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PILOT INTEGRATING VISUAL PLATFORM IN ONLINE COURSES

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Abstract

Being able to share visual course assignments and provide and receive personal feedback is essential in most studio design courses of Delft University of Technology. With the rapid growth of online and blended education teachers are confronted with the challenge of maintaining the same quality for this aspect of their teaching as in traditional face-to-face design courses. Looking for interactive ways to train creative skills in their courses, teachers found that the available WEB 2.0 tools were unsatisfactory. We mapped the requirements and found that Sketchdrive, a platform for sharing visuals, seemed to meet many of these requirements. We developed a course design integrating the visual platform Sketchdrive and collaborated with Sketchdrive to improve the platform. This resulted in a pilot project, including 3 MOOCs and 2 campus courses. This paper elaborates on the pilot project. We show how the visual platform is integrated into course designs. Next, we compare student and teacher experiences based on the results of surveys and interviews. Furthermore, we discuss differences in the blended campus courses and the online courses. In conclusion, we consider what still needs to be improved for better aligning the visual platform to our course designs. Finally, based on lessons learnt, we provide recommendations for integrating visual platforms in the course design of higher education studio design courses.

Keywords: online learning, blended learning, studio design education, higher education.

1 INTRODUCTION

With the growing number of blended and online courses design instructors at the faculty of Industrial Design Engineering and the faculty of Architecture of Delft University of Technology (TU Delft) started looking for ways for students to share their visual work online. Facilitated by the TU Delft Extension School a study group was formed to look into the needs and possibilities.

Initial experiments were conducted with Pinterest in Massive Open Online Courses on edX, such as the first runs of IMAGE | ABILITY - Visualizing the Unimaginable [1] and Urban Design for the Public Good: Dutch Urbanism [2]. Findings from this experiment, together with the wishes and needs from instructors of other courses were translated into requirements for creating a new tool or finding one that already fulfilled the needs.

We looked into several existing tools and compared them to developing one in-house. The local tool provider, **Sketchdrive**, was chosen since it is a Dutch company complying to Dutch legislation on data storage. Also, it was founded by instructors from different faculties of TU Delft and they were interested to collaborate. A larger third-party tool provider might not have been so keen on co-developing a tool because of the wishes of its other clients. The Sketchdrive tool was subsequently tested in a new MOOC on edX, Rethink the City: New Approaches to Global and Local Urban Challenges [3]. Results from this first test course were included in the list of requirements and development goals were drafted for the tool provider Sketchdrive. Next, the tool was tested again in various courses in the pilot project, which is the subject of this paper.

The aim of the Sketchdrive pilot was to find out whether this tool could be used for sharing visuals in TU Delft campus and online courses in a satisfactory way.

Also, we were interested in the effect using such an online image sharing tool would have on the feeling of engagement and community.

This case study reports findings from the Sketchdrive pilot project. We first provide a short background on studio design education in general and the TU Delft approach. We describe the methodology we used and how we organized the pilot project in section 2 and then present our findings in section 3. The concluding section discusses how the tool was used in the TU Delft courses and future implications. Finally, recommendations are made for further improvement of the tool.

1.1 Design education background

For hundreds of years the physical studio has been the place where design education takes place. The learning process mainly consists of the master modeling and teaching the student to deal with the complexities of the design process. In the meantime, the student is learning to design by doing it through trial and error and exploration. Students also learn by viewing what their peers are doing and by being part of the community of designers. Various theories have described the influence of the studio setting on the learning [4] and it is clear that the process that takes place here needs careful consideration when designing online design education.

George and Walker [5] show that previous research identified both benefits and constraints of online design education (or Distributed Design Education) and that while DDE can be effective, the take-up by design faculties has been slow. Their study concludes that this is due to the concern that the social interactions that occur within the physical design studio are not possible in an online environment. Therefore, they propose to build a virtual design studio applying the social learning theories to online design pedagogy in order to create a social learning environment that can support the social framework of the design studio.

At TU Delft the Architecture and Industrial Design faculties provide mostly design-related programs. The core of the curriculum of various programs at these faculties is defined by learning in Design studios. Other faculties, for example Aerospace Engineering, also provide design courses. All such design courses put the students' design process central. The design object plays a key role in the educational discussions between instructors and learners and in peer conversations. Therefore, the design studio is often scattered with design media, physical design artifacts, prototypes, models and images. Physical and digital media go hand in hand. In an online version of a design studio, such media should get their online representations. Online repositories for images should not only function as databases, but they should also appear on screen in such a way that they enable valuable interaction: exhibition, sharing and feedback.

The green arrows in Fig. 1 show how the educational starting points of Design and Project Education at TU Delft tend to be related to current learning theories. This links to the discussion above as it shows that our Design and Project Education is iterative (cycle of knowledge development) with a learner follow yourself approach (trial and error and exploration). Furthermore, it focuses on learner-master-learner and takes place in communities of practice (meaningful situation).

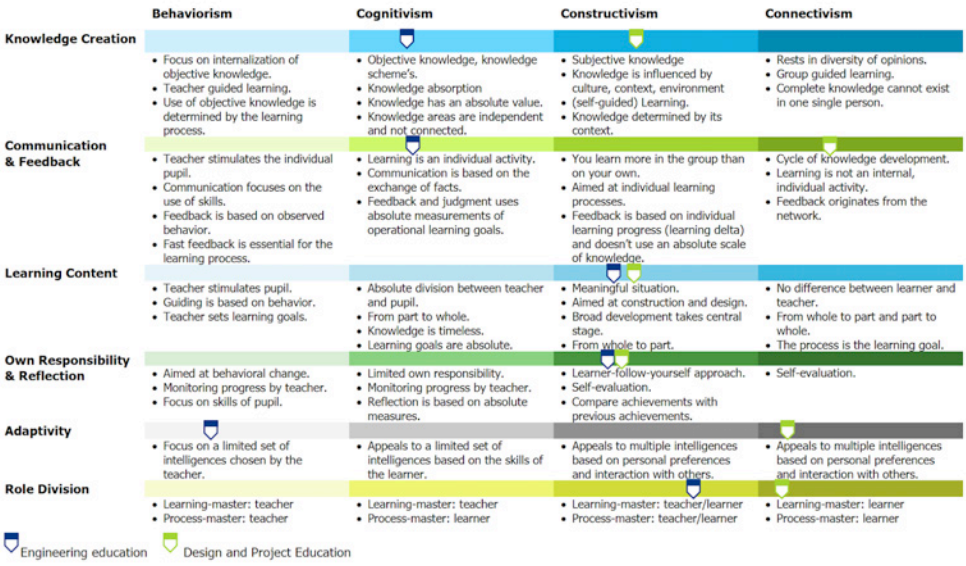

Figure 1. Educational taxonomy TU Delft [6]

For this project, our approach is not to build a Virtual Design Studio, but instead, find a suitable tool that can be integrated in the online learning environments that we use in our campus and online courses. In this way we can increase the number of available tools while maintaining the look and feel of the course environment. Many processes in design education rely on visual presentation, shared viewing, commenting and making annotations. For our online education we need to find, define, test and develop techniques that adopt, mimic or surpass the traditional affordances of a design studio.

This means that we need to find a platform where students and instructors can interact both on a content level and on a social level. It still appears to be a great challenge in online education to create such social interaction to stimulate learning [7]. Much research has been done into the role discussion forum can play in online learning [8-10] and we consider being able to share visuals and give online feedback will also create opportunities for interaction and engagement.

2 SKETCHDRIVE PILOT PROJECT

2.1 Methodology

This case study reports the findings of the Sketchdrive pilot project that was conducted at TU Delft from May 2017 to March 2018. In this exploratory case study we examine how the implementation of the Sketchdrive tool in design courses can contribute to teaching blended and online design courses. The use of a case study method is appropriate because it can provide an in-depth examination of the tool implementation in the courses selected for the pilot project. This approach can provide a holistic account of the phenomenon under investigation [11] and is used when we are aiming to find out what is happening, seek new insights and generate ideas and hypotheses for new research [12].

The study relied on three primary sources of data: (a) student and instructor surveys (b) interviews, and (c) Sketchdrive hard data.

2.2 Questions

The pilot project addressed the following questions:

How can the created interaction using an online tool to share visuals in design courses be compared to and used in the same way as -or- in combination with traditional face-to-face education methods?

What is the effect of a visual (feedback) tool on learner's processes when applying it in online education? Does using a sharing tool for visuals in online education, such as Sketchdrive, influence (the feeling of) engagement and community?

Other questions that were taken into account:

- Do learners find this way of interacting and learning satisfactory?
- Is the way in which feedback is given comparable to the way it is done in a live setting?
- Does the technical functionality meet the requirements requested by the teachers?

By evaluating our findings we hope to get an answer to these questions so we can make recommendations for continuing the collaboration with Sketchdrive and for integrating such a tool in design education.

2.3 Pilot project

In a study group of some 15 TU Delft design instructors and learning support staff the ideas and wishes for a visual tool were discussed in several sessions in 2016 and 2017. A core team was installed to summarize the results and develop a plan for further action. A next step was to evaluate the first experience with Sketchdrive in the Rethink the City MOOC [3] in 2017. Based on the results the decision was made to conduct a pilot project using the Sketchdrive tool. The purpose of the pilot project was to collaborate with Sketchdrive to see whether they would be able to deliver what was needed according to the study group. After Sketchdrive implemented adaptations to the tool, it would be tested in a variety of courses, both online and on campus. Positives results, both from the learner and instructor perspective, could result in the purchase of an institutional license and continuation of the collaboration with Sketchdrive.

2.3.1 Pilot Planning

In May 2017 the core team started official preparations for the pilot. Fig. 2 shows the planning. The first step was to decide on the criteria to use for evaluating whether Sketchdrive would be the tool that we would recommend for the institution to purchase (see 2.3.2). Sketchdrive was asked to adapt the tool based on the evaluation of Rethink the City [3]. Next campus and online courses were to be selected that would be used for pilot evaluation. In addition, we considered the course design implications (see 2.3.3).

In order to evaluate the pilot we created pre- and post-surveys for the learners to evaluate their experience and surveys for the instructors. We also planned to use the feedback from meetings with the instructors and with the Sketchdrive team as a source. (see 2.3.4).

And finally, we set an end date to evaluate the pilot project and decide whether to continue with Sketchdrive.

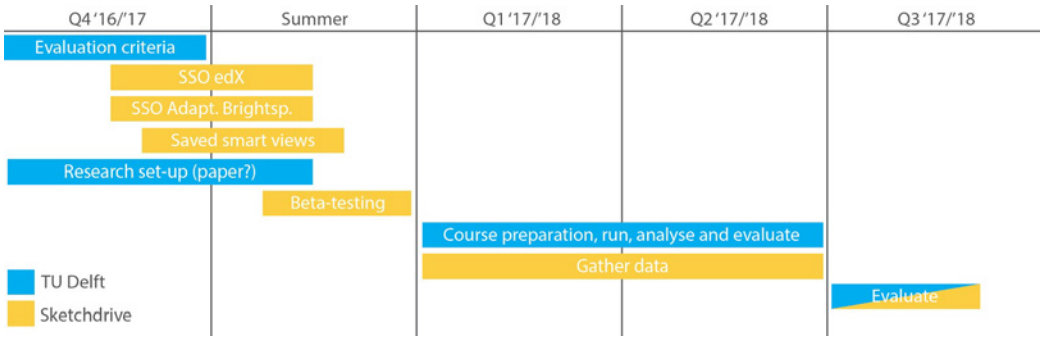

Figure 2. Pilot Planning

2.3.2 Sketchdrive requirements

When mapping out the project success criteria, the learner experience was the first focus. Fig. 3 shows the list with final criteria to evaluate the project with the target metrics and acceptable values.

We needed a seamless integration with our courses so the look and feel of the course would remain intact as much as possible. Furthermore, learners should not be hindered by having to go from one platform to the other. Another aspect to consider was that using the tool should be easy both for the learners and for instructors. Creating smart views that can be embedded in the course, giving feedback, filtering to find the work of a specific user or assignment: all should be as intuitive and user-friendly as possible.

From a technical point of view the performance needed to be fast to ensure a better user experience. If users have to wait for their visual or feedback on someone else's submission becoming visible, their experience will not be optimal. Moreover, the collaboration with Sketchdrive should be such that users with technical issues can receive timely support from Sketchdrive so that they can continue on our platform. And last but not least, we considered it important that Sketchdrive staff would be open to our feedback and continue to improve their tool using the feedback we provide.

Evaluation Criteria Sketchdrive Pilot

Category	Measurement description	Target metric	Acceptable values
Integration	1 - Users can sign in to Sketchdrive from other platforms without having to log in again. 2 – An administrator/teacher can setup the integration by him/herself 3 - For students it is a seamless integration between the LMS and Sketchdrive	• edX • Brightspace • edX Edge • Proffed (open edX) • Integration set-up with the learning environment • First time use is easy and very logical • Use after this is seamless and doesn't give any errors and the aim is to generate a minimal amount of (technical) support questions	1 - This category should be a yes (user testing) 2 – A survey produces the result that an administrator/teacher finds the setup of the integration easy. 3 – Surveys produce a significant ' yes ' to the previously mentioned questions
Smart Views	Users can create random personal collections manually and/or with use of the filter, by adding visuals to the / their collection at any given time. (course owner can share this collection in the instructions)	Collections can be: • Saved and recalled • Modified and saved again • Shared • Embedded in course platform and automatically updated	A survey is used to gather data on whether or not users find this functionality; • A user-friendly way of saving, sharing and embedding • An intuitive functionality (a user doesn't need a manual to know how to do this)
Feedback	1 - Users can give feedback on visuals, in text box, and by liking. 2 - Users are notified when they have feedback on their visuals. 3 - Users can check feedback by using the filter.	• Feedback threads per visual • Notifications of feedback • Filter function	• Feedback threads should have more than 1 level but no more than 4 levels. • Notifications do not need to be sent but they are visible in the course in Sketchdrive. • Filter function to view most replies & most likes
Performance	1 - Users shouldn't need to wait too long for a webpage to load. 2 - A user needs to see direct result of an action, after a click, the webpage should start loading. For longer loading time visual feedback on the progress is shown.	• Loading time • Bounce rate • Bandwidth	A performance test is used to assess whether or not: • Loading time is less than 5 sec. Per page in the Netherlands with an average bandwidth • The frame should be visible within one second, the first batch of images (visible on screen) starts loading immediately afterwards. • A user experiences more or less the same loading time on every page that's visited (it was experienced that it will take around 1 second for a page in Sketchdrive to load. When a project containing 1800 visuals was entered for the first time it took 25 seconds to load the page and 6 seconds for loading the same page a second time; this should be improved). • Visual feedback of the progress of loading the page is given.
Satisfaction	1-The teacher would recommend this tool to fellow teachers 2- The student scores his/her appreciation of this tool higher than 8/10.	• Teacher survey • Learner survey	A survey is used to assess whether or not: • More than 75% would recommend the tool to their colleagues • Average student rating of the tool is 8/10 or higher
Collaboration with Sketchdrive	The cooperation with Sketchdrive is pleasant	• Low amount of technical questions (from our side/student's side) • Response time is appropriate	• Technical questions are less than one in fifty students. • Response within 24 hours on working days, 48hours during weekends.

Figure 3 List of requirements

2.3.3 Courses and course design

Several criteria were used to select courses that were to be part of the pilot project. First of all, the courses should have a visual aspect that is core to the course experience. Second, we thought it would provide more insight if both campus courses and massive open online courses (MOOCs) were used. The audience for these two types of courses is different and the tool's scalability could be tested. And last, we considered it valuable to incorporate courses from different faculties. This resulted in the courses shown in Table 1.

Table 1. *Pilot courses*

Faculty	***Course name***	***Course type***	***Number of participants***
(pre-pilot) Architecture	*Rethink the City: New Approaches to Global and Local Urban Challenges*	*MOOC on edX*	*9450*
Industrial Design	ID5272 Computersketching	Campus course on Brightspace	60
Aerospace	AE1111-II Engineering Drawing	Campus course on Brightspace	450
Architecture	Image | Ability: Visualizing the Unimaginable	MOOC on edX	3900
Architecture	Managing Sustainable Building Adaptation: A Sustainable Approach	MOOC on edX	2445
Technology, Policy and Management	Entrepreneurship for Global Challenges in Emerging Market	MOOC on edX	2115

Previous research has shown that several factors contribute to the success of online teaching, such as a clear and consistent course design and interaction with course content, teacher and peers. [13] The course design integrating Sketchdrive kept this in mind and focused on the following aspects.

In order to avoid confusion learners should be able to easily go from one platform to the other without needing to create another account or having to log in each time. Therefore, a Learning Tools Interoperability (LTI) component was created in the Brightspace environment to ensure single-sign-on was possible (Fig. 4)

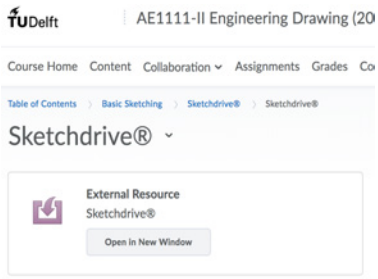

Figure 4. Example of Sketchdrive button in Brightspace

In the MOOCs we also created an LTI component with a button linking the learners to Sketchdrive (Fig.5). The text mentions that the learner's username and address will be used for Sketchdrive but not shared with other parties. Then users are asked to consent that their user name and email address are sent to a third party.

Figure 5. Example of Sketchdrive button in edX

Clear step-by-step instruction texts on how to use the Sketchdrive tool were added in a special section to the course content of each course. In addition, a specific discussion thread was added to ask questions about the Sketchdrive assignments. Learners with technical questions were referred to the Sketchdrive support team.

Furthermore, the look and feel of the course should remain more or less the same. This was achieved by creating courses on the Sketchdrive platform that incorporated the course images, adding feedback videos and providing the same assignment instruction texts as in the edX environment.

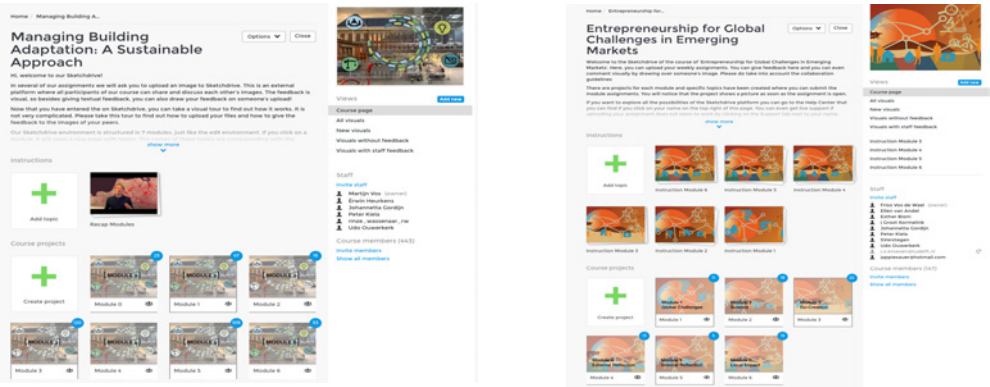

Figure 6 and 7. Examples of Sketchdrive course look and feel

Figure 8. Example of edX Image | Ability course look and feel

An interactive museum image, linking learners to Smart views of the submissions of the week assignments, added to the playful style in the edX Image | Ability course as shown in Fig. 8.

Another important aspect was the grading of the assignments in the MOOCs. Currently it is not possible to connect the edX grading system to Sketchdrive. This was solved by adding checklists to the modules. Students could obtain points for checking several items: uploading an assignment to Sketchdrive and giving feedback to other learners. Instructors selected examples to discuss in feedback videos. They did not give assignment feedback on the Sketchdrive platform. The campus courses are taught in a blended way. In these courses the tool was mainly used for sharing visuals online and instructors would give feedback both on Sketchdrive and in class.

2.3.4 Data collection

To collect data necessary for answering the questions and evaluating the pilot project a combination of sources was used. Questions related to the Sketchdrive experience were added to the pre- and post-surveys used in the MOOCs (a standard practice of the Extension School). For the campus courses, surveys were created incorporating the same questions as in the MOOC surveys. Another survey was created for the instructors that worked with the Sketchdrive tool. The unstructured interviews during meetings with the course instructors provided interesting additional feedback on how they experienced working with the Sketchdrive tool and what they considered should be improved. Statistical data was collected by the Sketchdrive team.

3 FINDINGS

In total, the post-surveys were completed by 82 participants, both students and instructors. In the following section the tables show how the requirements were scored by Sketchdrive users. Fig.9 shows that most Sketchdrive users were able to access Sketchdrive without any issues. Fig.10 illustrates that less than 10% needed technical support.

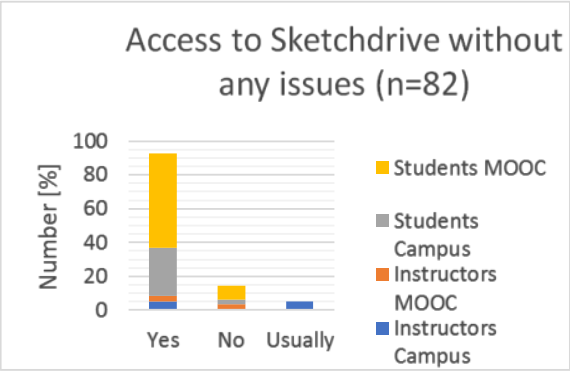

Figure 9. Access to Sketchdrive without issues

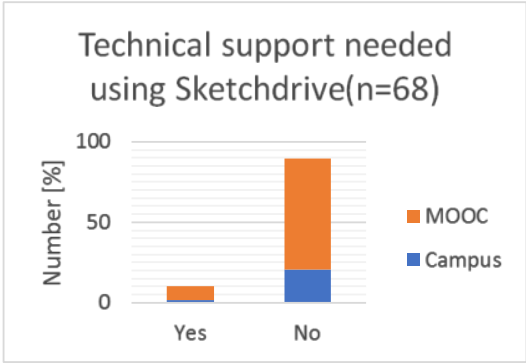

Figure 10. Technical support needed

Fig. 11 shows how students rated the tool as a whole on a scale from 1-10. Fig. 12 provides a more detailed insight into how the students experienced the different features. The scores are sufficient; however, we had set an acceptable value of 8/10 (see Fig. 3 in *2.3.3*) and this has not been achieved.

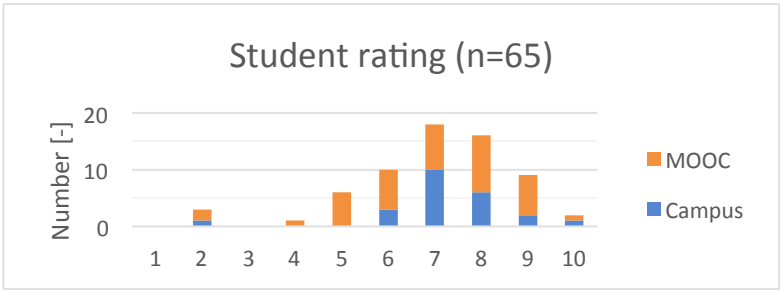

Figure 11. Student rating, mean = 7

We found that in some courses learners used mobile devices more than in others: 60% of Engineering Drawing and 13% of Managing Sustainable Building Adaptation students as opposed to 0% in the other courses. There was a correlation with how they rated Sketchdrive, as their rating was considerably lower. We expect this also has to do with loading time, as images do not load as fast on mobile devices.

Moreover, the Engineering Drawing course ran before Sketchdrive introduced the tag feature. This affected the course design as students could not find uploads as easily. A more positive trend can be seen in the survey results of the courses that ran later. Student replies to the open questions show more positive feedback, such as replies to the question What did you like best?: 'Enjoying the intelligent use of visuals', 'Sketchdrive assignments', 'the museum and seeing everyone's work'.

Instructor reactions have been predominantly positive on the use of Sketchdrive in both MOOCs and campus courses. More than 90% would recommend the tool to a colleague, with some reservations as shown in the quotes in Table 2.

3.1 Feedback

Students rated how valuable the feedback they received was. Fig. 13 shows they thought the feedback was rather valuable, especially textual feedback. This can be attributed to the fact that they received less visual feedback than textual feedback (19% received both visual and textual and 6% received visual only). In the MOOCs feedback was given by peers and most assignments did not ask to give visual feedback. Instructors in the campus courses tried to give both visual and textual feedback, however, they mentioned they could not always give visual feedback easily (Table 2).

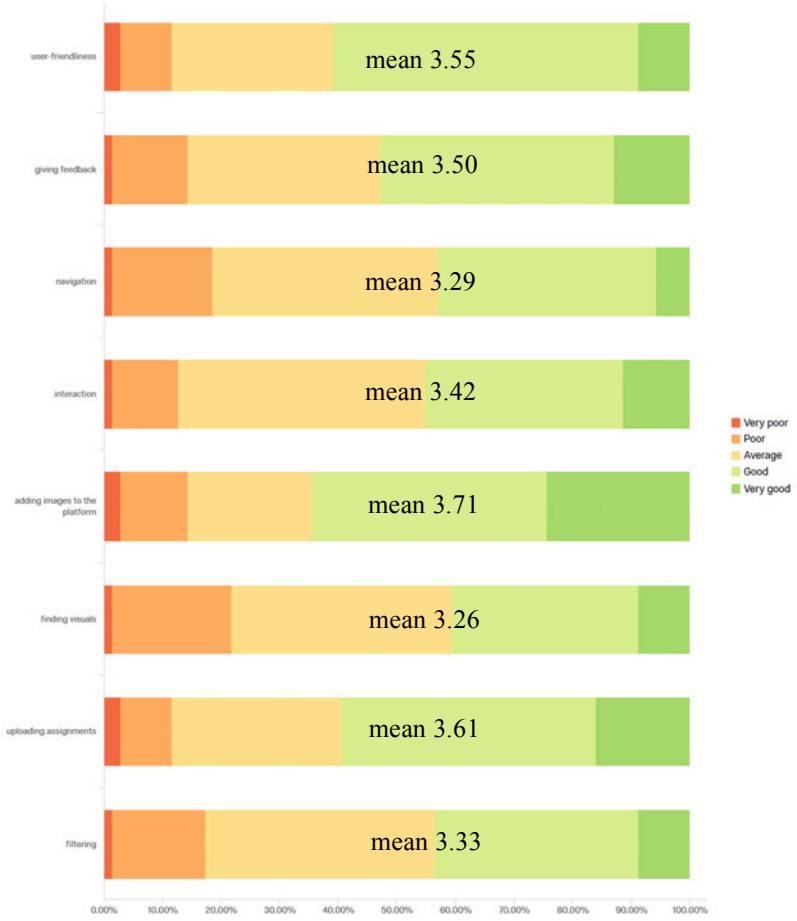

Figure 12 Sketchdrive features rating

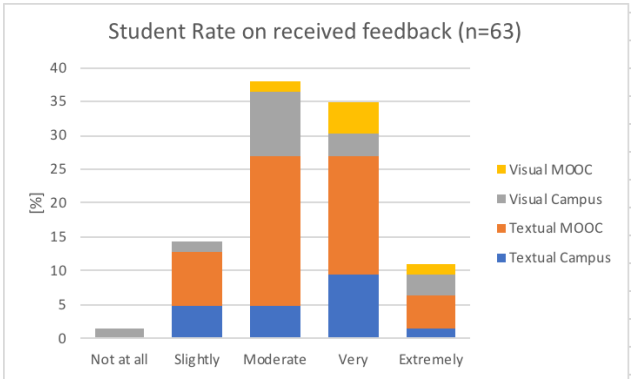

Figure 13. Student rating of feedback

3.2 Community feeling

The survey results have yielded interesting information about the feeling of community in the course as can be seen in Fig. 14. Sharing images and viewing what others uploaded gave inspiration and helped learners do their assignments. It also gave 70% of the learners a group feeling.

3.3 Educational opportunities

To address the question on how using the Sketchdrive tool can contribute to design courses compared to traditional face-to-face courses, table 2 summarizes some of the benefits and challenges that emerged from the data. The table includes quotes from open questions in student and instructor surveys and from interviews.

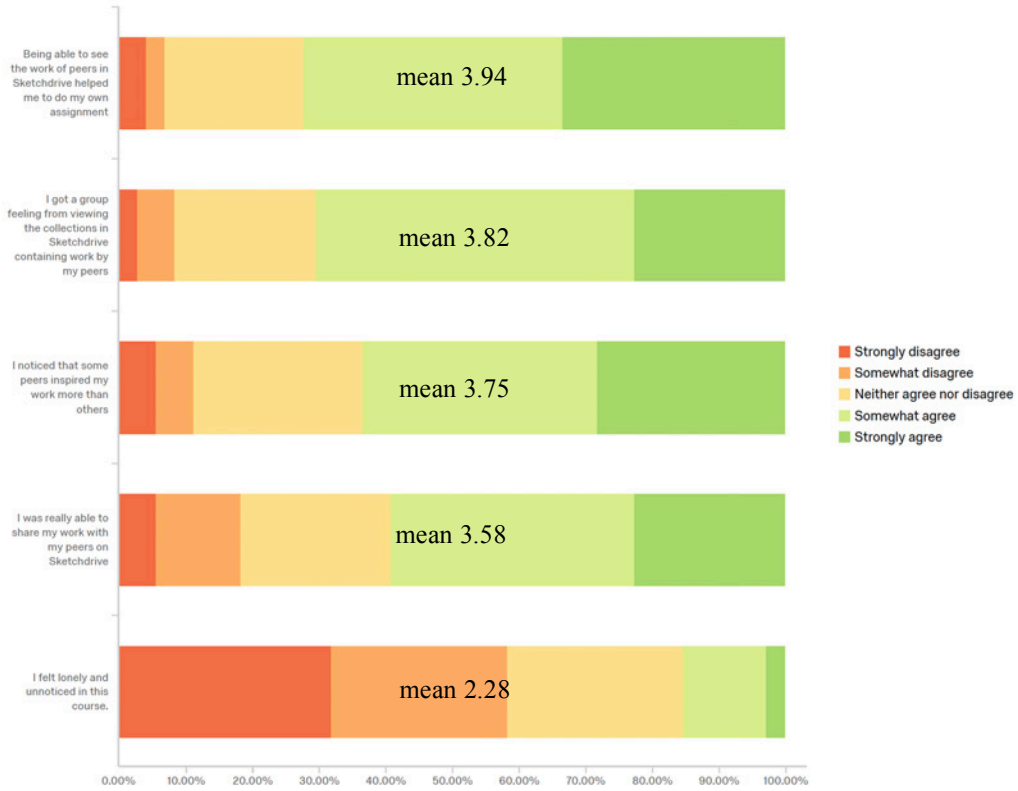

Figure 14. Community feeling

Table 2. *Opportunities of Sketchdrive*

	BENEFITS	**CHALLENGES/IMPROVEMENTS**
1. Sharing	Instructor quote: • *Students dare to share* • *The various uploads provide insight into how students develop their work*	Student quote: • *The website works well for sharing images. My main concern is that it is not very clear what the history of an image is*
2. Stimulating interaction and feedback	Instructor quote: • *Students can see what others have uploaded and provide feedback* • *Digital portfolio enables feedback right away; sharing of content between students beneficial. good indication of general progress and 'problems', enables immediate feedback in classes* Student quote: • It was very convenient for posting photos and for receiving feedback.	Instructor quote: • *Lost overview due to too many students / too many uploads not suitable for bulk feedback work*
3. Technical functionalities	Instructor quote • *Strong combination possible of visual and textual feedback.* Student quote: • The feedback system that uses drawn lines is really useful if you want to explain something. Additionally, the bulk upload is a nice quality-of-life feature.	Instructor quote: • *The limited options (e.g. only red color)* • *Filtering visuals with feedback from a staff member is not possible, filtering on participant feedback is not possible (e.g. to detect student-student interaction)* • *For this moment it was a bit too buggy and unintuitive to add a lot of value. nevertheless, with some tweaking it could add great value mainly in the form of peer collaboration etc.*
4. Time-saving	Instructor quote: • *It saves time as the work is not submitted by mail anymore*	Instructor quote: • *It takes more time than we as staff have*
5. Course design: What instructors would change	Instructor quote: • *Would change approach to reviewing uploads and providing feedback: start sooner* • *Incremental course with pass / fail grading (only)* • *more study at own pace with general class feedback sessions at regular intervals, feedback request function*	

4 CONCLUSIONS AND RECOMMENDATIONS

The results of the pilot project revealed a general satisfaction with the Sketchdrive tool. We found wide agreement among both learners and instructors that Sketchdrive can address the limitations of working with visual assignments in an online course and that it can even provide added value (e.g. community feeling). The study, however, also shows that it is crucial to improve some of the technical functionalities in Sketchdrive. The feedback thread with possibility for multiple posts is already an advantage, however some tweaks are still needed to make it better, such as timestamps.

Furthermore, instructors mention that they would like to see enhanced possibilities for providing visual feedback, such as pens with multiple colors and pressure sensitivity and opacity. Moreover, a feature that allows grading to be linked to the gradebook in an edX course would be a plus.

Some survey results show that more tutorials for students could help them use the tool even better (navigation and filtering) and for the instructors training sessions should be considered to support them with creating even better courses and show them how to integrate the tool with all its functionalities as part of their course and provide feedback in ways that engage their learners even more.

The integration of platforms is extremely important in order to guarantee a continuous satisfactory learning experience. Using the single sign on is a step in the right direction, but learners still mentioned they needed to find out how to navigate the platform as Sketchdrive is different from the learning environment. Except for platform integration, alignment, a consistent course structure and structured assignments are also valuable for creating an effective learning environment on both platforms.

More research could be done to look into whether a positive correlation exists between the use of this type of tool and the number of learners who finish a course.

The collaboration with Sketchdrive on the whole was a positive experience, although some issues needed to be discussed. Agreements have been made to fix remaining bugs and align future upgrades with our course runs.

All in all, this case study shows that the Sketchdrive pilot project can be considered a success and TU Delft intends to continue the collaboration with Sketchdrive.

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