# How do STEM students use digital and non-digital learning resources?

## Conference or Workshop Item

A study focusing on level 2 Physics, Maths and Computing students

# How do STEM students use digital and non digital learning resources?

Laura Alexander and Alexis Lansbury

Life-changing Learning

# The Open University

## WE ARE INNOVATIVE, UNIQUE, GLOBAL; OPEN TO PEOPLE, PLACES, METHODS AND IDEAS

**A SIGNIFICANT PRESENCE IN ALL FOUR UK NATIONS**

**THE LARGEST UK UNIVERSITY, AND ONE OF THE LARGEST IN EUROPE**

**174,898 STUDENTS**

**24,709 STUDENTS WITH A DISABILITY**

**1,400 STUDENTS IN SECURE ENVIRONMENTS**

**3 IN 4 STUDENTS IN WORK – EARNING WHILE THEY ARE LEARNING**

## CELEBRATING 50 YEARS OF OPENING UP EDUCATION FOR ALL

# The Open University - overview

- Headquarters in Milton Keynes, but with no on site undergraduate teaching.
- Open entry, all ages, all backgrounds.
- Students across all of the UK and abroad.
- Associate Lecturers also based all over the UK, working from home.
- 170,000 students, mostly part time, typically taking 6 years to complete a degree
  - Level 1 (first year undergraduate)
  - Level 2 (second year undergraduate)
  - Level 3 (honours level undergraduate)

# The Open University – study materials

- OU has always prided itself on being at the forefront of technology - BBC, video, audio tapes, DVDs – and offered a blend of study formats.
- Shift to digital - less and less books and face to face tuition.
- Move to entirely online digital learning for some modules, (variable across schools).
- Strong student voice, message has been that many students are not enjoying entirely online modules.

# eSTEeM (OU centre for STEM pedagogy) Project

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## Research Questions

- If students meet modules which rely on different media for learning resources (books, online etc) part way through their studies,  what is the impact of this?

- Does it affect student progression and retention and could there be ways to mitigate this impact?

# Aims and Objectives

- Identify similarities and differences between the different approaches that schools in STEM faculty take.
- Identify the similarities and differences between students' learning strategies in the different schools
- Identify how the use that students make of different types of learning resource evolves over time
- Investigate whether students' preferences for specific types of resource have any correlation with factors such as age, gender, first language/mother tongue
- Use individual interviews to investigate whether any correlation has an underlying causality.

# Students have very different experiences at level 1 and at level 2

We chose 3 level 2 modules in different areas of STEM

| Physics | Mathematics | Computing |
|---|---|---|
| **Level 1**<br>Up to 2016 students first module involved a combination of book based and online.<br>From 2016 students first module will be entirely online. | **Level 1**<br>Mostly book based study resources, with forums, quizzes, screencasts and other additional resources available online. | **Level 1**<br>A mix of book based and online study resources, including programming practice. |
| **Level 2 - S217**<br>Entirely online<br>(Note, most of our students are part time, so in 2017 would have started their studies with the combined book based/online module) | **Level 2 - MST224**<br>purpose-written text-books | **Level 2 - M269**<br>blend of digital resources, texts in the public domain and texts specifically developed for the module |

# Data Collection

- Sent a questionnaire to students on Oct 2017 presentations of 3 level 2 modules in January 2018
- Mix of quantitative and qualitative questions
- 200 students on each module.
- **19%** response rate

| | | Age | | | | | Gender | |
|---|---|---|---|---|---|---|---|---|
| | Number of Respondents | Mean | SD | Median | IQR | Range | Male | Female |
| **Computing** | 35 | 33.2 | 10.4 | 30 | 9.5 | 50 | 29 (83%) | 6 (17%) |
| **Maths** | 33 | 44.5 | 14.4 | 45 | 24 | 46 | 23 (70%) | 10 (30%) |
| **Physics** | 45 | 32.3 | 11.5 | 35 | 18 | 52 | 31 (69%) | 14 (31%) |

# What did we ask them?

- What was your first level 1 module?
- What methods did you use to study it? (select from list plus text box)
- What proportion of your time was spent using each method?
- Did you change how you studied for subsequent level 1 modules? (Why?)
- Considering current level 2 module, What methods did you use to study it? (select from list plus text box)
- For your current level 2 module, did you need to change how you studied? (Why?)
- Did this cause you any issues? (What issues?)
- Would you be willing to take part in follow up interviews?

# What resources did you use to study?

| Method of Study |
| --- |
| Online quizzes and Computer Marked Assignments |
| Doing module exercises and activities on paper |
| Making notes on paper |
| Using module software |
| Annotating module textbooks (where available) |
| Using Forums |
| Accessing additional books |
| Making notes using a word-processor |
| Using external digital resources |
| Annotating printed PDFs |
| Annotating files on-screen |
| Using print versions of online module materials |
| Using a personal blog |

# How do you study

- **Online quizzes and iCMAs** and **Doing module exercises and activities on paper** were two most popular ways of studying for **both** initial level 1 and current level 2 modules.
- Fairly even split between using digital and non-digital resources at level 1 **and** level 2.

| | Computing | Maths | Physics |
|---|---|---|---|
| **First Level 1 Module, methods of study** | | | |
| **Digital** | 58% | 46% | 51% |
| **Non-digital** | 42% | 54% | 49% |
| **Current Level 2 Module, methods of study** | | | |
| **Digital** | 61% | 47% | 48% |
| **Non-digital** | 39% | 53% | 52% |

# How do you study, digital vs non digital

Students seem to stick to the approach they developed on their first level 1 module

Max 3% shift in digital/non digital study approach from first level 1 to first level 2

- But 47% of all students surveyed felt they had to change their approach to study as they moved to level 2 study!

Indicates students find an alternative method which still falls into the same category.

- For example, Physics students, (whose Level 2 module material was entirely online), appear to have changed from annotating module textbooks at level 1 to annotating printed pdfs when studying S217, rather than developing ways to annotate information online or making notes electronically.

# Did you have to change how you studied?

- Note most Physics students in this first survey had studied a books + online module as their first OU module

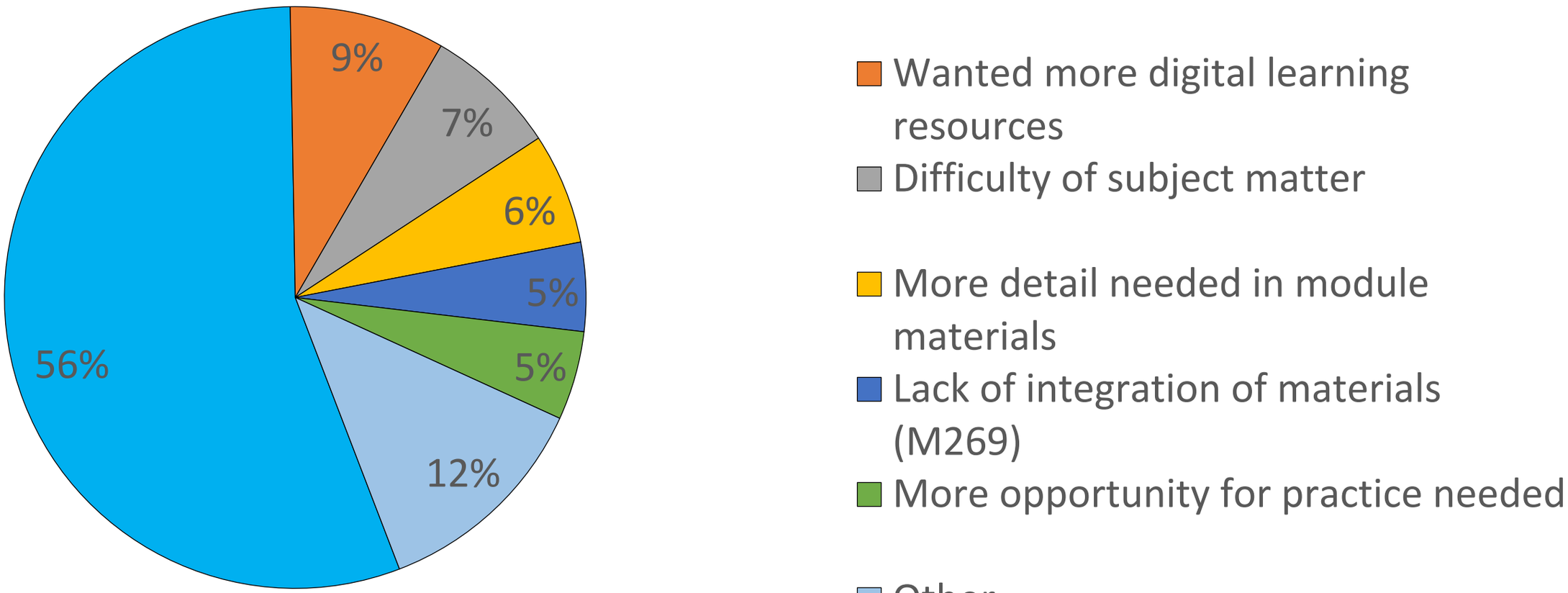
| Students currently studying module | Approach changed between first level 1 module and subsequent level 1 modules | Approach changed when studying first level 2 module |
|---|---|---|
| **Computing** | 5 (14%) | 17 (49%) |
| **Maths** | 5 (15%) | 9 (27%) |
| **Physics** | 9 (20%) | 27 (60%) |
| **Total** | **19 (17%)** | **53 (47%)** |

# Studying at level 2 – did changing approach cause issues?

| Module | Changing approach caused issues (percentage of those who had to change approach) |
|---|---|
| **Computing** | 9 (53%) |
| **Maths** | 3 (33.%) |
| **Physics** | 23 (85%) |
| **Total** | 35 (66%) |

# Analysis of free text comments

Primary concern raised by each student who made open text comments



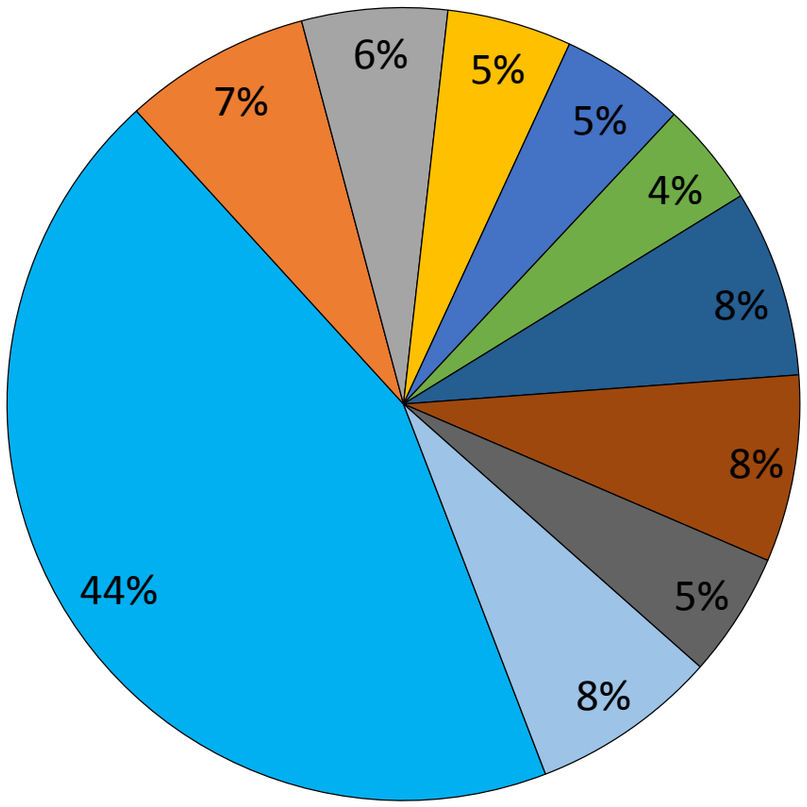
# Secondary concerns more revealing

Highlighted other preferences including:-

- Desire for more non-textual online content
- Desire for offline access to digital resources
- Enjoy the combination of books and online

# Analysis of free text comments 2

Combined primary and secondary concerns raised by students who made open text comments




- Wanted more books
- Wanted more digital learning resources
- Difficulty of subject matter
- More detail needed in module materials
- Lack of integration of materials (M269)
- More opportunity for practice needed
- Wanted more non-textual online content
- Wanted offline access
- Like combination of books and online
- Other (including tutorials)

# Next Steps part 1

- Planning to repeat questionnaire on Autumn 2018 cohort in January 2019 – this time most Physics students should have started with an entirely online module at level 1.
- This will enable us to test two alternative hypotheses:-

## Hypothesis 1

- Students tend to stick with the study methods they develop on their first module, regardless of how subsequent modules are presented.

## Hypothesis 2

- Students come to the OU with an approach to study methods which is already fixed, and this is not affected by how module material is presented to them.

# Next Steps part 2

- We have completed approx 12 in depth interviews

*'I find it easier to learn from a book than I do from looking at a screen. I look at a screen all day long at work'*

*'I'm less likely to take notes when I'm reading it digitally'*

  - 'What do you think would make a well-integrated package of learning resources for a module?'
    Every student wanted books plus visual and interactive online resources, particularly more practice online quizzes with detailed answers, and more recorded screencasts.
- Online note taking only seemed to be at all effective for those with the newer iPad Pro and an Apple pencil. Even these students said annotating paper copies was better.
- Many students said that they remembered content studied on paper better, they could visualise it on the page.
- Internet access issues meant students wanted digital resources that were available offline – several references to DVDs.
- Several students mentioned health issues, headaches, eye strain due to spending too much time looking at screens.

# What have we learnt?

How does this affect what I do?

1) The following were all more important to students than tutorials or forums:-

- More non-textual online content, particularly screencasts
- Offline access to digital resources
- Having the combination of books and online

2) The study methods students used most commonly, at all levels and across all modules/subjects were:-

- Online quizzes and Computer Marked Assignments with feedback
- Doing module exercises and activities on paper

# What do we need to investigate?

We need to learn more about the barriers to learning digitally.

- Do we need to change how we deliver digital material so it is easier to navigate?
- Can we encourage students to develop skills to actively study online materials eg online note taking, using multiple devices etc?

Or

- Should we accept that core material, particularly in STEM subjects, is best supplied in book form, and focus on using VLEs to supply more visual and interactive resources, eg Screencasts, interactive quizzes etc

# Thank you for listening

If you are interested in this area, please get in touch:-

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# What resources did students use?

| Method of Study | First Level 1 Module | | | | Current Level 2 Module | | | |
|---|---|---|---|---|---|---|---|---|
| | M269 | MST224 | S217 | W. Avg | M269 | MST224 | S217 | W. Avg |
| (D) Online quizzes and iCMAs | 3.55 | 3.41 | 3.31 | 3.42 | 3.63 | 3.61 | 3.27 | 3.48 |
| (ND) Doing module exercises and activities on paper | 2.45 | 3.78 | 3.14 | 3.11 | 2.23 | 3.52 | 3.41 | 3.07 |
| (ND) Making notes on paper | 2.34 | 2.89 | 2.58 | 2.60 | 2.1 | 2.94 | 2.71 | 2.59 |
| (D) Using module software | 2.9 | 2.22 | 2.33 | 2.48 | 3.33 | 1.39 | 1.9 | 2.20 |
| (ND) Annotating module textbooks (where available) | 1.45 | 2 | 2.02 | 1.83 | 1.17 | 2.13 | 0.17 | 1.06 |
| (D) Using Forums | 1.45 | 1.19 | 2.33 | 1.72 | 1.53 | 1.16 | 0.95 | 1.19 |
| (ND) Accessing additional books | 1.17 | 1.11 | 1.28 | 1.20 | 1.73 | 1.06 | 1.61 | 1.49 |
| (D) Making notes using a word-processor | 1.76 | 0.85 | 0.89 | 1.15 | 1.8 | 0.84 | 0.89 | 1.16 |
| (D) Using external digital resources | 0.97 | 1 | 1.41 | 1.15 | 1.83 | 1.58 | 1.71 | 1.71 |
| (ND)Annotating printed PDFs | 0.79 | 0.89 | 0.95 | 0.88 | 0.93 | 0.77 | 1.85 | 1.24 |
| (D) Annotating files on-screen | 0.72 | 0.26 | 0.48 | 0.49 | 0.97 | 0.45 | 0.61 | 0.68 |
| (ND) Using print versions of online module materials | 0.28 | 0.07 | 0.53 | 0.32 | 0.23 | 0 | 0.27 | 0.18 |
| (D) Using a personal blog | 0.28 | 0.33 | 0.25 | 0.28 | 0.3 | 0.39 | 0.07 | 0.24 |

# Does age affect preference for online or paper resources?