Gathering student perception about online/distance practical science at level 1

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Executive Summary

This eSTEeM project has investigated student perception about online practical science for two modules at level 1. Students were interviewed and completed online questionnaires before and after studying these modules. The interviews confirmed the anecdotal evidence that students felt more positive about studying practical science online after they had studied the modules and 71.2% of students were pleased that they participated in the module. High percentages of students agreed that they were able to carry out practical science when it suited them and that they were able to design experiments and draw conclusions from experiments with other distance learners. There was an increase in students agreeing that they were able to learn well by reading text on screen. Only a low percentage of students agreed that their group found it easy to make group decisions together, this aspect of collaborative group work forms the basis of another ongoing eSTEeM project.

Aims and scope of the project

The project aimed to assess if there was a change in student perception about online/distance practical science before and after studying two level one modules. S155 Scientific Investigations and S141 Investigative and mathematical skills in science were both level one modules delivered solely online, S141 being the larger course which incorporated the online practical science element developed in S155. It is this online practical science element that the project focussed on.

There was anecdotal evidence that students had a negative perception of the value of online science before starting these modules. They appeared to only do the module because it was a requirement of their pathway and were sceptical about how much "real science" they would be learning. Whereas after the presentation, students appeared to be very positive about the experience and value of online tuition. We aimed to capture the student experience to demonstrate the value of this innovative method of delivering and developing practical science skills. We used telephone interviews and questionnaires to gather this information, with the aim of improving knowledge of student perception at the end of level one. This information could be used to inform the development of practical science skills in the Open University Science curriculum at all undergraduate levels.

Activities

The overall approach was to use telephone interviews and then online questionnaires to assess any change in student perception before and after studying these modules and to use this information to help inform the wider university about student perception of online practical science.

The planned activities were to get an understanding of student perceptions via small numbers of in depth telephone interviews then go on to investigate larger populations of subsequent cohorts of students using before study and after study online questionnaires.

The majority of the planned activities went ahead on schedule but the project leader began full time employment at The Open University mid-way through the project which has delayed the analysis of the results and final reporting.

The data and evidence gathered were 52 telephone interview transcripts (from 26 students interviewed both before and after study) and 277 completed online questionnaires (184 before study and 93 after study).

Findings

The main findings of the interviews and questionnaires have been that we have been able to formalise the anecdotal evidence and show that there is a shift in student perception surrounding the study of practical science online.

The phone interviews were transcribed and analysed using grounded theory. There was a stark difference in the types of phrases used by the students pre and post study. Typical phrases used when talking about the prospect of studying practical science online were "I'm not sure if I will feel like a real scientist" "There is a lack of really nice practical stuff, test tubes and a few chemicals" "I would probably get more out of a face to face situation in a real laboratory" "Oh I really don't want to do this but I have to". This last comment was a reference to the fact that the module is a compulsory component of a qualification and the students frequently stated that they wouldn't have studied the module if it wasn't compulsory.
However after the module had been completed typical phrases were focussed on the collaborative nature of the module. Overall they commented positively on the process of discussing the experimental planning and results. "you get the whole process of discussing things" "we spent a long time debating and coming to mutual decisions" .

Students commented on the authenticity of the experiments "It did feel like I was a real scientist, albeit without the white coat" "They were proper experiments because we did all the planning and preparation steps" "The importance of scientific method and procedures was brought home to us".

A few students commented on their preference for reading on paper rather than on screen and some seemed to be adapting to using mobile learning "I'm getting more used to it, it just takes a bit of mental adjustment". Many stated that they enjoyed using mobile learning "it was good online because it was all there in front of you" "no problems with reading the material online".

They commented positively on the resources available via mobile learning "I liked the video content; it was helpful" "the OULive recorded sessions were helpful" "I like to watch the recordings when it suits me". Although not all comments were positive and some students wanted to have laboratory based practical work "It would be nice to actually get behind a lab bench again". Some students were aware that their perception had changed "there was a degree of scepticism at first" "the online science was a lot better than I was anticipating".

Overall students said that they would like to participate in a similar module again if there was another module offering practical science online, with one Scientific Investigations student commenting "I would prefer a longer module, not just 10 weeks, I would like to get my teeth into longer experiments, it has reawakened my passion for science".

The responses to the telephone interviews were also used to assist in the design of the before study and after study online questionnaires. The responses from the online questionnaires were not as conclusive as those from the telephone interviews. This could be because students were more honest or frank answering an online survey rather than speaking to another person.

For many of the questions asked there was little or no change in the student responses, for example "I learn/t well using self-led study" before study 85.5% of students agreed or strongly agreed and after study 83.3% agreed or strongly agreed. This was similar for the student's perception of how well they learned for other methods of study (data led, discussion led or investigation led). There was a fall in those agreeing that they learnt well using instructor led study: 81% before study fell to 59.6% after study. Students did not change their perception about how the practical science on the module was

relevant to the way that practical science is conducted in the real world. They did not change their perception that the practical science they carried out would deliver meaningful results or that they would be able to learn practical science even without using sophisticated equipment. There was a fall in those agreeing with the statement "The data or observations I generate/d will be as good as those gathered from a laboratory situation (27.3% before study and 20.7% after study). There was also a fall in those agreeing with the statement "Carrying out practical science at home will feel/felt as real as a laboratory situation" (22.7% before study and 16.1% after study).

After studying the modules high percentages of students agreed with the following statements "I was able to carry out practical science when it suited me" 72.4%, "It was possible to plan experiments with other distance learners"64.4%, "It was possible to draw conclusions from experiments with other distance learners" 73.5% and I was pleased that I participated in the module"71.2%.

After studying S155 students felt more positive about learning online. The statement "I learn/t well by reading text on screen" had only 12.9 % students agreeing or strongly agreeing before study but this increased to 18.4% after study.

Successes to report: A book chapter and an HEA conference presentation have been published as a result of this project.

An unexpected outcome was that students mentioned negative issues associated with online collaborative group work during their telephone interviews. This was also reflected in the responses to the after study statement "My group found it easy to make group decisions together" – only 42% of students agreed or strongly agreed with this statement. Consequently a second eSTEeM project has been set up to look into this aspect in more detail.

Impact

a) Student experience. The project has not had direct impact on student learning. It may have helped the students who were interviewed by increasing their reflection on their learning for these particular modules.
b) Teaching. The staff associated with the project have gained by reading the transcripts of the student interviews and the data from the completed questionnaires. Others within the OU will have gained by having opportunities to learn about this shift in perception as a result of attending eSTEeM annual conferences. The conference proceedings and book chapters have highlighted implications for future practice for module teams who are presenting modules with an online practical science component, such as the need for module teams and tutors to support students in their transition to becoming confident online learners. Students are often not confident in their ability to learn online before study, but after study they have increased confidence in learning practical science online. The impact of the project outside of the OU has been to highlight that practical science can be successfully taught online.
c) Strategic change and learning design. The conference proceedings and book chapters have highlighted implications for future practice for module teams who are producing and modules with an online practical science component.

List of deliverables

Nicholas, Victoria (2015). Mobile Learning for Online Practical Science Modules in Higher Education. In: Crompton, Helen and Traxler, John eds. *Mobile Learning and STEM: Case Studies in Practice.* Abingdon: Routledge, pp. 234–243.

HEA STEM Annual Learning and Teaching Conference 30 April – 1 May 2014: Enhancing the STEM Student Journey. Oral presentation "Student perceptions of online practical science". Powerpoint from presentation included as an appendix

Abstract submitted for the Horizons in STEM Higher Education Conference: Making Connections and Sharing Pedagogy

Two eSTEeM annual conference presentations:

- 2015 Student perception of online practical science – Project update
- 2014 Student perceptions of online practical science

References

Nicholas, Victoria (2015). Mobile Learning for Online Practical Science Modules in Higher Education. In: Crompton, Helen and Traxler, John eds. *Mobile Learning and STEM: Case Studies in Practice.* Abingdon: Routledge, pp. 234–243.

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