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# Utilising FM Software in Collaborative Design-Learning

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## ABSTRACT

In this paper, we describe a case study of computer-supported collaborative learning in design using FM (FlashMeeting), a Web-based video-conferencing tool offered freely on OpenLearn. This 6-week experiment, involving Open University students and staff, aimed to explore the capabilities of FM software to support several phases of the design process including formulating a design brief, discovering user requirements, setting design specifications, concept generation, design embodiment and implementation of proposed concepts. We conclude this paper with lessons learned from using FM in a design e-learning project.

## Categories and Subject Descriptors

**K.3.1 [Computer Uses in Education]:** Collaborative learning, Distance learning.

## General Terms

Design, Experimentation

## Keywords

FM, Computer-Supported Design Learning, Open University

## 1. INTRODUCTION

The Open University, UK (OU) was established in 1969 to promote and develop distance learning for students with great diversity in education, background, professions and age and who cannot commit to full time study. The Open University offers a unique structure to teaching and learning. Students receive course materials that they study and discuss with their local tutors and small peer groups, through face-to-face, telephone or online discussion forums.

The Design group at the Open University offers several short (100 hour) and full credit (600 hour) courses, including a second level course: 'Design and designing' and a third level course: 'Innovation: designing for a sustainable future'. Together the courses lead to a Diploma in Design [3] [4]. The development of a new first level 600-hour 'Design Thinking' course (U101) will eventually lead to a degree award in design. Such an award opens up the opportunity to improve learners' engagement and experiences in distributed design education. The second and third level design courses consist of printed course materials supplemented with interactive and pre-recorded course elements distributed on DVD and a course web site. The material is mainly studied linearly, with the exception of supplementary worksheets that focus on the development of

students' practical design skills in parallel to the course text.

The course production teams' efforts for the new first level 'Design Thinking' course concentrate on the exploitation and further development of the University's Virtual Learning Environment (VLE) to support a non-linear learning experience. In this model, which aims to better reflect design practice, learners not only develop design skills and knowledge but create and co-create design artefacts both individually and with fellow students.

The Web 2.0 resources provided by OpenLearn (<http://www.open.ac.uk/openlearn>), the OU's Open Content Initiative, offer a unique opportunity for highlighting non-linear, collaborative and interdisciplinary design learning. These resources include FM, a browser-based application using the Adobe Flash 'plug in' and Flash Media Server [5] that was developed by The Knowledge Media Institute (KMI) at the OU and is freely available on OpenLearn. This synchronous communication software comprises video chat, text chat, voting and whiteboard functions among others.

This paper reports on the utilisation of FM software in a design learning experiment that was part of a broader piece of research in the area of engagement with Open Educational Resources [1] One of the objectives of this research has been to explore ways in which OpenLearn, can contribute to course development at the OU by providing a platform for experimentation and trial of new ideas [2].

## 2. CASE STUDY

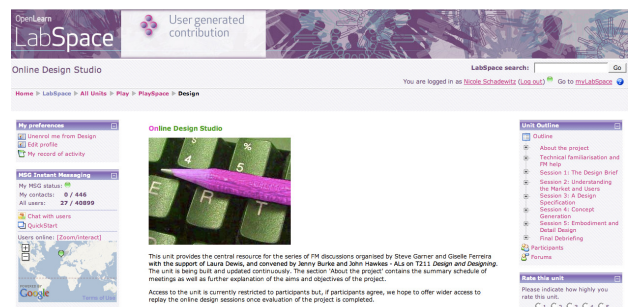


Figure 1 Online Design Studio in OpenLearn LabSpace

### 2.1 Setting

Initially 6 students, 2 Associate Lecturers (tutors) plus 2 'observers' enrolled in the experiment. A senior design lecturer acted as group moderator. The student participants were drawn from the current second level design course so had some familiarity with design processes. The aim was to use FM to collaboratively design a sustainable domestic product. A design brief, project outline and asynchronous message board discussions were also accessible via the Online Design Studio

in OpenLearn LabSpace (Figure 1). The participation in the project was voluntary and non-credit bearing.

## 2.2 Learning Task Outline

This project asked the students to consider the problems and issues of energy usage in UK homes and the opportunities provided for new consumer products through renewable energy technologies. Students were asked to gather some data on domestic energy use, new and emerging lifestyles and renewable energy technologies in order for the team to be in a position to make a proposal to design a specific domestic product. Thus the students' brief was partly to design their own design brief - and then to set about resolving it.

Deliverables were a graphic presentation and a 200-word explanation of the proposed design outlining its key features and identifying how it addresses the requirements that have been identified. The task was structured into 6 group discussions that were held for one hour once a week. Students and tutors also conducted some independent research on each topic in advance to present to the group in the following meeting.

A project outline was set up, and meetings were scheduled in a series of 1-hour sessions:

- Technical familiarisation and FM help
- Session 1: The Design Brief
- Session 2: Understanding the Market and Users
- Session 3: A Design Specification
- Session 4: Concept Generation
- Session 5: Embodiment and Detail Design

## 3. OBSERVATIONS

The observations are grouped into 3 categories:

- Organisational aspects (**OA**), such as availability and training/instruction;
- Pedagogic aspects (**PA**): such as briefing, structure, and scaffolding;
- Interaction aspect (**IA**): such as engagement of students/tutors with tool and modes of interaction.

### 3.1 Technology Familiarisation

Before the technology familiarisation meeting, web cams were sent out and installed by the participants in their homes. Students and staff were asked to create an account on OpenLearn, enrol on the project, write an introduction about themselves and post it in the Online Design Studio OpenLearn space. The studio space contained links to each FM session.

**OA:** The initial session allowed students to become familiar with the technology and special features of FM. All 11 participants were present plus one technical advisor. First, hardware (camera and microphone) problems were surveyed. Features of FM and LabSpace were explored/explained.

**IA:** FM functionalities, such as "raising hands" to join the cue to be the next speaker, voting, whiteboard use, were tested. Participants varied in their perception of ease of use of FM. The feature of raising the hand and cuing up for an allocation of speaking time was confusing. Students expressed additional confusion about FM usability, such as logging out (accomplished by closing the browser window). Many participants preferred receiving individual emails instead of

reading messages only on the LabSpace forum for preparing for following meetings.

**PA:** Students reported after the first technology familiarisation session that ice-breaking exercises and introductions were insufficient. This stumbling block was made up for in the next session where the design brief was discussed.

### 3.2 Project Briefing Session

**OA:** 3 tutors and 3 observers, but only 5 students participated in this first design session. No whiteboard was offered in this session.

**DA:** The first design session proper began with an introduction to the collaborators background and expectations of this project. Most participants joined this experiment out of curiosity about group design work in distance learning. Most participants had design or engineering related professions and, as noted above, they are also part-time students of OU's second level design course. One student expressed some concerns about distributed synchronous collaboration arguing that "it puts one on the spot for immediate response or action" and "it gives less time and space for reflection". Others had fewer concerns.

The group moderator shortly introduced the scope of the design project. He stressed that this project should not focus on any preconceived design solution. Instead, collaborative ways of problem finding as well as evolving creative alternative solutions should be explored. Next, the moderator initiated a discussion about interpretations and ideas around the topic of sustainable energy generation and reuse. The discussion was similar to a brainstorming exercise and was summarised by the moderator. During the closure of this session, negotiations about what should be done in preparation for the next meeting were held. While the moderator intended to leave those decisions to the students, students expected the moderator to tell them exactly what to do. This contradiction reoccurs frequently in design education settings (distributed or co-located). While students expect strict guidance and frequent feedback from tutors, tutors expect self-directed learning and taking of responsibility for design decisions. Tutors often encourage students that there is no right or wrong decision in early design stages. All possibilities should be kept in mind. Problem finding in design requires an open mind-set and initiative from all collaborators. However, students can expect orchestrated interaction in learning environments. Determining an appropriate level of scaffolding in design learning remains a controversial topic.

**IA:** Thumbnail video images were perceived as too small when the whiteboard tool was added to the meeting. An interesting observation was the use of the replay feature in FM. Although each collaboration session was recorded and could be replayed by all participants, the moderator took notes of the meetings independently. These assisted moderation but one student asked for those summaries, so that he didn't have to replay the entire recorded session. It might be that the recording and replay function serves an important function to inform participants who miss a session [4]. However, this was not clearly observed in this experiment.

### 3.3 Understanding the Market and Users

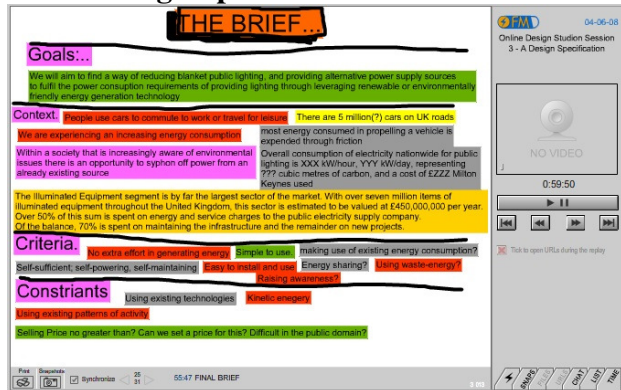
**OA:** Session 1 ended with a distribution of voluntary tasks including researching ways of utilising human generated power. The scope and direction of research task was left open. The session moderator changed in this session. 2 tutors and 2 observers were present.

**PA:** Students completed some research before the second FM session. One student presented an example of a human powered roundabout toy that pumps up water from a well when children play with it. He uploaded a jpg picture to the whiteboard. Others explained verbally what they found or input links into the chat field. All findings confirmed that human power couldn't generate much energy. More alternative ideas were presented. Students felt overwhelmed by the wide variety of ideas offered and wished to focus down on one idea, which was less technologically focused, because they felt they were not knowledgeable enough to judge the breath of those ideas. After this tutors encouraged the group to vote on favorite ideas so that a design brief could be formulated. However, students felt they had too little information to make a decision on which direction the project should go. One student, who had some clear ideas, felt that he would not like to take the lead, because that was a tutor's role. Tutors, on the other hand, wanted students to reach a group decision. Meta discussions about the perception of differing aims of students and tutors evolved in this experiment. Difficulties of negotiating a common design aim in video chat were discussed.

Participant feedback at this stage refers to an 'intimidating medium'. There was some consensus that FM was difficult to handle for participants who are new to the medium as well as new to this particular design topic. A tutor suggested following a simpler design idea, so there was less pressure on the participants. More ideas were generated and compared to earlier ideas but no consensus could be gained. Participants wanted to focus on reducing the energy need to provide blanket public street lighting. Everyone agreed to look into this area and refine the brief on his or her own through research into market and user needs. Perhaps a larger pool of students would facilitate a more animated discussion.

**IA:** Student participation differed from week to week. Some suffered illness, some had technical problems and others felt they did not know enough about the topic in order to contribute to the discussions. A meta-discussion on how to discuss and make decisions in video conferencing software occurred. These issues slowed down the democratic decision-making. Parallel chat conversations sprung up to facilitate the needs of students that lost their voices due to illness or technical problems. Regardless of the synchronicity of interaction, a design brief beginning was negotiated in the parallel chat and spoken discussion. Once everyone had agreed on an idea, it was visually presented on the whiteboard. Here, the whiteboard served as visual decision-making tool when parallel discussions in chat and speech were held. However, image scaling and text display were perceived as limitations of the whiteboard.

### 3.4 A Design Specification



**Figure 2** Use of whiteboard to compose a design brief

**OA:** In the third session only 2 students, 2 tutors and one observer were present. There was a new moderator to the session.

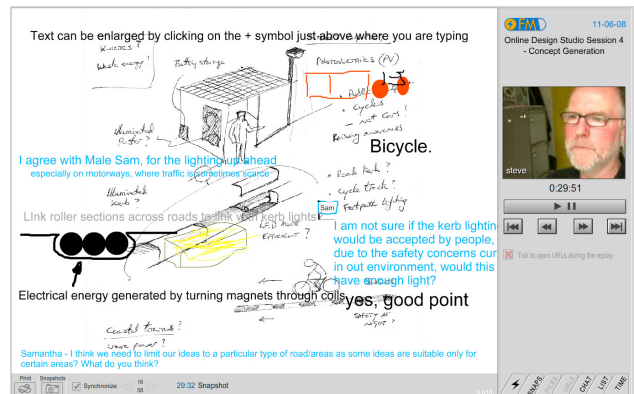
**PA:** In this session, the participants' task was to flesh out the design brief defined in the previous sessions. The moderator tried to structure the session by summarising what was done before and what the goals for this session might be. Pre-negotiations of how to use the whiteboard for writing a design brief followed. A 5 min 'brain writing' session was followed by a discussion of these notes. There was discussion about whether the brief should (or not) prescribe a particular product.

**IA:** The whiteboard was structured by a tutor using the headings: goals, context, criteria and constrains. Participants collaboratively filled in the gaps using a specific colour. However, it was unclear who used what color (Figure 2) Parts of the texts were rewritten and rearranged during a discussion. Thereafter, some visual ideas that aligned with the brief were generated. All participants had the feeling the team made a huge leap forward in this session. All ideas were on the 'stage' (whiteboard). There was less asynchronicity in communication. The whiteboard efficiently guided a discussion with fewer students. A growing familiarity with the medium was observable.

### 3.5 Concept Generation

**QA:** There were 3 tutors and 3 students in session 4. The moderator from the first two sessions returned.

**PA:** He first congratulated the group on the process and felt pleased about the collaborative negotiation of the direction of the design project, which he thought was one aim of this experiment. He commented on the brief composed in the previous session and asked for a review of initial ideas that met the brief. A lively and wide-ranging discussion ensued, including experiences of street lighting, examples of existing renewable energies and also technologies used to light road signs or street furniture (Figure 3).



**Figure 3** Use of whiteboard to generate ideas

An alternative idea emerged regarding the use of collected rainwater to power low voltage lights. This reconnected to an earlier idea using a playground to pump up water from the ground by children. While the idea may not have been commercially viable it potentially had value as an education demonstrator - perhaps sponsored by a local organisation for schools to visit. The moderator suggested producing a concept drawing to be shown to companies and other potential sponsors, which everyone agreed on. He also distributed some work done offline to fuel the final discussion. In the perception of the tutors, this session also went well. The reason behind this was assumed to be growing familiarity by all participants with

the functionality of the medium. Another reason might be the guiding structure on discussion offered by the moderator.

**IA:** Between bouts of idea generation, a structuring meta-discussion was initiated by the moderator addressing the use of the whiteboard, such as colour of font etc. He appointed a person to act as 'page keeper' to save versions of a whiteboard so other participants were free to concentrate on the creative concept development. They were then available to be re-loaded onto the whiteboard. An option to save previous whiteboard uploads would have been helpful. Images on the whiteboard could be worked into, for example with annotation.

### 3.6 Embodiment and Detail Design

**OA:** In the final design session, only one student was available to participate in the meeting. Tutors and observers had to become more active design participants. A short discussion about the organisation of the project arose at the end of the session. Over the sessions, it became apparent that the schedule was difficult to keep to. Students would have preferred to go on and implement this idea in further sessions. One student commented that "we seem to have settled in an area...but we are...too close to the end of this to really explore, which is a pity as the exploring bit is where this medium does seem to work". Students were also critical of the openness of the task. Much of the early sessions were spent defining the precise problem to look into. Time for developing this concept further was then limited. Students suggested focusing on solving a clearly defined design brief (but how representative of 'design' is this?). But it might better create the feeling of having achieved something tangible and rewarding within a short time of collaboration. The organisers were convinced that this was a realistic design brief and the frustrations were typical of resolving realistic complex design problems. Tutors tried not to prescribe directions and spoon-feed students but deliberately left the directions for this project open for exploration and creative play.

**PA:** Subsequent to the concept generation the project gained a real-life context. One tutor knew of a NGO (A UK wildlife centre) that might be interested in the concept devised by the team. The moderator suggested developing the design concept so as to meet the particular requirements and constraints of this particular NGO. Since, this NGO frequently invites children to their venue, the possibility for this concept to become an 'interactive learning centre' was the focus of the remaining discussion. Learning incentives and the utilisation of the energy generated by children's play were discussed. The concept could contribute much to raising children's awareness of renewable energy. Sketches done offline were uploaded, which communicated initial ideas better than sketching directly on the whiteboard. Related projects were discussed, too. Next, the moderator guided participants through all parts and stages of a possible concept that composed a system of various ways of saving and generating energy and educating children about these mechanisms. Other details were discussed. The discussion was lively and the concept gained depth. The moderator asked every participant as final homework to compose a visual representation of a system with annotations that could be offered to this NGO.

**IA:** All participants were proficient using the FM system. Uploading pictures of sketches was frequently used. Impromptu sketches on the whiteboard were seldom attempted because detailed implementations are more difficult to illustrate on the whiteboard.

## 4. LESSONS LEARNT

From an organizational point of view, we learnt that great care should be taken when changing project leader/moderator over the project. In addition, other tutors should be trained for the moderator's role. We should allow for at least 2-3 hours of training to become proficient in using the medium. The demand of time for all concerned (especially considering the time put in outside of the FM meetings) needs to be made clear to all participants upfront. We experienced great variation in prior level of design skills and knowledge. Where possible levels of participant expertise should be matched.

From a pedagogical perspective, we noted that we only achieved flowing discussions in the later sessions. We need to apply better icebreaker and introduction sessions to warm up participants and allow them get to know each other. In addition, participants' roles and responsibilities were perceived ambiguously. Hence leadership and authority issues arose in subsequent sessions. Establishing a clear pedagogical model for design learning might be useful to avoid such confusions.

Considering the interaction aspect, we learnt that we could utilize the FM medium for exploratory discussions and brainstorming supported by visual aids. Summing up ideas frequently and using the whiteboard to note down ideas to make them available for further use was especially successful in this experiment. However it offered less support when detailed design implementations were needed. The whiteboard seems to be more a scribble tool than a drafting tool but its value for uploading pre-made images was well liked. Switching between different communication forms such as video chat, text chat and use of whiteboard disrupted the flow of the conversation in the beginning. However, after participants became more familiar with features, the multi-modality of FM seemed to support the flow of conversation. More research is needed to fully understand how the multi-modality of FM can be utilized in such learning contexts.

These findings will be taken into consideration when developing new courses in distance design learning, such as in U101 Design Thinking. It's clear that more work needs to be done if we are to facilitate peer learning and collaboration, and see the establishment of an online design studio culture.

## 5. ACKNOWLEDGMENTS

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