Using OpenStudio in STEM learning

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Executive Summary

The 'Using OpenStudio in STEM learning' project was established to evaluate the use of online studio-based learning in the Open University. Studio-based learning provides a model that can be adapted for online learning. In conventional teaching settings, studio-based learning follows an apprenticeship model where students work independently or in groups, under the guidance of a tutor, using real-world activities.

The project consisted of two main phases: a workshop for module team chairs followed by an in-depth study of the use of OpenStudio on two Computing & IT modules. Educators representing distance learning modules from a range of STEM disciplines including Computing and IT, Design, Engineering and Environmental Technology participated in a workshop to share information about the use of OpenStudio on their modules. A simple model of OpenStudio activities was derived from the workshop to illustrate the process of 'showing and sharing', viewing and reviewing', commenting and critiquing', and 'reviewing and reflecting' involved. Two Computing and IT undergraduate modules were then selected for more detailed analysis, one at level 1 (TU100) and another at level 3 (TM354). Both quantitative and qualitative data were gathered from samples of students on these modules and analysed. In addition, tutors from both TU100 and TM354 were invited to participate in focus groups in online forums to provide a fuller picture of the activities.

The data suggest that students enjoy the OpenStudio activities, especially the visual nature of artefacts and the idea that shorter comments may be made, rather than longer more discursive pieces of writing. In addition to learning about their subject area, students are also learning how to give feedback to their peers and how to use the feedback they receive, both of which are important skills. Many students are confident in their own ability and are able to evaluate the feedback they receive. However, some students may lack confidence in their own ability to give feedback on the work of their peers, particularly at level 1. Importantly, there needs to be an opportunity to complete the cycle of the experiential learning model in the activity by allowing students to produce another artefact. The experiential nature of the online studio activity presents an opportunity for students to reflect-in-action as well as reflect *on* their actions (Schön, 1983). Comparisons between the OpenStudio model, the survey findings and Kolb's Experiential Learning model (1984) revealed the range of student views and the diversity of students' experiences of the learning activities, and provided some thought-provoking insights into student behavior in carrying out the OpenStudio activities.

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Introduction

OpenStudio, an online studio environment developed by the Open University, enables students to create and upload audio-visual resources, and to engage in dialogue with their peers, their tutors and their module team around these resources. The OpenStudio environment is known by various other names in the University according the module, e.g. 'ShareSpace', 'OpenDesignStudio' and 'OpenEngineering Workspace'. This online space allows students to carry out similar processes to those that take place in the physical studio, such as identifying the 'quality' features of works in progress, comparing their fellow students' work with their own and giving, receiving, and reflecting on feedback.

Focussing students' interactions around artefacts created by students themselves and encouraging them to share and discuss their creative practices is seen as a valuable approach to learning (Lee et al., 2008). This is an important part of the process of reflection-in-action and reflection-on-action (Schön, 1987). Similarly, students are becoming part of a 'community of practice' (Lave & Wenger, 1991) through participation in a community of learners focussed on a particular task and learning not only from their tutors and the module team but also from their more experienced peers. This type of learning is well supported by theories based on constructivism and collaborative learning, that view cognition as a social process (Brown, Collins & Duguid, 1989). Studio-based learning may be also viewed in terms of Kolb's experiential learning model (1984) i.e. moving through a cycle of Concrete Experience, Reflective Observation, Abstract Conceptualisation and Active Experimentation.

In studio-based learning the process of creating an artefact (for example a design prototype or an early version of a product) involves experiential learning (Kolb, 1984). As an active form of learning that emphasises student collaboration with their peers and effective communication, studio-based learning can be used effectively in STEM subject areas. There are studies on the use of studio-based learning in fields such as Human Computer Interaction (HCI) education, notably Hundhausen et al. (2012) who describe an HCI education case study using studio-based learning conducted in a conventional university setting. The learning activity is improved if students are taught what is expected of them in defining a problem and are also taught the iterative process of generating, refining and evaluating possible solutions (Cennano et al, 2011).

Studio-based learning is an apprenticeship model that moves the learning from a focus on knowledge of concepts and techniques to an appreciation that communication, design and problem-solving are of key importance. These are especially relevant skills in the teaching and learning of Computing & IT; they are also skills that are increasingly in demand by employers (Shadbolt, 2016)

In an online context, Web 2.0 tools can support the creation of artefacts by learners and their active engagement in collaborative tasks involving knowledge building. The use of these online tools is most effective when used in conjunction with the appropriate teaching and learning strategies, (Lee et al, 2008). Literature discussing studio-based learning in online environments is limited and mainly relates to Design (e.g. Jones & Lloyd, 2013), although issues around peer comment in an online studio environment are explored in Thomas et al (2014).

The 'Using OpenStudio in STEM learning' project, sponsored by eSTEeM aimed to explore the use of OpenStudio in STEM disciplines across the Open University, with a view to providing information about the ways in which it is already being used in modules, and collating evidence of good practice.

Aims and scope of the project

The main research questions for the project were:

- How is OpenStudio being used in STEM subject teaching across the Open University?
- How are students using OpenStudio in their learning?

- How do tutors use OpenStudio to support students in their learning?

The project aimed to:

- Identify the aims and objectives of module teams from STEM disciplines in the design and development of learning activities involving OpenStudio.
- carry out a small-scale study to explore:
    o the experiences of students in using this environment;
    o the views of tutors supporting students in using this learning environment, and
    o the value of an artefact-centred conversation in students' learning.

Activities

The planned activities of the project included:

Phase 1 - A workshop for the chair or their representative of modules that use OpenStudio or its variants.

Phase 2 - The selection of two modules for in-depth study involving a student survey and tutor focus groups
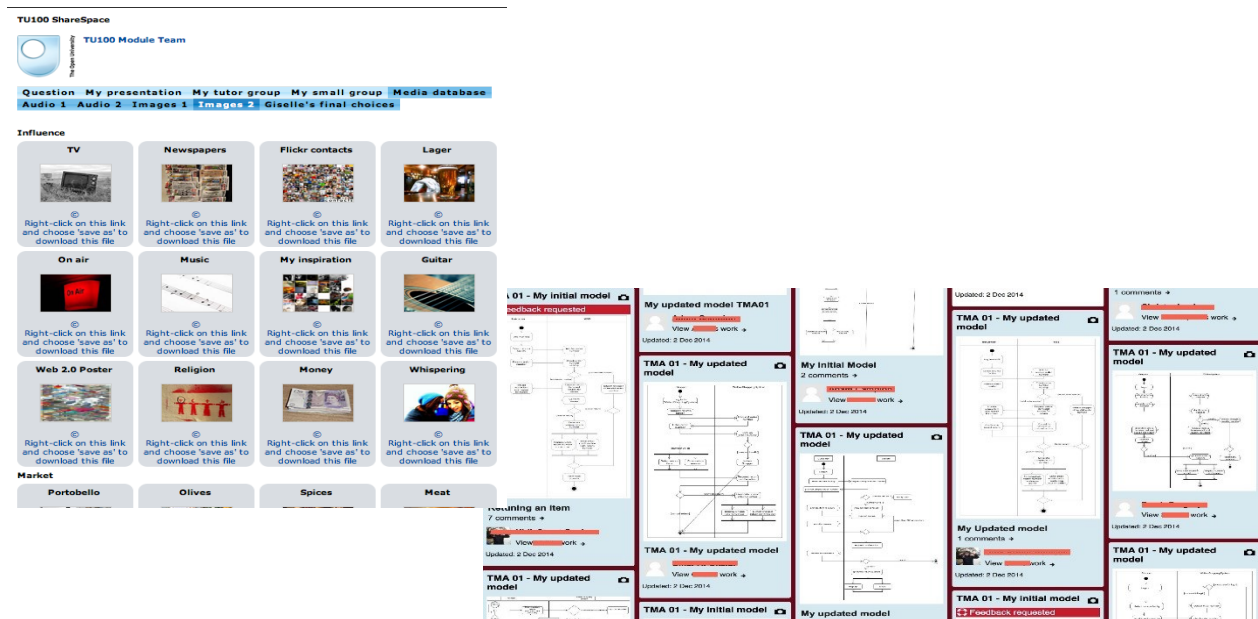

Figure 1 Examples of the ways in which OpenStudio is used in TU100, a level 1 Computing & IT module, and in TM354, a level 3 Computing & IT module

Results

The results for each phase of the project are set out below.

Phase 1

We began the project by organising a workshop for module team chairs to share their experiences of using OpenStudio in their modules. Organising the workshop was quite challenging in itself, partly because there are so many variations of OpenStudio being used on modules, but also because there is no way of finding out who is using the environment, apart from contacting module teams to ask them. The workshop was held on 27th January 2015 and was attended by the chairs or representatives from 11 modules from the School of Computing and Communication and the School

of Engineering and Innovation. We asked each module chair to make a short presentation on: how OpenStudio was used in their module; the rationale and approach; and the benefits and issues in relation to OpenStudio.

Results of the workshop and discussion

The results of the workshop are summarised in Table 1.

Table 1 Summary of the data from the module team chair's workshop

Discipline	Activities and assessment
STEM access module (Y033)	Students upload images of their module work e.g. a photograph of a model bridge they have built. They comment on their own images. The activity is assessed.
Digital photography (level 1 course) (T189/TG089)	Students upload photographs in each of 10 weeks. Other students add evaluative feedback comments. Weekly activities are not assessed but final work is.
Design level 1 (U101)	Students upload images of their designs for peer comment throughout the module. 42 uploads are required over 9 months. Only one assignment directly assesses use of OpenStudio.
Design levels 2 & 3 (T217/T317)	The aim is to develop a design community. Peer feedback is encouraged. OpenStudio supports reflective activities; used for individual project work at level 3.
Engineering level 1 (T174)	Students upload a relevant image and comment on each other's. They then work in small teams on a design task. Later tasks are more discursive. OpenStudio work is assessed throughout module.
Environmental Technology Management levels 2 and 3 (T219/T319)	Students post artefacts related to systems techniques and diagrams. They add textual descriptions, and comment on each other's artefacts. At third level, students work in tutor-led and student-led groups. OpenStudio work is not directly built into the assessment.
Computing and IT level 1 (TU100)	Students create and upload an audio-visual presentation, and comment on the presentations of at least two other students. The assignment assesses: the presentation, the feedback given to other students, and the reflection on how the student might use the feedback they received.
Computing and IT level 2 (M258)	Team working is central to this module. Some activities involve uploading documents as well as images. In the first assignment students share results of individual work. In the second they discuss their work and produce a team document.
Computing and IT level 3 (TM354)	Students upload diagrammatic models, comment on other students' models, and use the feedback received to improve their own model. Each assignment includes an OpenStudio activity, assessing these or related aspects.

Significant points were made at the workshop concerning the visual nature of the artefacts, encouraging students to engage with the activity by viewing the artefacts and making comments. In addition, the visual nature of the artefacts and the relatively short comments makes a refreshing change from typically longer text-based exchanges in forums and wikis. Also, there is the potential for use in individual and group project work and for the development of team-working skills. The visual nature may present accessibility issues, but students should be encouraged to provide

descriptions of images, which is good practice for web-based images. Workshop participants emphasised the importance of providing guidance to students on giving feedback to their peers. Participants reported that module tutors are not always happy with the depth of reflection and the quality of feedback provided by students. Finally, aligning the different stages in commenting activities to a specific time frame is helpful to ensure that students receive peer feedback at appropriate times.

From the workshop we identified an initial model of learning activities in the online studio environment:

Showing and sharing – students upload a digital artefact, such as a photograph or a graphical image, and display it to their peers;

Viewing and reviewing – students look at the work of other students and review their own work in comparison to that of others;

Commenting and critiquing – students are asked to evaluate the work of other students and give them feedback in the form of comments; and

Receiving and reflecting – students receive the comments of other students, reflect on the comments and then think about how they might improve their own work.

The first two types of activity, 'showing and sharing' and 'viewing and reviewing' are common to all the modules, but use of the 'commenting and critiquing' and 'receiving and reflecting' activities depend on the learning design of particular modules. For example, both the level 1 and level 3 Computing & IT modules (TU100 and TM354 complete all the activities, but in the STEM access module Y033 students are just asked to view the work of their peers). OpenStudio also provides a means of collecting and curating digital artefacts for the duration of a module so students can look back over their work.

Phase 2

The next stage of the project entailed a more detailed study of two of the modules which use OpenStudio: the level 1 module My digital life and the third level module TM354 Software engineering. These modules were chosen because a member of the TU100 module team and the chair of the TM354 module team were part of the project group which helped to facilitate access to the data needed. The work was carried out with the agreement of the chair of TU100.

In TU100, students use audio and image processing software tools to create an audiovisual presentation, which they upload to OpenStudio. Students are expected to view the presentations of others within their tutor group, and give feedback on the presentations of at least two other students. Students are assessed on their presentation and its storyboard and they are asked to provide evidence of the comments they make on the presentations of two other students. They are also asked to explain how they would use the feedback they received from other students in order to improve their presentations, but they are not required to actually change their presentations.

In TM354, the OpenStudio activity was intended to help students learn how modelling is used within agile software development to share an understanding of a problem or of a solution. The activity also gives a feeling for agile working practices such as the daily stand up meeting to reach an agreement on what needs to be done. Students were asked to develop an artefact which was either a model to understand a domain problem or a model to work towards a software solution for the domain problem. Students were expected to comment on the work of at least two students, reflect on the feedback received and change their models based on the feedback and their reflections. In both modules, students were only able to see each other's artefacts once they had uploaded their own.

A student survey and tutor focus groups were planned to gather data on the way that the activity was perceived by students and tutors on each module.

As this phase entailed collecting data from students, we applied to the Student Research Project Panel (SRPP) and the Ethics Committee to obtain clearance to conduct a survey of students on TU100 and TM354.

Invitation emails containing a link to the survey were sent out by the Student Statistics Team to samples of 500 students from TU100 and 300 students from TM354 in 2015. The survey consisted of 11 questions in total, with students invited to give a response using radio buttons and a text box for comments associated with each question. Copies of the invitation email and the survey instrument are shown in Appendix 1.

Both quantitative and qualitative analyses of the survey data for each module were carried out and the results collated.

Results of the survey and discussion

A total of 500 level 1 students and 300 level 3 students were invited to participate in the survey. The response rate was 19% (n = 95) and 13.6% (n = 42) respectively. The quantitative results of the survey are summarised in Table 2.

Table 2 Quantitative results of the student survey

Survey results

Over 90% of all respondents agreed or strongly agreed that the instructions for carrying out the OpenStudio activity were sufficiently clear.

When asked about being prepared to give feedback to their peers, over 85% of the level 3 students while 79.6%, thought that they were adequately prepared to give feedback.

Almost all of the students from both modules (98%) looked at the presentations of more than one student.

The majority of level 1 respondents (96.8%) had commented on the work of more than one student, although 2% said they had not commented on anyone's work. Although 88.1% of level 3 students had provided comments for more than one student, some 9.5% had provided comments for just one of their peers.

86% of level 1 respondents had received more than one comment from their peers but some 4% had received no comments at all. Three quarters of level 3 students had received comments from more than one of their peers, but 17% had received only one comment. Two students had received no comments (possibly because had uploaded their work after the deadline had passed).

Over 60% of respondents agreed or strongly agreed that their skills had improved as a consequence of looking at the work of other students. Around a quarter of level 1 students and a fifth of level 3 students were neutral about the impact on their learning. Some 17% disagreed that their skills had improved.

79% of level 1 students and 85% of level 3 students agreed that they saw that a range of approaches were possible for examining the work of other students.

Students were asked whether their work had improved as a result of receiving comments from their peers. Around three-quarters of level 3 students and around half of the level 1 students agreed that their work had improved.

In all 75% of level 1 respondents reported that they understood the importance of giving and receiving feedback after carrying out the OpenStudio activity.

Over three quarters of level 3 respondents agreed that they gained a sense of what it means to share an understanding of a model.

Finally, two-thirds of level 3 respondents and 72.9% of level 1 respondents reported that they had enjoyed carrying out the activity.

In the final stage of the project's activities, online focus groups were used to collect data from tutors on both the TU100 and TM354 modules. The focus group discussions took place in the VLE tutor forums and ran during April 2015. The questions used to seed the discussion forums are shown in Appendix 2.

Results

Supporting students in using OpenStudio –Tutors on both modules reported that, for the most part, there were few technical problems for students using OpenStudio. TU100 tutors reported a few technical issues but mainly with the software used to produce the artefact rather than with OpenStudio itself. Other issues included large files that exceeded the upload limit. The main issue reported by tutors on both modules was in time management: students not keeping to the schedule, some were slow to post their artefact and/or late in commenting on other people's work.

Preparation to give feedback – overall, most tutors thought that students were adequately prepared to give feedback as the guidance and instructions were clear. However, tutors noted a lack of critical comment and a reluctance to offer suggestions for improvement. Also, the quality of some responses was poor and lacked depth. Some TU100 tutors thought that students need to be given more guidance on how to make critical comments as they may be unfamiliar with the practice of critically evaluating other people's work. Time management skills were also considered to be important as some students were late in uploading their presentations

Level of engagement – Tutors on both modules reported that engagement with the activity was very good. However, some students may have left it until very late to make postings. Very few tutors needed to send out reminder emails although some TU100 tutors reported sending out group emails and posting messages to the tutor group forums to remind students to make comments. TM354 tutors were interested in the timing of the postings as late posting meant that time for interacting with other students was limited.

Some tutors were disappointed by the numbers of postings as some students had made the minimum number of postings required (2), so interaction was limited. However, other tutors reported that the more technically skilled students were supporting those who were late in posting.

Richness of the learning experience – most tutors commented positively on OpenStudio as a rich learning environment.

- Students being able to see each other's work which helped them to reflect on their technical skills and/or develop new skills.
- Being able to see each other's feedback meant that less experienced students could learn from the skilful way in which more experienced students provided both positive and negative feedback to others.

On TM354 several tutors commented that the that the OpenStudio activity helped students to interact, to see other people's solutions and reflect on their own work

A small number of TU100 tutors thought that the important features of the learning experience involved using new software for creative work and critiquing the work of others. Therefore, other tools, such as YouTube or a forum discussion could work just as well. (However, there are important pedagogical reasons for using a 'walled garden' such as OpenStudio, for example, privacy issues.)

Was the richness reflected in student answers? – The majority of TU100 tutors felt that the richness of the learning environment was reflected in the students' answers in that the 'insightful' answers showed students had looked at their own work and other students' work for ideas, and that there was 'valuable' feedback in responses. Similarly, TM354 tutors thought that the richness of the environment was reflected in student answers, especially as there was a requirement for students to make changes to their models based on feedback they had received. However, some tutors were disappointed with the depth of reflection on the process by some students in that students did not

say what they thought of the feedback they received or why they had accepted or rejected it. There was a tendency to just list the changes they had made to their work.

<u>Findings</u>

The OpenStudio activity model developed from the workshop for module team representatives illustrates the range of learning activities that can be carried out in OpenStudio. The first two types of activity, 'showing and sharing' and 'viewing and reviewing' are common to all the modules, but use of the 'commenting and critiquing' and 'receiving and reflecting' activities depend on the learning design of particular modules. For example, both the level 1 and level 3 Computing & IT modules (TU100 and TM354) complete all of the activities, but in the STEM access module Y033 students are just asked to view the work of their peers.

The OpenStudio activity for both sets of students in the study is a 'situated' learning experience (Lave & Wenger, 1991) simulating real-world activites, i.e. presenting work to one's peers, observing the work of others and giving and receiving feedback, in an online context. The findings from the study were explored in terms of the learning activities in the OpenStudio model derived from Phase 1 of the study: 'showing and sharing', 'viewing and reviewing', 'commenting and critiquing' and 'receiving and reflecting'. These learning activities were then compared with the stages of the Experiential Learning Cycle, namely, 'Concrete Experience', 'Reflective Observation', 'Abstract Conceptualisation' and 'Active Experimentation' of Kolb's Experiential Learning Cycle.

Showing and sharing

In terms of the Experiential Learning Cycle, students undertake the 'Concrete Experience' of producing the artefact and then displaying it to their peers: the *showing and sharing* stage of the studio-learning model. On the whole, students were enthusiastic about this activity; for example, they enjoyed the visual nature of the artefact.

Viewing and reviewing

The *viewing and reviewing* activity enables students to reflect on their own artefact by observing the different approaches adopted by their peers and comparing their own work with that of others.

The majority of students agreed that they had learnt from this process,

> "I viewed every single presentation submitted by my group. Not only was it interesting but it gave me ideas for any future efforts I will make in other courses." (Level 1 student)

Students appreciated the diverse approaches to developing the artefact taken by their peers,

> "It was interesting to see the variety of approaches to the problem - including some good ideas and a great many bad ones…" (Level 3 student)

Commenting and critiquing

In the studio environment, *commenting and critiquing* activity of providing feedback to other students may further enable the 'Abstract Conceptualisation' process, as students consider the 'quality' features of each other's work and how it could be improved. Again, many students actively participated in this phase of the activity. One respondent even said they had commented on the work of everyone in the group. However, there was an issue of confidence in their own learning amongst a very small number of level 1 students who did not feel ready to comment on the work of their peers even within the confines of the tutor group. This issue adversely impacted their enjoyment of the activity.

Receiving and reflecting

Having received feedback from their peers, students are expected to consider how they might improve their own artefact: the *receiving and reflecting* aspect of the OpenStudio model. This prepares them for the 'Active Experimentation' stage in Kolb's Experiential Learning Cycle. In our study most of the respondents felt that they had learned from this process,

> "The feedback was all positive and had some constructive criticism, all of which I was grateful for." (Level 1 student)

Completing the experiential learning cycle

An important part of the learning experience involves developing an artefact for display in OpenStudio, for example a presentation on TU100 and a software model on TM354. While TM354 students submit a revised model using feedback from other students, TU100 students are asked to explain how they *would improve* their presentations based on comments from other students, if given the opportunity. In comparing the learning activities in OpenStudio on each module with Kolb's experiential learning cycle, it was clear from the student survey data that, in the TU100 activity, students need an opportunity to complete the learning cycle by submitting a revised presentation.

Negative views of peer comment

The students who disagreed that they had learned from their peers' comments said they preferred to receive early feedback from their tutor or that they lacked confidence in the competence of their peers.

A small number of students were dissatisfied with the peer learning approach and felt that they did not learn anything important from the activity. For example, some students were not convinced of the value of artefacts produced by their peers, e.g. they were sufficiently confident in their own skills and felt they had nothing to learn from their peers and also a very small number carried out the activities only because it was expected as part of the module. It appears that two students had lost one or two marks by following the advice of their peers.

This suggests that the 'commenting and critiquing' and 'receiving and reflecting' aspects of the OpenStudio activity requires further development, partly to reassure participants of the value of peer comment, but also to ensure that students are confident enough to evaluate the feedback they receive from their peers.

Recommendations

The design of activities involving OpenStudio should also take account of the following recommendations:

- Students should be provided with guidance on giving feedback to their peers and, importantly how to evaluate the feedback they receive from their peers.
- Students need time to develop the confidence and the skills to offer more 'in-depth' feedback to their peers. Confidence increases with the student's experience of study.
- Time management skills are particularly important for students carrying out activities in OpenStudio where students are dependent on each other for feedback, so they need advice on these skills.
- Where possible, aligning the different stages of commenting activities to a specific time frame is helpful to ensure that students receive peer feedback at appropriate times.
- The learning activity should take account of Kolb's experiential learning cycle so that students have an opportunity to review their artefact in the light of their reflection on the feedback they have received.

Finally, OpenStudio offers a means of collecting and curating digital artefacts for the duration of a module so students can look back over their work. However, it is not possible currently for students to carry over their work in OpenStudio from one module to another. This might be something to consider for further development of OpenStudio in future.

Conclusion

The work of the project has highlighted a number of important features of OpenStudio, particularly its visual nature and the use of artefacts, such as photographs and other images, as the focus for responses. This is very important as it encourages students to engage with the activity by viewing

the artefacts and making comments. The visual nature of the artefacts and the relatively short comments makes a refreshing change from typically longer text-based exchanges in forums and wikis.

The two case studies of a studio-based approach to support the teaching of valuable Computing & IT skills development at a distance. The work of the project demonstrates that the approach supports the development of a set of key transferable skills: sharing, discussing, giving feedback and reflecting on feedback received. These skills are all important for Computing & IT careers generally, and agile software development, in particular. The approach also gave TM354 students a flavour of some activities undertaken in an agile practice context while TU100 students were given the opportunity to show their creativity.

The evaluation suggested ways in which the approach can be improved. Students can be given more specific support and preparation, in particular for the development of deeper critical reflection and academic evaluation. Improvements are needed to the stage of the approach where students reflect on the feedback they have received, and decide whether and how to use it. We will be focusing on this aspect in future, and will provide preparatory activities to support students in reflecting on, and using, feedback.

The success of the studio-based approach in TU100, TM354 and other STEM modules in the study suggests that the approach can be extended to other activities and modules. In particular, the studio learning approach supports the development of core skills in demand by employers, such as: negotiation; receiving feedback constructively and incorporating it into one's own development; and application of analytical and critical thinking skills.

Impact

The workshop for module chairs during the first phase of had a positive impact in different ways:

- In the process of sending out invitations for the workshop for module chairs, we discovered that there was no easy way of identifying the modules that were using OpenStudio and its variants. Therefore, we had to contact a lot of module teams and network with people working on OpenStudio to identify the 11 module teams who sent representatives to the workshop. Once we began to disseminate the work of the project we discovered further modules in Education and Science who were using OpenStudio.
- The workshop enabled module team representatives to share their experiences of using OpenStudio, compare the design of the learning activities and how, if at all, they were assessed. Module team representatives also compared student participation rates between modules and the impact that assessment involving OpenStudio had on level of participation.
- The work of the project as a whole influenced the design of an assessed activity involving OpenStudio for the new introductory level 1 module: TM111 *Introduction to Computing and Information Technology 1*. This activity, which involved students uploading a photograph of the computer they use in their studies, has proven to be very effective in engaging students in the early stages of the module.

List of deliverables

External

Barroca, Leonor and Kear, Karen (2016). Agile practices taught online at a distance. In: The Online, Open and Flexible Higher Education Conference, 19-21 October 2016, Rome. http://oro.open.ac.uk/47512/

Kear, Karen & Rosewell, Jon (2015) Working with others sharing artefacts. Poster session at the EADTU Online, Open and Flexible Higher Education Conference, Hagan, Germany, October 20th-30th 2015.

Thomas, Elaine; Barroca, Leonor; Donelan, Helen; Kear, Karen; Jefferis, Helen and Rosewell, Jon (2016). Online conversations around digital artefacts: the studio approach to learning in STEM subjects. In: Proceedings of the 10th International Conference on Networked Learning, Lancaster, 9th-11th May 2016 (Cranmer, S.; de Laat, M.; Ryberg, T. and Sime, J. A. eds.). http://oro.open.ac.uk/45212/

Internal

Leonor Barroca, Helen Donelan, Karen Kear, Jon Rosewell and Elaine Thomas (2015) 'Diverse approaches to using OpenStudio in STEM learning: case studies'. Presentation at the 4th eSTEeM conference 16th-17th April 2015.

Elaine Thomas (2015) 'Diverse approaches to using OpenStudio in STEM learning'. Presentation at the CALRG Conference June 15h-17th June 2015.

Leonor Barroca (2016) 'TM354 Software Engineering – case studies, assessment, tools', Quality Enhancement Lunchtime Seminar (QELS), Institute of Educational Technology, 27th January 2016.

Elaine Thomas, Karen Kear, Helen Donelan, Leonor Barroca and Jon Rosewell (2016) 'Student perspectives on learning in OpenStudio, the online 'studio' environment'. Structured discussion at the 5th eSTEeM conference 14th – 15th April 2016.

Other

Project blog which displayed information about the project as it progressed: http://www.open.ac.uk/blogs/OpenStudioinSTEMLearning/

Poster for eSTEeM

Poster at the Module Team Chairs training event 19th-20th March 2015.

Figures and tables

List of figures and tables provided in the report.

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Thomas, E.; Rosewell, J., Kear, K., & Donelan, H. (2014). Learning and peer feedback in shared online spaces. In Ninth International Conference on Networked Learning 2014, 7-9 April, 2014, Edinburgh, UK, pp. 382–385.

<u>Appendices</u>

Appendix 1

Questions from the student data

1. Did you upload your work to ShareSpace

    Yes/No
2. The instructions in the module materials and theTMA about the activities in ShareSpace were clear.
3. I felt I was adequately prepared to give feedback on other students' work.
4. Did you view other students' work in ShareSpace?

    I looked at the work of one other student

    I looked at the work of more than one student

    I did not look at any student's work
5. Did you comment on other students' work

    I commented on the work of one student

    I commented on the work of more than one student

    I did not make any comments
6. Did you receive comments on your work from other students?

    One student commented on my work

    More than one student commented on my work

    No one commented on my work
7. My skills improved as a result of looking at other students.
8. From looking at other students' work, I saw that a range of solutions are possible.
9. My skills improved as a result of receiving comments other students' models.
10. By looking at other students' work, I got a sense of what it means to share an understanding of a model.
11. I enjoyed carrying out the activities.
12. Is there anything else you would like to tell us about your experience of using ShareSpace?

Please provide a list of appendices and either append to the end of the report or provide as a separate file(s), clearly named '[yourname]_Appendix A', '[yourname]_Appendix B', etc., and submitted in **electronic form** with your final report.