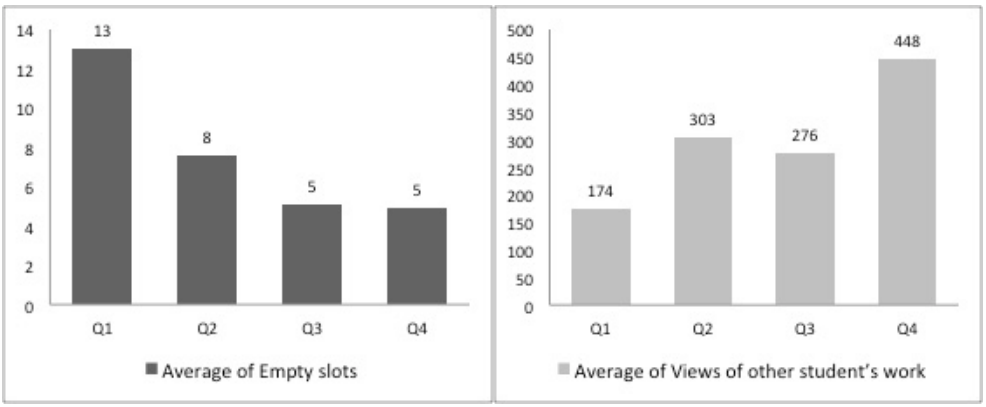

Figure 6 – Final result quartiles (Left) Average number of empty slots per student; (right) Average number of views per student.

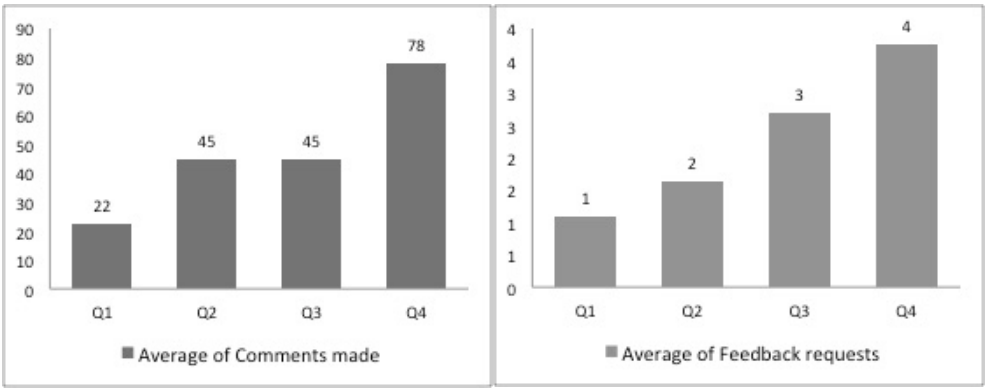

Figure 6 – Final result quartiles (left) Average number of comments made per students; (right) Average number of feedback requests per student.

As with the result outcome division, it is clearly the lower and upper populations that exhibit the most direct correlation. The apparently linear correlation in feedback requests is thought to be due to low numbers in both result and sample size.

Looking across the entire student population, there is (perhaps unsurprisingly) a moderate negative correlation (r=-0.42) between student success and empty activity slots (Figure 7).

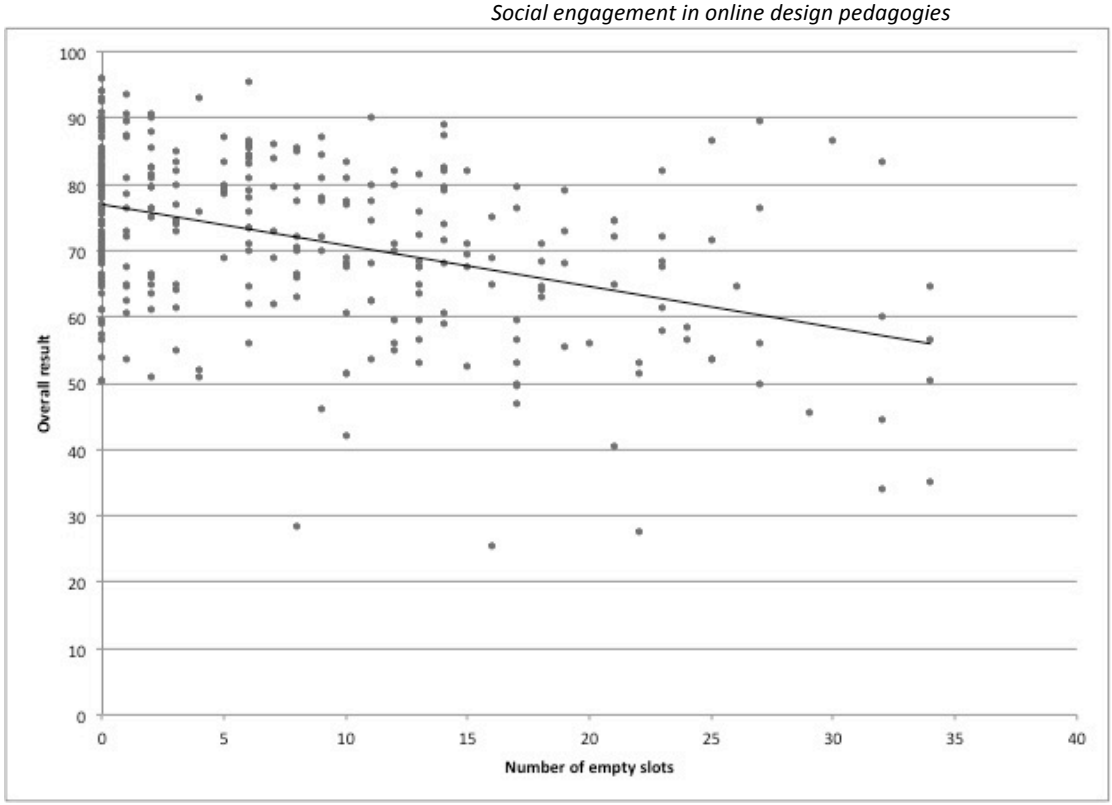

Figure 7 – Correlation between student success and number of empty slots

There is a reasonable positive correlation (r=0.33) between student success and the number of slots viewed (Figure 8). That is, the higher the number of slot views, the better the final student result.

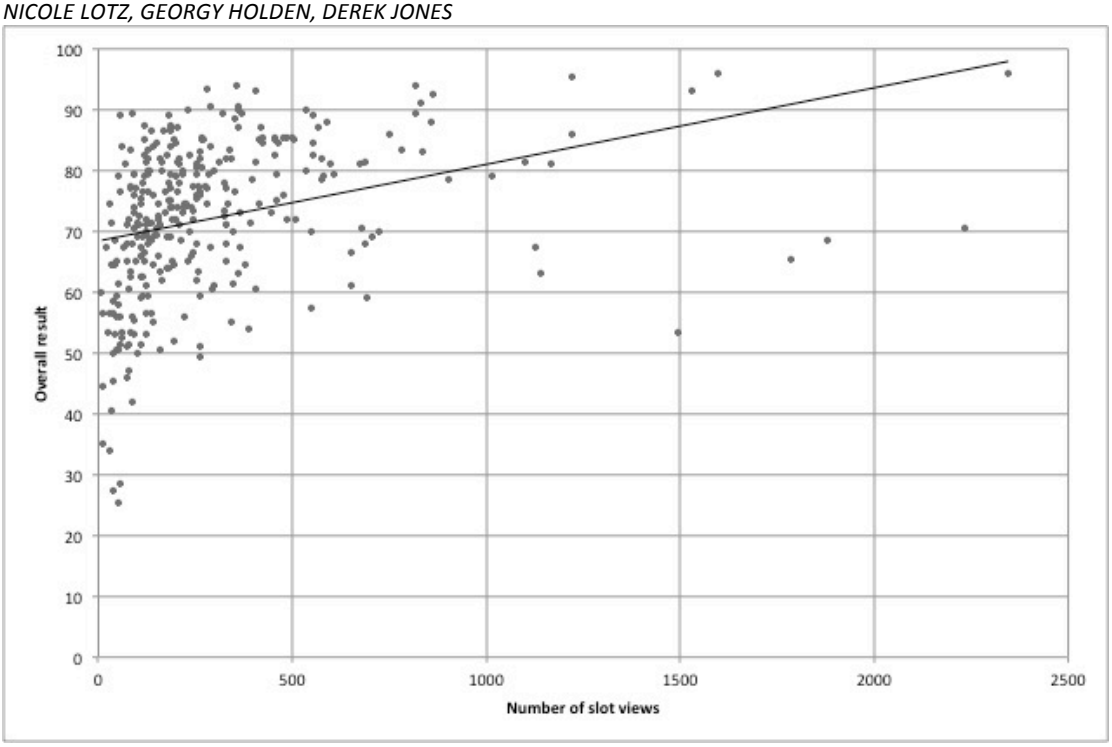

Figure 8 – Correlation between student success and number of slot views

This distribution is interesting in terms of the extreme outliers, both the individual outliers with high view numbers and also the larger population of students who view far fewer slots but do well. This strongly suggests that, whilst the overall correlation holds, individual student contexts have far greater causal impact. However, observation of the previously identified extremes of student success do correlate; no student who has viewed fewer than 50 of their peers artefacts (slots) achieved a distinction and no student, who viewed more than this number, failed (Figure 9).

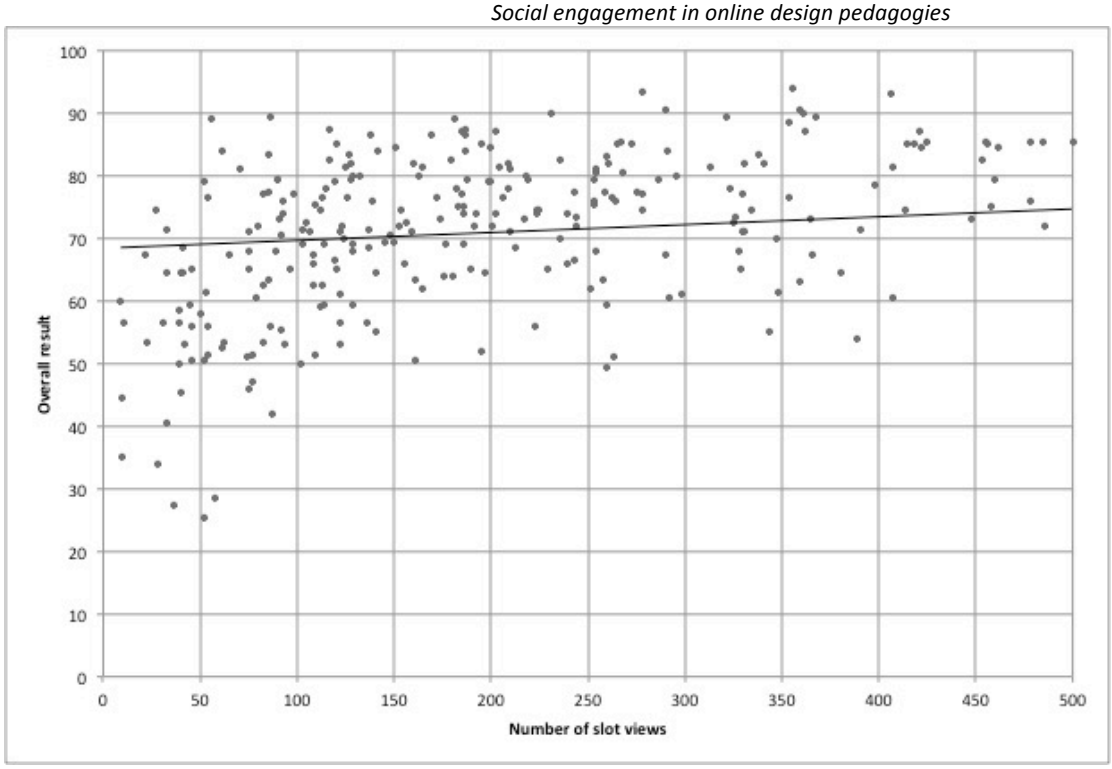

Figure 9 –Correlation between student success and number of slot views (0-500 views horizontal range)

There is a reasonable positive correlation (r=0.30) between student success and the number of comments made (Figure 10). Interestingly, this correlation and its distribution, is almost identical to that of number of slot views, despite the relative difference in activity (see Table 1).

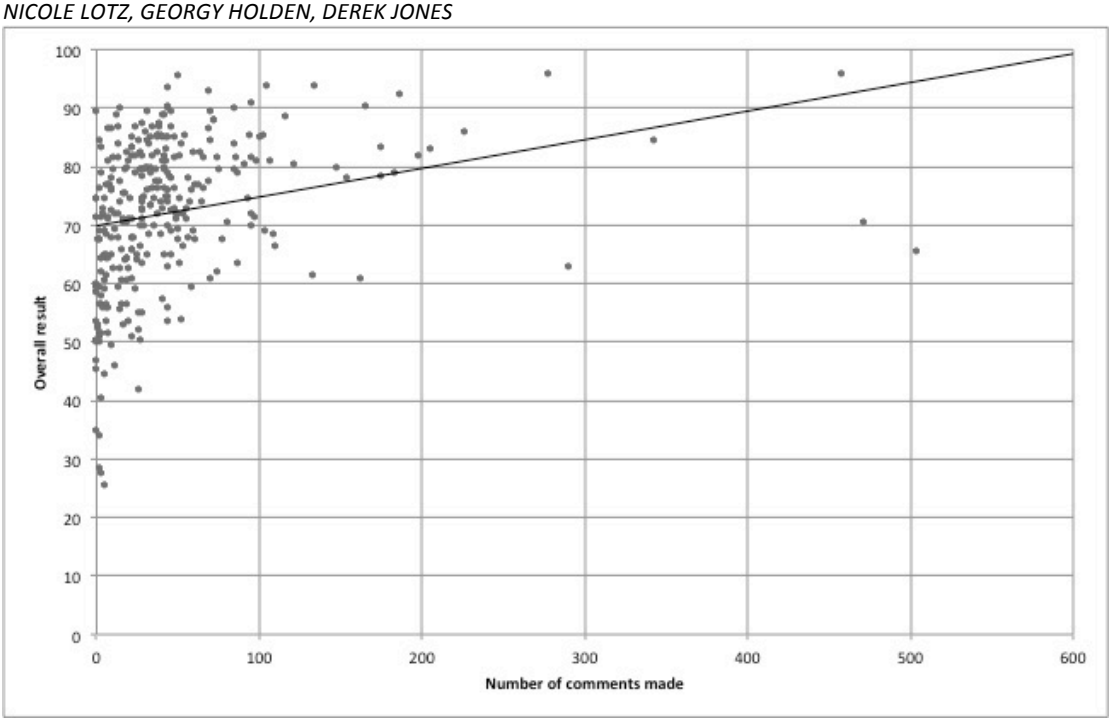

Figure 10 – Correlation between student success and number of comments made

But it is in the distribution of this correlation that the difference becomes apparent (Figure 11). Some students are actively viewing slots but do not engage through commenting and, unlike the number of views made, students can still obtain good results without doing so.

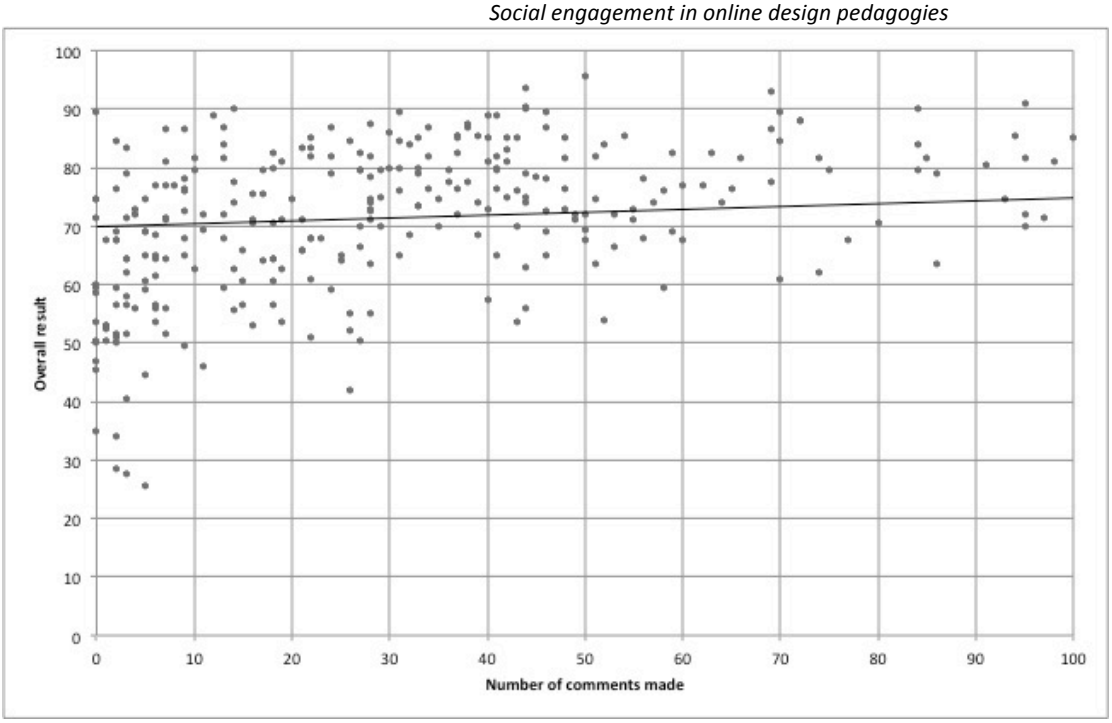

Figure 11 – Correlation between student success and number of comments made (0-100 comments horizontal range)

There is a weak positive correlation (r=0.28) between student success and number of feedback requests (Figure 12). As with the slot view correlation, the distribution of this is quite specific, probably reflecting the limited use of this feature as identified above.

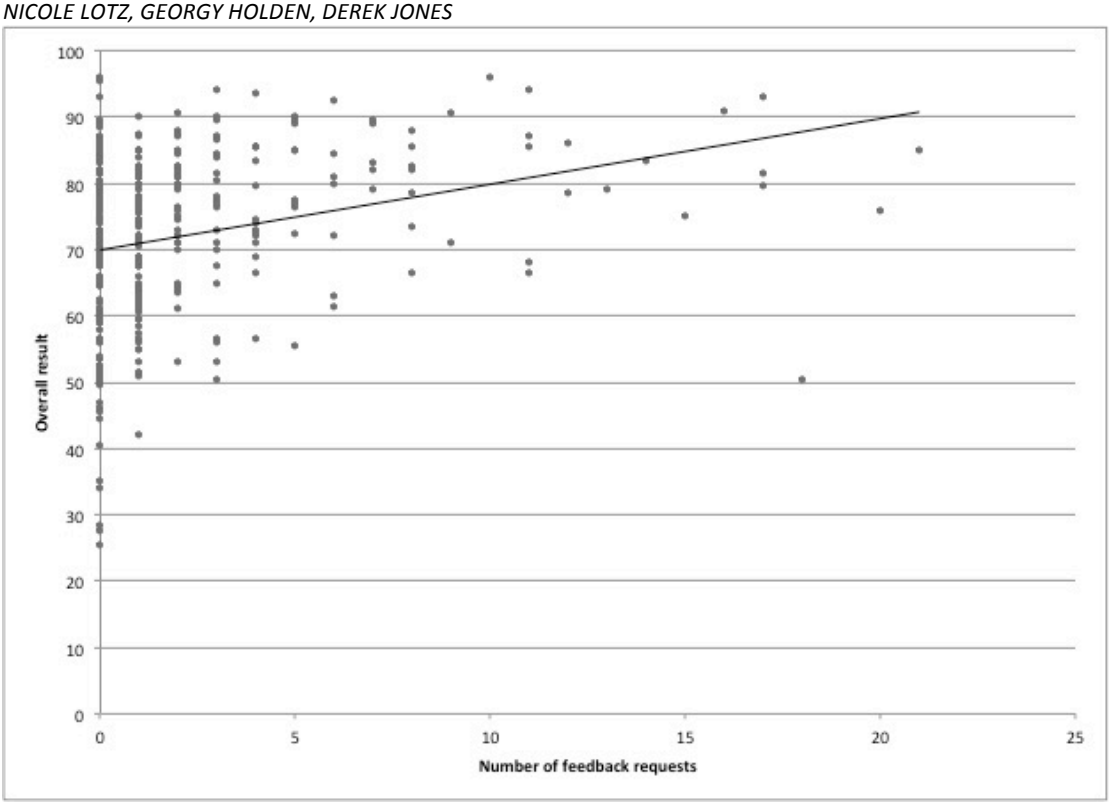

Figure 12 – Correlation between student success and number of feedback requests

Relation of views to comments

There is a very strong correlation (r=0.76) between students viewing and commenting on slots (Figure 13). This is partly explained by students having to view a slot prior to commenting on it, but the strength of the correlation is such that the two behaviours are worthy of further attention.

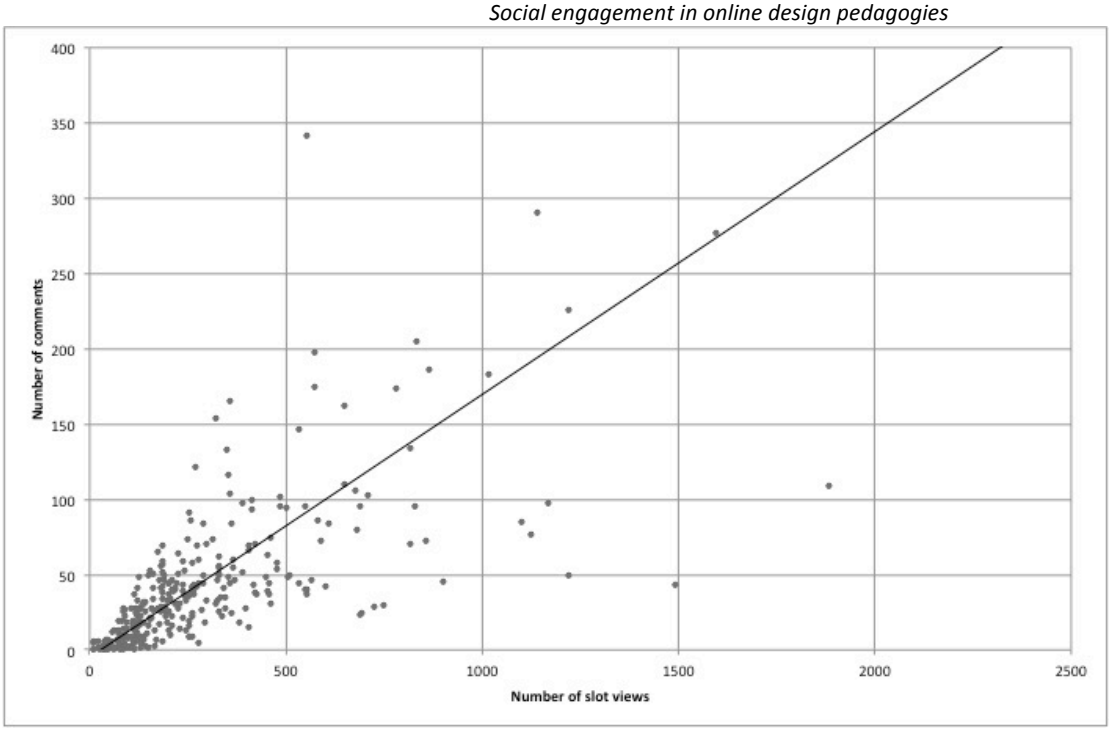

Figure 13 – Correlation between student slot views and comment

Discussion of engagement and interaction

As a result of this statistical analysis, the qualitative analysis of student behaviour and views expressed in the end of module survey the following major themes emerge that shed some light on the ways in which students engage in the online studio.

Time on Task

The results show that students are engaging with ODS actively and using it to complete their work. In fact, most are doing more than directed by the module material. The concept of 'time on task' in learning suggests that "time plus energy equals learning" (Chickering and Gamson, 1987), and this seems to be supported by these findings. The interface design is thought to be beneficial because students have immediate, visual feedback that they are progressing.

It can also be seen that time spent engaging with the online studio by uploading material and viewing correlates to learner success, particularly at the upper and lower ends of the success spectrum. Put simply, engagement by completing, presenting and sharing work is a clear indicator of investment in learning; and that engagement is linked directly to student success, a correlation found in a number of other studies (e.g. Clay, 2008; Allen & Lester, 2012). This is also evident from student comments:

> The whole idea of learning is fun shone throughout the active exercises I posted on the Open Design studio like the storyboard, which really got me thinking about design. (Student 11)

The finding that no student with fewer than 50 slot views achieved a distinction and no student failed who viewed more than this number, is potentially important here, suggesting some minimum level of engagement that may exist, which supports earlier research on online studios and performance (Robbie and Zeeng, 2012). This, possibly obvious, finding, has a very simple application to the practice and theory of virtual studios – engagement (and thereby student success) can be supported through activities in and around an online studio.

Listening in

Another form of engagement is viewing the work of others on the same task. Whilst 'lurking' is often viewed disparagingly, students emphasise the value of sharing and viewing others' work:

> … display the best possible amount of work (… and to) gain an understanding of other peoples work/participation.
>
> … upload my ideas and designs so that other people could view them and feedback on them. (Students 01, 13)

Statistically, the correlation of viewing and success is slightly weaker than the correlation of uploads and success. This may suggest a sub-group of students who prefer not to engage by commenting but who are still very much engaging by viewing and observing. Understanding their motivation for doing so is essential in understanding the basic operation of an online studio.

Cennamo and Brandt (2012) found the value of 'listening-in' to expert crits in a physical studio as important as reflection in action (receiving feedback on own design from tutor). There are no teacher-experts involved in the ODS studio but the qualitative analysis of outliers, identified student-experts. These students were seen as valuable contributors whose conversations were listened into. These high frequency commenters appear to take on an 'expert' role in providing appraisal across a wide range of their peers, including weaker students. The sheer number of views indicates that others see those comments. Though the extent of interaction depends on whether this is acknowledged and responded to (also see section 'A stable core network'). The level of cooperation and willingness to share in this environment contradicts the assertions of Shih, Hu and Chen (2006) that students primarily view one another as competitors, at least in the Open University context.

We conclude that in the absence of teacher-experts, students find value in viewing other students' work and engage in peer-to-peer comparison activity (e.g. Festinger, 1954; Gilbert, Giesler & Morris, 1995). Again, this is supported in student feedback:

> Secondly, it allowed me to view other people's work so that I could see what techniques they were using that were different to mine. (Student 01)

Whilst this study could not examine these peer comparison activities in sufficient detail (this would be a significant piece of work in its own right), we can conclude that students are engaging both 'actively' and 'passively' in social learning. One of the reasons they do this is the value they perceive in peer comparison and self-evaluation.

The intensity of use of ODS demonstrated in the findings supports this: students would not use ODS as they do unless they saw some value in doing so. Again, for theorists and

practitioners in virtual studios this is an important consideration to take account of. The debate about online community may still be on-going, but online social mechanisms are definitely in operation and visibly active.

Quick social engagement

The 'quick' social tools provided in ODS are reasonably well used but not as much as expected in the original design. Students used the 'made me smile' button most (15% of slots); and Inspired and Favourited least (6% and 4% of slots respectively). The intention behind these markers was to allow all students to engage quickly and easily at some level as a social group, something that can be a challenge in online distance education. But the findings suggest that students actually seek more valuable social interactions in this type of environment, like those listed above, analogous to a finding made by Weaver and Albion (2005) in relation to social presence and online social engagement.

Use of the 'Feedback request' feature is relatively low with only 6% of slots having a feedback request marker applied. Students can be reluctant to ask for help directly for a variety of reasons. According to Joel (2007) appraisal seeking is a very personal matter, e.g one would not shout to the entire studio for help, but go to specific individuals who have been recognised as helpful and trustworthy.

It should be noted that students also make use of other spaces to ask for feedback, possibly preferring to use more conversational methods then simply pressing a button. For example, help requests (often with specific details) are observed in forums (main, tutor group and café) as well as via social media channels such as the U101 Facebook group. Further research into the spaces where students seek informal critique is required to fully appreciate how this mechanism expresses itself online.

Comment to conversation

Students are only directed to comment on other students' work twice in the module but are encouraged to develop this practice. The ratio of comments (17,844) to slots completed (20,021) shows students do not comment on all uploads, as seen previously, only 7% of all slots have comments attached.

Given the volume of information produced this is not surprising - for each slot to get 2 comments would require students to make 100 comments each. Interestingly students in the top quartile of our dataset did make 100+ comments each and some considerably more. This may relate to the observations made by Wang et al (2012) that not all the online content receives the same amount of user attention. Where there is a large selection of content, users of online media only pay attention to high quality content. Although not the only indicator, content that already has a number of comments often attracts more which may lead to a conversation thread. High quality content is thus more likely to achieve a critical mass of comments.

It was discernible that high quality uploads stood out from others because of the strength of image or an unusual approach to the task. A thorough classification of high quality uploads is far beyond the scope of this paper. The authors in support of other scholars (e.g. Wang et al, 2012) believe that this is worthy of systematic investigation.

Interestingly, the qualitative investigation noted a slight difference in attention focus between student groups. Amongst the more successful students conversation and reflective interaction could be seen as students discussed artefacts and questions raised,

whilst, with less successful students comments on posts were less likely to lead to conversation, and where they did so this conversation was more superficial and social in nature. At one point in the module, all students were required to communicate and collaborate with one another to find a problem to work on as the basis of a piece of assessment. Though all students received comments on their uploaded problem statement, from every peer in their allocated group, only amongst the high commenting group, was conversation, rather than disparate commenting seen.

Posts that were examined qualitatively demonstrated that reciprocation and timeliness mattered most. That is, if comments were responded to (meaningfully) this increased the chance of a conversation emerging. But this response has to happen within a limited time frame – a comment that is not responded too in time (no matter how valuable) will not lead to conversation. Timeliness corresponds to the fact that the module follows a weekly schedule of study. Activities and associated ODS uploads are generally done within a certain time frame, nevertheless students are free to study slower or faster if it suits them. Finally, if the conditions of reciprocation and timeliness are met, there is evidence that conversation momentum takes over – i.e. that more attention is paid to the emerging conversation. This is probably due to the investment made by students involved as well as it being seen as an active event in the studio. This notion of commenting momentum is one that has analogies in other online social tools (e.g. Weaver and Albion, 2005; Donelan, Kear and Ramage, 2010). Again, in terms of theory and practice, knowing that such momentum is required should inform learning and teaching design as well as online tuition activity. The potential of translating approaches and methods from other online social environments that have similar requirements should also be recognised.

A stable core network

Through close examination of the ODS portfolios of students who make a high volume of comments, it was noted that these students interact with one another, creating an in-group or core social support network characterised by their commenting behaviour. Joel (2007) also observed core networks of appraisal (seeking and giving feedback) in the physical studio and points out that higher grade students seek and provide feedback more than lower grade ones, this can also be observed in our data (correlation between comments and rank).

However, high volume commenters are also seen outside of their core network commenting on peers across the range of both engagement and success. In the main population of students, one or two comments are seen on high quality or humorous uploads, but there is little or no conversation around posts because the owners of uploads do not respond the comments made. This is in contrast to the core network of high commenters who not only give comments but also pick up on the replies to their comment leading to a conversation on the uploaded design work. In addition to thread length and topic, tie-strength influences the scale and depth of commenting. Tie-strength is the strength of relationship between individuals in a network (Granovetter, 1973). If a student from the normal population is not part of the core group (or has a weak tie-strength) conversations are less likely to occur.

The follow function, which was intended to assist in social network construction, is, in practice, infrequently used with only 4% (12 students) having more than one follower. This may be a problem of interface design or understanding of the function. Despite this, the

depth of some of the networks evidenced in the qualitative study shows the active construction of networks by students (though not using the tools provided). The follow tool may have negative connotations from social media or be seen as an artificial construct.

In summary, a striking image draws views; if it has already some comments, then there is a good chance that more will follow; but only if students are willing to invest time in responding and discussing to develop strong ties (or potential ties) between themselves and other students. Indeed students commented:

> I found ODS frustrating for the lack of easy threads … It was great for looking, not for building relationships. (Student 10)

Although students do browse their peers' posts, the current interface does not facilitate all students in the establishment of strong ties and engagement in conversation. Students do value and are seen to have a desire to develop social networks as well as design skills. This finding supports similar observations made by Ashton and Durling (2000) that the social aspects of design education should not be underestimated. The social network dimensions of ODS needs to be studied in much more depth than was possible in this paper.

Spectrum of engagement

It has been argued in several places that there is a hierarchy and/or progression for participation in online social spaces (Preece, 2009; Mustafaraj et al. 2011). While Mustafaraj et all (2011) identify a continuum from Silent to Vocal users, Preece (2009) identifies motivations to move from Reader to Leader.

It is outside the scope of this study to look at changes in student behaviour and so conclusions cannot be drawn about possible progression through these ranks. However, individual students exhibited a range of characteristics like those found in these hierarchy and/or progression models. For example, at one end of this spectrum we see students who hardly engage and rarely interact; at the other, students who view thousands of slots and make hundreds of comments. This finding is partially evidenced by the strong correlation between viewing slots and commenting on slots. Whilst we cannot state a causal relationship between viewing slots and commenting, we can say that one certainly follows the other. The affordances of OpenDesignStudio support the types of behaviour we might wish to encourage in an online studio.

It could be argued that it is not entirely necessary, in entry level study to have students advance from reader to leader in order to increase learner success. Lamer (2009) posits that for entry-level study (and especially in online, distance education), it is valuable to have students interact simply and realise that they are not alone. From the results in this study, it is clear that ODS is an online environment that can assist with this facilitating the finding of likeminded peers in the online studio.

Students who reflect on their own work, providing commentary on their posts and identifying issues, problems or insight into their design process are more likely to provoke comment leading to conversation than those who use no, or minimal description or refection of their work when posting artefacts. This reflection may help peers to identify like-minded students and may be an aid to the development of networks. On the other

hand, students who use the interface to post humorous or social images and descriptions are most likely to provoke humorous or social comments in response.

Conclusions

We started our investigation with the question: what kinds of engagement and social interaction can we observe without an expert being in the online studio and how might this relate to learners' success? We observed a good positive correlation between engagement and interaction in the online studio and student success. We also identified six themes of engagement and interaction with peers in the online studio: Time on task, Listening In, Quick Social Engagement, Comment to Conversation, A Stable Core Network, and Spectrum of Engagement. Each theme was seen to contribute to student success.

Successful engagement in the online studio needs to be situated within the structure of the online Design Thinking module. Many students come to the module with prior professional knowledge (although not necessary from design disciplines). Before engaging in the studio, the students' learning is structured through readings and skill building tasks. Although tutors are not in the studio to give expert advice, students receive expert tutor feedback on their assessed work, which is also uploaded to ODS. In summary, peer learning is about learning how to 'judge the accuracy of information' (Boud, 2001). The module contents and activities outside of the studio and the student's prior knowledge and experience, guide judgement of the accuracy of information given in the studio (uploads made and comments given). Without these prerequisites, peer learning in the online studio would not work.

This work has shown that, perhaps unsurprisingly, there is a spectrum of social and academic engagement; that a high level of engagement is dependent on many of the factors observed in other online social spaces (such as critical mass) as well as a few key studio-specific ones (such as reflective practice). It has been shown that engaged students seek one another out and re-enforce each other's behaviour through frequent, interactive engagement. This behaviour is informed by the usefulness of the engagement that students experience. In the absence of immediate 'expert' feedback in the studio, students make use of (and develop) their own expertise through their prior knowledge, the guidance and cues provided by the module material and prior engagement with tutors outside the studio.

The overall message from this analysis is clear: social interaction and peers learning is not only possible in online studio environments, it is something that is actively constructed and sought out by students. Social learning mechanisms represent one of the oldest and most natural pedagogies and online studios, one of the newest forms of human interaction, offer novel opportunities in which such learning can take place.

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