Pilot final report: March 2012

Applying standardised representational frameworks for the pedagogical benchmarking and review of a module

By Rebecca Galley

Abstract

The Principle Investigator of an international OER project, and member of the OULDI steering committee, asked the OULDI-JISC team to conduct a design review of a module before and after redesign using the OULDI representations as frameworks for review.

This piece of work was of significant interest to the OULDI-JISC team because it provided them with an opportunity to trial how effective the representations were in terms of acting as 'stand-alone' artefacts communicating the essential features of a module to others (as the OU's parallel institutionally funded Curriculum Business Models (CBM) project proposes), and also to see how well they worked as valid and reliable tools for expert review. If it were found that the tools worked well to support an expert review, then the OULDI team would have piloted and costed a design review process that other people in the university could use, for example to support developmental testing of modules within the university, or by module teams in preparation for updating and refreshing older modules (called in the OU a module 'remake').

Overall, the representations were found to have worked effectively as frameworks for benchmarking and review purposes, although they should not be thought of as entirely objective tools. In addition, they were found to be of interest to associated groups and were seen to be effective in improving a shared understanding of the structure of a design and confidence in design decisions, however the importance of ensuring that their purpose and potential use was more widely understood at the point of sharing became apparent.

Pilot final report: March 2012

Contents

1. Introduction 3
2. Context 3
2.1 Bridge to Success 3
2.2 Project focus 4
2.3 Project barriers, challenges and enablers 4
3. Methodology 5
4. Overview of interventions and activity within the project 5
4.1 Review of existing module design prior to redesign 5
4.2 Review of the redesigned module 12
5. Case study narratives 13
5.1 Patrick McAndrew 14
5.2 Rebecca Galley 18
6. Impact analysis 23
Success criteria 1: To apply standardised representational frameworks to the pedagogical review of a module and to determine the effectiveness and sharability of these. 23
Success criteria 2: To develop a set of guidelines to support others using the OULDI representations for review and evaluation. 24
7. Conclusions and recommendations 24
7.1 Critical success factors 24
7.1.1 Objectivity vs subjectivity 24
7.1.2 Communication 24
7.1.3 Timing 25
7.1.4 Ownership of designs 25
7.2 Recommendations for B2S/ institution 25
7.3 Recommendations for the sector 26
References 26
Acknowledgements 27
Appendices 27
Appendix 1: Design review of 'Starting with Maths', September 2011 27
Appendix 1.1 Module Map of 'Starting with Maths' 38
Appendix 1.2 Pedagogy Profile of 'Starting with Maths' 40
Appendix 1.3 Learning Outcomes view of 'Starting with Maths' 41
Appendix 2: Design review of 'Succeed with Math' (SWiM), February 2012 43
Appendix 2.1 Module Map of 'SWiM' 57
Appendix 2.2 Pedagogy Profile of 'SWiM' 59
Appendix 2.3 Learning Outcomes view of 'SWiM' 61

Pilot final report: March 2012

1. Introduction

This pilot sits with eight other OULDI-JISC pilots: three of these are located in the Open University (one in the Faculty of Education and Languages (FELS), another in the Learning and Teaching Solutions (LTS) unit, and the third in the Library Services unit) and five are located the project's partner universities (University of Reading, Cambridge University, London South Bank University, Brunel University and the University of Leicester).

2. Context

2.1 Bridge to Success

The Bridge to Success (B2S)[1] project is part of a Next Generation Challenge Grant. The grant was awarded to the Anne Arundel Community College, the Open University, UK (OU), the University of Maryland University College (UMUC) and the Massachusetts Institution of Technology (MIT) to develop an open content module to encourage and improve the readiness of adults returning to education - especially in relation to building math's confidence.

The B2S project has taken two successful Open University (OU) introductory modules '*Starting with maths'* and '*Preparing to learn'*, redesigned them and made them available as an open educational resource (OER), free to use and/or adapt in colleges or by individual instructors or students in the US.

The Principle Investigator for the B2S project (see section 5.1) is based at the OU, and is a member of the OULDI steering committee. He asked the OULDI-JISC team to conduct a design review of the existing *'Starting with maths'* module using the OULDI representations and tools (see Appendix 1), and a follow up review of the redesigned OER (see Appendix 2). The original purpose of these reviews was twofold: firstly it was hoped that the review of the original module would act as a reliable benchmark so that the OU based B2S evaluation team would be able to more clearly identify what changes had been made to the module, and the potential impacts of these changes on student learning; secondly, the reviews should identify any generic design challenges in converting a pre-existing module into an OER, and that this would help the team to develop a set of guidelines to support others converting whole modules into OERs in the future.

The design reviews were also used in further unexpected but significant ways as a result of serendipity rather than intent. Firstly, the completion of the first review report coincided with a series of important B2S planning meetings - and although intended primarily for the evaluation team – the review's findings and recommendations were presented to the whole

[1] More information about the B2S project is available at http://b2s.aacc.edu.

team and appeared to structure much of the subsequent planning discussion. Secondly, the representations and report were shared with a university team who were at that time engaged in a periodic review of the introductory programme. These unplanned uses of the representations and design reviews will also be evaluated as part of this pilot report.

It should be noted that the OULDI-JISC team are not members of the B2S team and that work completed for this pilot has not been funded or evaluated by the B2B team. The projects, although complementary, have remained entirely separate.

2.2 Project focus

This piece of work was of significant interest to the OULDI-JISC team because it provided them with an opportunity to trial how effective the representations were in terms of acting as 'stand-alone' artefacts communicating the essential features of a module to others (as the OU's parallel institutionally funded Curriculum Business Models (CBM)[2] project proposes), and also to see how well they worked as valid and reliable tools for expert evaluation. If it were found that the tools worked well to support an expert review, then the OULDI team would have piloted and costed a design review process that other people in the university could use, for example to support developmental testing of modules within the university, or by module teams in preparation for updating and refreshing older modules (called in the OU a module 'remake').

The dual focus of this pilot was therefore:

Success criteria 1: To apply standardised representational frameworks for the pedagogical review of a module and to determine the effectiveness and sharability of these.

Success criteria 2: To develop a set of guidelines to support others using the OULDI representations for review and evaluation.

2.3 Project barriers, challenges and enablers

- The B2S team were focused on student experience throughout the redesign process, and were consistently positive about working with the OULDI team.
- However, the purpose of the reviews and their anticipated impact did not appear to be well communicated across the wider team. This led to some misunderstandings about who, or what, the design reviews were for and how the B2S team might use them.
- A contributory factor in this was that there is an established quality kite-mark widely used in the US that sets criteria for good instructional design. It has been important to emphasise that the design reviews conducted by the OULDI team were not

[2] More information about the CBM project is available at http://www.open.ac.uk/blogs/OULDI/?page_id=833

quality control activities but rather they aimed to capture and communicate aspects of the modules and identify areas for design focus.

- The cultural differences in assumptions about what makes good learning and teaching were found to be more significant than expected both in terms of a US/UK perspective, and also in terms of academic/instructor perspectives about what the module intended to offer students. These differences impacted on the final design and are also likely to have impacted on how the design review reports were received and understood.

3. Methodology

The OULDI representations 'Module Map[3]', 'Pedagogy profile[4]' and 'Learning Outcomes View[5]' were used to provide a framework for design reviews of the original module and the new module post-redesign. Semi-structured interviews were conducted with the principle investigator and the module chair of the original module, email feedback was received from two members of the US based team, and the OULDI project officer who conducted the reviews maintained a reflective log to document the review process.

Key themes from the data were identified using thematic analysis (Boyatzis, 1998; Joffe & Yardley, 2004) and findings and results are presented in Sections 4 and 5.

4. Overview of interventions and activity within the project

4.1 Review of existing module design prior to redesign

A 'top-level' pedagogical review of the structure of the original *'Starting with Maths'* module was conducted, and a report prepared for the design team (see Appendix 1). The OULDI project officer (see section 5.2), a skilled teacher with experience of working with adults returning to education, led the design review process with support from another member of the OULDI project team, who sits in the Learning and Teaching Development team in the university.

The module's student facing documents and materials were used to inform the review, and three OULDI representations were chosen to enable review from three different pedagogic perspectives. These were:

[3] For description, resources and activities for the Module Map see http://jiscdesignstudio.pbworks.com/w/page/33031185/OULDI%20-%20Module%20Map
[4] For description, resources and activities for the Pedagogy Profile see http://jiscdesignstudio.pbworks.com/w/page/33031409/OULDI%20-%20Pedagogy%20Profile
[5] For description, resources and activities for the Pedagogy Profile see http://jiscdesignstudio.pbworks.com/w/page/33031528/OULDI%20-%20Learning%20Outcomes%20View

- **Module Map** which gives an 'at a glance' textual overview of the module across four 'student experience' dimensions: Guidance and support; Content and experience; Communication and collaboration; Reflection and demonstration.
- **Pedagogy Profile,** a bar chart representation of student activity across the module - the aim of this representation is to capture visually what students *do* as they study, rather than what they are studying. The categories used derive from a learning activity taxonomy (Conole, 2007; Conole 2008) that characterises the types of tasks learners undertake into six types: Assimilation (reading, watching, listening); Information handling; Communication; Productive; Experiential; Adaptive; Assessment.
- **Learning Outcomes View,** a notational view informed by Biggs' notion of 'Constructive Alignment' (Biggs, 1999), which shows how the learning activities and assessment tasks are aligned with the intended learning outcomes of the module

The first step in the review process was to identify all the learning and teaching 'assets' that were used in the module - including tools, resources, texts, guidance materials etc including those it was expected that the student will provide – and make judgements about which dimension they were primarily intended to support. So for example the Welcome letter and study calendar aims to guide and support, whereas the 'Starting with maths' book contains module content, and the learning plan and review templates support reflection and demonstration of learning etc. Next, the student facing documents were scanned for information about how it was anticipated these tools and resources would be used to support learning and teaching, and all of this inserted into the Module Map Excel template.

'At a glance' Module Map

This worksheet has been created by the JISC-funded OULDI project.

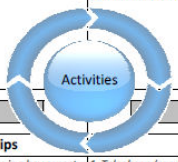
Course/ module title: Y162-11K

Guidance and Support

Tools and resources	Roles and relationships
1. 'What do I do first?' Openings leaflet (PDF and printed copy) *2.Module timetable (PDF, Word and printed copy)* *3.'Start here' (Video on DVD and PDF transcript)* *4.'Fitting it all in' (Video on DVD and PDF transcript)* *5.'Working with your tutor' (Video on DVD and PDF transcript)* *6.'A sense of acheivement' (Video on DVD and PDF transcript)* *7. 'Hello and welcome from the Y162 Module team!' module website message (online, optional)* *8. Library Guide: using your online library (online only, not integrated and optional)* *9. One stop search and helpsheet (online only, not integrated and optional)* *10. Library Training via Elluminate (online only, not integrated and optional)*	16:1 tutor ratio. Approx 2 hours 1-1 tutor time in total (telephone) Tutor role 'to help support learning', and in particular to: - help learners develop confidence in mathematical ability and strategies for problem solving - help learners plan their work and think about the ideas explored in the module - encourage students to ask themselves questions about their learning experience

Content and Experience

Tools and Resources	Roles and relationships
1. Starting with maths (PDF and printed copy) *2. Calculator booklet (PDF and printed copy)* *3. Exercise booklet (PDF and printed copy)* *4. Additional resources booklet (PDF and printed copy)* *5. Graph paper (PDF and printed copy)* *6. 'Views on mathematics' (Audio on DVD and PDF transcript)* *7.' A brief history of numbers' (Audio on DVD and PDF transcript)* *8. 'Designing the website' (Audio on DVD and PDF transcript)* *9. Online activities (optional)* *10. OU Library (optional)*	Three themes run through the module. These are: 1. improving mathematical skills, including use of a calculator 2. developing your approach to problems 3. helping you become an effective learner. No prior knowledge or experience is assumed Module materials start gently and gradually build up to degree-level study Activities are differentiated i.e. opportunities are provided to build on existing knowledge and understanding where it exists (e.g. via margin notes/ prompts) Module designed to encourage an active approach to studying i.e. learners encouraged apply learning to actual examples Variety of activity formats (case studies, puzzles, historical snapshots and more recent mathematical discoveries)



Reflection and Demonstration

Tools and resources	Roles and relationships
1. The learning plan (RTF, PDF, Word and printed copy) *2. The learning review (RTF, PDF, Word and printed copy)* *3.Assignment booklet (online, PDF and printed copy)* *4. List of module learning outcomes (in assignment booklet)* *5. TMA01 (formative) all module outcomes 1-8* *6.TMA02 (formative) all module outcomes 1-8* *7.EMA (summative) all module outcomes 1-8* *8. 7 x Study checklists - unit level learning outcomes (in 'Starting with maths')* *9.Tutor marking guidelines - includes introduction to the learning outcomes, learning plan and review, feedback process, TMAs and EMA (not available to students)*	Critical reflection on learning and progress is a key aspect of this module. Tutors will: - comment on and help with learners' written work (in particular after the TMAs in writing and by telephone) - work with learners to produce an end of module study plan Learners will: - apply learning to actual examples - reflect on learning and discuss progress with tutor - work with tutor to produce an end of module study plan - learn to ask themselves questions such as ' What do I know and what do I want?', 'Would a diagram help?' 'What's the same and what's different about this problem...?' etc.

Communication and Collaboration

Tools and resources	Roles and relationships
1. Telephone (required, landline preferred) *2. Module forum (optional)* *3. Openings forum (optional)* *4. Email (optional)* *5. Television (optional)*	1-1 telephone tutorials (Week 1, and ? - other tutorial times not specified??). In total these amount to approx 2-hours 1-1 time per student in total . Written feedback is given after TMAs on script and on the PT3 form Email communication between learner and tutor is optional. There are no face-to-face learning or teaching opportunities. Peer to peer communication and collaboration is optional via the forums (forums only mentioned in 'Hello and welcome' module website message)

Module summary
This Openings course introduces a range of key ideas (including using a scientific calculator effectively), to help learners tackle everyday mathematical problems at home, work, or in your further studies. Case studies, activities, puzzles, historical snapshots and more recent mathematical discoveries are included, as well as advice on studying generally.

Keywords
Maths, study skills, confidence, calculator, Openings, problem solving

Figure 1: Module Map (Appendix 1.1)

The OULDI project officer then used the representation to identify key module features and potential design challenges the B2S team might face. A list of the kinds of questions she used to interrogate the representation is detailed in section 5.2. The Module Map took approximately 6 hours to complete in total, including review and reporting.

Next the pedagogy profile was completed. To do this, the module was considered in weekly 'chunks' and the directed study hours of students in that week categorised according to the taxonomy, and the figures entered into the Excel spreadsheet tool. The following table was used to help structure the decision making in relation to which category and activity should fit into:

Category	**Process outcomes (learners will...)**
Assimilative	e.g. Read, Watch, Listen, Think about, Observe, Review, Study
Finding and handling information	e.g. List, Analyse, Collate, Plot, Find, Discover, Access, Use, Gather, Order, Classify, Select, Assess, Manipulate

Communication	e.g. Communicate, Debate, Discuss, Argue, Share, Report, Collaborate, Present, Describe, Question
Productive	e.g. List, Create, Build, Make, Design, Construct, Contribute, Complete, Produce, Write, Draw, Refine, Compose, Synthesize, Remix
Experiential	e.g. Practice, Apply, Mimic, Experience, Explore, Investigate, Perform, Engage
Interactive/ Adaptive	e.g. Explore, Experiment, Trial, Improve, Model, Simulate
Assessment	Include summative (graded) assessment only here e.g. Write, Present, Report, Demonstrate, Critique

Table 1: Pedagogy Profile key

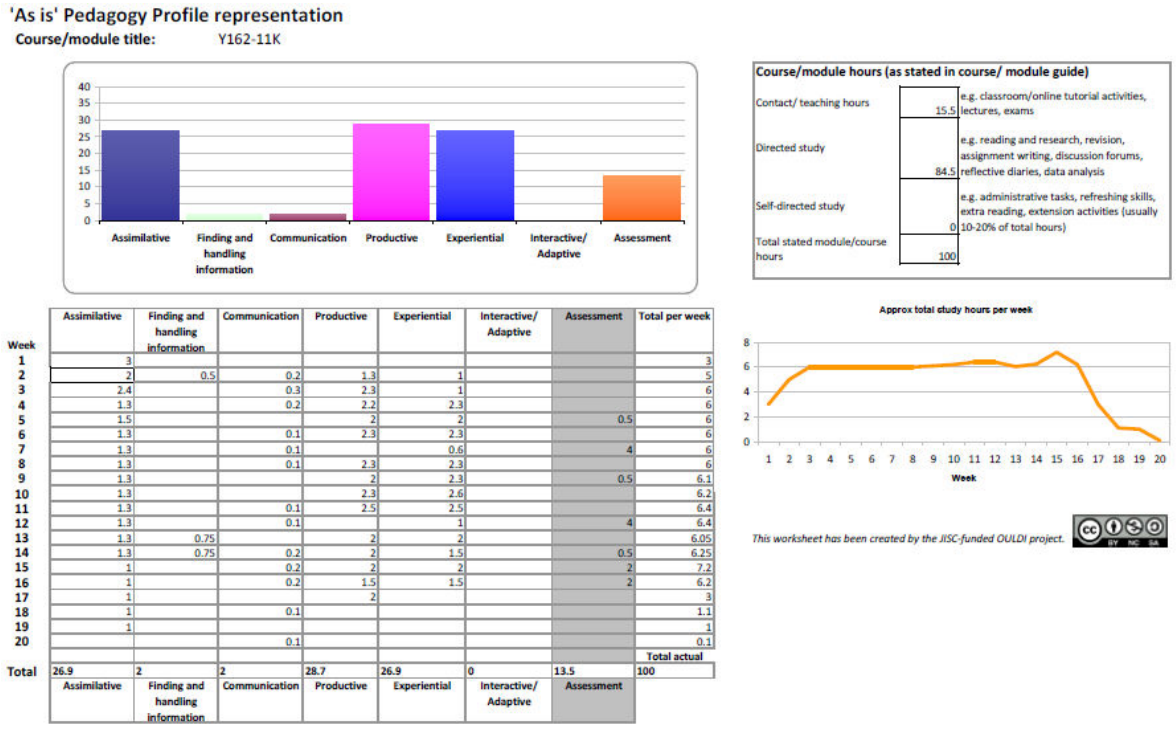


Figure 2: Pedagogy Profile (Appendix 1.2)

Once the representation was complete, it was used to enable a review of how students spent their time while studying the module. The questions used to interrogate the representation are again included in section 5.2. Completion of the Pedagogy Profile, including review and reporting took approximately 6 hours in total.

Finally the module was reviewed to discover how far learning outcomes aligned with student activities and assessment. The OULDI notation tool *CompendiumLD*[6] was used to draw out the OULDI Learning Outcome View. Below, Learning Outcome 7 is used as an example:

[6] For more about CompendiumLD see http://compendiumld.open.ac.uk/

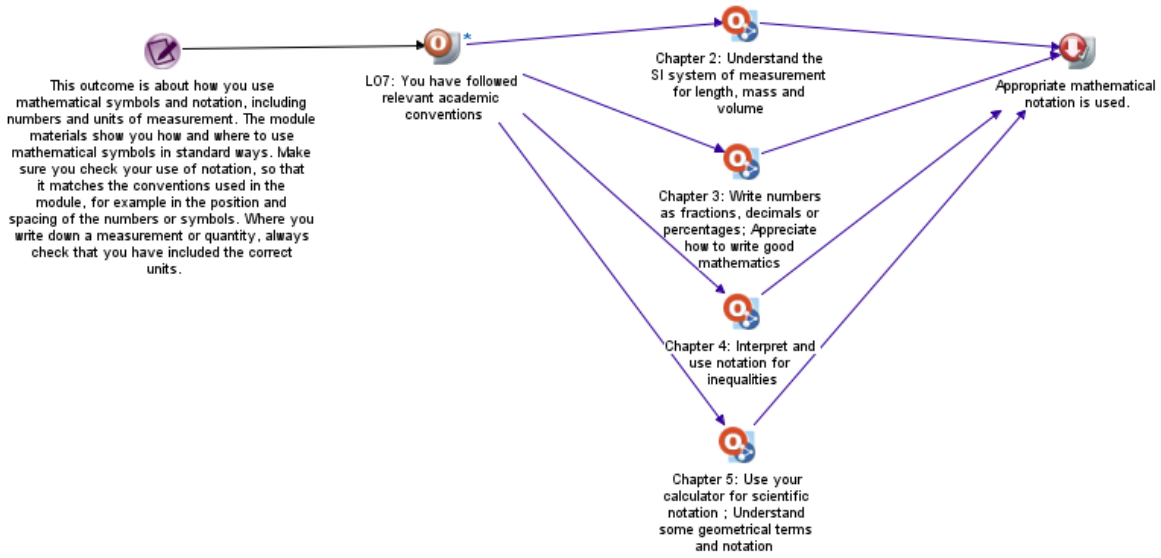


Figure 3: Learning Outcomes View (Appendix 1.3)

The mapping and review of the Learning Outcomes View took approximately 6 hours and again the questions used to review the design are detailed in section 5.2.

Finally the findings from the review of the representations were collated into a report. The focus of this review was to capture the key features of the module, and thus provide a 'benchmark' from which to measure change, and also to identify any possible design challenges the B2S team might face. It was anticipated that the most significant design challenge would be created by the removal of embedded tutor support. For example, in the absence of a tutor:

- How would students be supported in recognising their progress not only in understanding and applying the mathematical concepts, but also in developing confidence, resilience and problem solving skills? And how would progress be rewarded?
- How would online students be supported in asking themselves timely critical questions in relation to their maths practice (i.e. What do I know and what do I want? Would a diagram help? What's the same and what's different about this problem...? etc), reflect on learning, articulate progress, plan goals and next steps.
- How would intrinsic and extrinsic motivation be supported and sustained throughout the learning journey to ensure that good completion rates were maintained?

Completion of the report coincided with a series of key project team meetings and a summary of the review's findings was shared with the wider B2S project team. The B2S

Principle Investigator shared the representations and top-line recommendations as a presentation and then led a discussion entitled 'Ways forward'

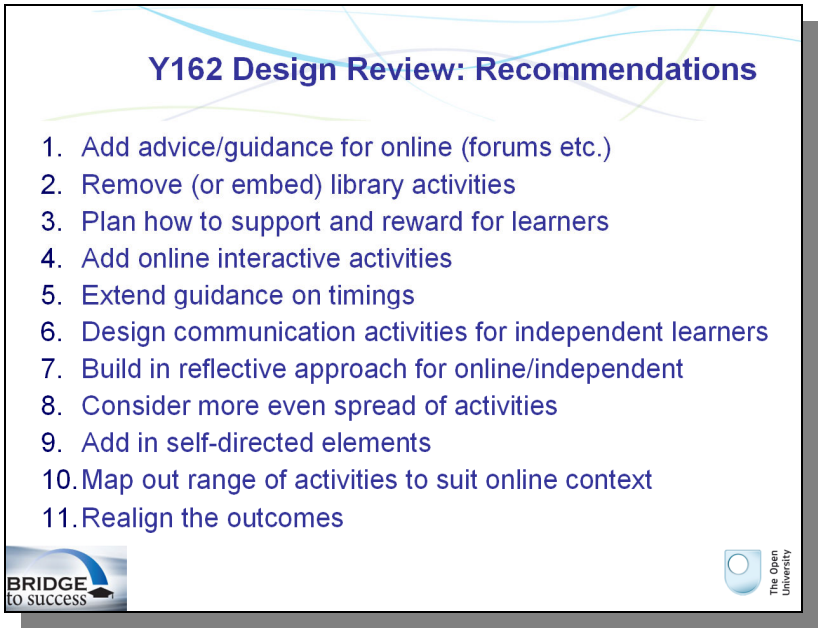


Figure 4: Slide from the project meeting presenting a summary of recommendations

The Principle Investigator's view was that the presentation of the key findings of the review "*changed the nature of that meeting; it made it much more effective*".

The review was also shared with a university team conducting a periodic review of the Openings programme (a set of introductory 10 and 15 credit access modules) as it was felt that they would find the report useful as they worked though the review process:

> *"The main reason [I sent it to them] was that they were undergoing a periodic review of the programme and I thought it would be very useful for them to see somebody's view who hadn't been associated [with these modules] at all".*
>
> **B2S project Senior Lecturer (UK based)**

The representations and the report were produced for the specific purpose of benchmarking the module prior to redesign so it is significant that both the Principle Investigator and the Senior Lecturer felt compelled to share the representations and report with people outside of the project evaluation team; however it should be noted that the individuals that they shared the report with, generally appeared to find the documents less useful or compelling. For example one participant in the planning meeting said:

> *"I can't say that we really did much with that [...] it's entirely possible that the delta between [Starting with maths] and the B2S module wasn't that great, so there wasn't much change that was necessary, or that there was so much to do on the content side that we didn't get to the other "stuff""*

B2S project team member (US based)

The Senior Lecturer reported that although the original production team had found that several of the design challenges highlighted were ones that they recognised and had begun to address - and that the report had been useful in providing reassurance in relation to these - they did identify a number of strong concerns in relation to the representations and report:

> *"We do feel that some key parts of what [the module] is trying to do haven't been included and also some bits - and you might not have had all the relevant documents – weren't correct"*

B2S project Senior Lecturer (UK based

Several of the issues detailed related to disagreement about how the Pedagogy Profile had been used to represent activity. It was felt, for example, that because one unit was dedicated to the subject of data handling and graphs, much of that unit should be counted as 'Finding and handling data'. Similarly, it was felt that since a key part of the module was to develop students' mathematical writing and use of mathematical notation and language, more time should be allocated to 'Communication'

There was also concern that the description of the module was inaccurate and incomplete in places, particularly on the tutor support, communication and assessment. For example the first point in the Guidance and Support section was about forums but it was felt that forums were a very small and entirely optional part of the module, and that there were sound subject-specific reasons for this. They felt that the main mechanism of support was via the tutor and that it was critical that this should be described first. Finally, although they agreed with the recommendation to draft up some new learning outcomes for SWiM, they felt that the description of the assessment as unaligned with activities was in practice incorrect and that this would reflect badly and completely unfairly on the module. The feedback highlighted the need to provide opportunities for discussion between the designer/ reviewer and the academic, so that there is better shared understanding about what aspects of the module the tools can be used to represent and the process. It is perhaps also important that researchers who then use the pedagogy profile share this agreed understanding.

Similarly, when attempting to explain why the documents were not used more by the design team, the Principle Investigator suggested that the way that the representations and review report were communicated may be an issue, or alternatively that existing team processes and practices may have inhibited the way that the representations could be used:

> *"I don't know whether there's a lesson from that, whether there's a lesson that [the representation set] still needs yet another layer of simplification or communication support to get to people, or whether it was just an artefact of the way that we were working with people"*

4.2 Review of the redesigned module

A follow-up review of the redesigned module was commissioned just prior to it going 'live', and again the report was circulated to the wider B2S project team as well as the evaluation team (Appendix 2)

This time the aim of the review was to identify and articulate the pedagogical design and structure of the new B2S module, and highlight any potential design issues or areas for further evaluation as it came to be used in a US, open learning context. It also attempted to reveal how far emerging design problems had been solved by the design - in particular in relation to the removal of the tutor role - and draw out the ways in which this was achieved.

Again the module Map, Pedagogy Profile and Learning Outcomes View were used and the same set of review questions were used to interrogate each representation. The representations can be found in Appendices 2.1-2.3. In particular, this second review found that the team had chosen to solve the problem of the tutor role by shifting the pedagogic structure of the module from a broadly cyclical experiential structure - students try mathematical problems, reflect-on and conceptualise their learning journey, and set goals, try the next set of problems etc, to a more linear instructional model – students are guided step by step through a sequence of progressively more complex mathematical concepts via a series of prompts and problems. Generally, the mechanisms for supporting student goal setting, planning and reflection had been removed (with the exception of a student notebook), however the pedagogic elements one might usually find in an instructional model (i.e. clearly articulated and aligned learning outcomes) had not been added as part of the redesign. Interestingly however, despite significant changes to the pedagogical model, the pedagogy profile for both the original module and the redesigned module remained almost the same, indicating that although the pedagogic structure, and particularly the way students were guided and supported, had significantly changed, there had been very little change to what students were expected to do:

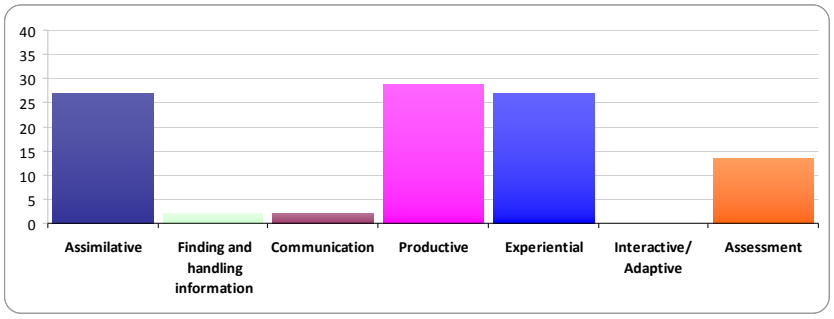


Figure 5: Student activity profile: original module (y=study hours, x= activity type)

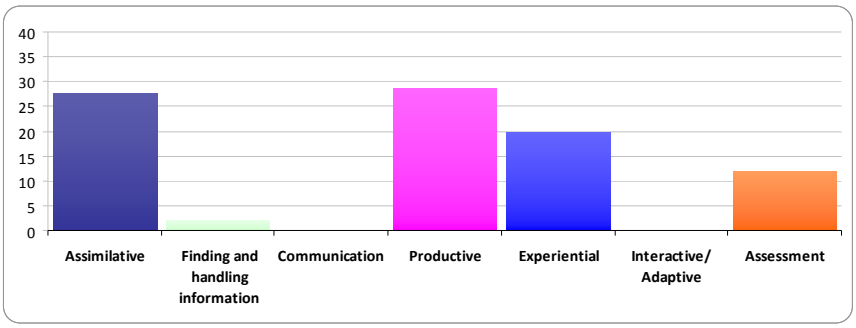


Figure 6: Student activity profile: redesigned module (y=study hours, x= activity type)

Despite being received after the launch of the new module, more of the wider project team seemed able to engage in the findings of the second review than the first. In part this appeared to be because they were already looking forward to follow-on funding that would enable them to work on a second iteration of the design, but also the review was given to them in its entirety (rather than as a bulleted summary) and the report discussed in detail in a telephone meeting. Members of the team had already recognised that the challenge of the lost tutor role had not yet been sufficiently addressed, and the report was seen as being useful in helping frame that issue:

> *"I can say that we're taking the input seriously as we move into the summer. The interaction with tutors that got dropped (the biggest change, if you will between the existing OU module and the B2S module) is the biggest missing component. We know that some of that interaction gets picked up in the way faculty and institutions are implementing B2S. But for modules that were never meant to be entirely solo, I think they're getting used that way now. So there is something missing in the B2S modules".*
>
> **B2S project team member (US based)**

Additionally one member of the US project team has become interested in the transferability of the representations to his own educational context:

> *"I'd love to learn more about the methodology [the OULDI project officer] used for doing the learning design review of SWiM. I can see the value of it as applied to the courses we're working with here, perhaps walking through MITx to show the methodology?"*
>
> **Email from B2S project team member (US based)**

5. Case study narratives

The following narratives tell the story of two individuals involved in this pilot: the Principle Investigator and the OULDI project officer who conducted the reviews. They should not be seen as representative of the experience of all those who were part of the pilot, rather the aim of these narratives is to draw out the potential impacts on individuals' practice and tell

the story of the pilot from an authentic 'insiders' point of view. These narratives sit alongside more than 24 others from the other pilots and so have been written so that they can act as standalone mini-case studies as well as sections in this report. It is hoped that a synthesis of these will enable the project team to identify the key impacts, barriers and enablers of the project as a whole.

5.1 Patrick McAndrew

Patrick McAndrew is a Professor of Open Education with a particular interest and expertise in the research and evaluation of Open Educational Resources (OER) and practices (OEP). His university has led on the OULDI-JISC project, and Patrick has been a member of the university's OULDI-JISC steering group committee since 2008. In 2011 he became the Principle Investigator for an international project which took an established and well received distance learning introductory maths module and re-designed it into a US-facing OER for use by individuals seeking to improve their confidence and capabilities in maths. Aware of the OULDI representation set[7], Patrick asked the OULDI team to produce a set of representations of the original distance learning module so that he and his team could better identify, monitor, evaluate and share the changes made to the module as it was redesigned by the US team. The module was represented using the Module Map[8], Pedagogy (or Activity) profile[9] and the Learning Outcomes view[10], and a 'wrap-around' report produced to summarise finding:

> *"So it had got more of a research motivation than a practical motivation to start with. Here was a chance to be able to reflect on a course that already existed and to which we were making specific changes, for a context we knew about [...] it [would] give us a way to record all the changes and show people what it is we're changing and talk about the way in which we can apply this as a model again. So it gives us a way to look at what we are doing which will enable us to be clearer about a process we'd expect to repeat and the things that we'd expect to change rather than treating what we are doing as a one off".*

The representations and report were also used in a further unexpected but significant way as a result of serendipity rather than intent. The completion of the report coincided with a series of important project planning meetings and – although intended primarily for the

[7] For a poster description of the set see http://www.open.ac.uk/blogs/OULDI/wp-content/uploads/2010/11/5-views-image.png
[8] For description, resources and activities for the Module Map see http://jiscdesignstudio.pbworks.com/w/page/33031185/OULDI%20-%20Course%20Map
[9] For description, resources and activities for the Pedagogy Profile see http://jiscdesignstudio.pbworks.com/w/page/33031409/OULDI%20-%20Pedagogy%20Profile
[10] For description, resources and activities for the Pedagogy Profile see http://jiscdesignstudio.pbworks.com/w/page/33031528/OULDI%20-%20Learning%20Outcomes%20View

evaluation team – Patrick presented a bullet point summary of the report's findings and recommendations to the team within the project that was working on changes to the content. Patrick found that this presentation and setting out the conclusions seemed to structure much of the subsequent planning discussion:

> *"The particular timing that occurred was that this report was available just as we were having a week long joint meeting in the US with the people who were actually involved in re-planning the content, and it meant that we used the report with those people. And that had not been the expectation really because we expected to be at a different point entirely when we did this. We expected to be able to have a retrospective look and then we'd be having the refresh of content and then having a look at that. But actually the analysis was able to feed into the process of change".*

Patrick is able to identify both personal and project team benefits of having the representations at that stage:

> *"I think if we hadn't done that work on the plane [studying the representations and report before the meeting] we might have had a bit of a shock coming into a meeting where we suddenly felt a lot of people saying "Well, what do you think about this? What do you think about that?" We could actually show people that we had gone through a process of thinking about this. It might have been ok to have done it without a back-up of an actual analysis but the existence of the analysis itself made things feel much more secure"*

> *"I think it had quite a big impact on the confidence of people in the process overall and so I think that some people involved felt very much that they were the only people that understood that there were issues in making this and that perhaps there was an impression that we were saying "this material will work anywhere", and they were saying "well it's not going to work right for us and we're the only people in the room that know that and we're the only people that realise that this won't work" and this showed that - no, we understood that there was a difference between where we were starting from and where we wanted to end up and so I think that gave them some greater trust in us [...] I think it helped open up dialogue and a spirit of compromise and a better understanding of what the project was trying to achieve rather than what the content might achieve".*

Additionally, Patrick felt that sharing the representations and report with the wider team enabled a discussion where all participants could discuss change openly and begin to allocate ownership or responsibility for particular design challenges:

> *"I think people who were working on the mathematics content had felt that they needed to take on board all of the issues they could think of including the change of*

context, the change from paper to online, how it would be framed and they could see that we were actually identifying the issues to do with that change and I think it helped them to relax – they weren't the only people that had thought about the need for change and we could say "well some of that is to do with the environment and it's not to do with the mathematics material".

Overall Patrick highlighted three impacts of this 'opening up of discussion' on the redesign process relating both to effectiveness and efficiency:

"It particularly resulted in perhaps three things happening: one was this bringing out of more generic changes so that they could be dealt with at a level across the project [...]; the second was confirming that some of the issues that had already been spotted were the right sort of things [...]; and the third one was that some of what was planned could be dealt with in lighter-weight ways. What we didn't want for the project overall was for every change to be done in the most detailed way possible because actually that is not repeatable. If you just took our course as inspiration and wrote another course then it's not actually doing what we wanted to do and that was very helpful because we could see that that was a real risk at that stage, that people were not paying enough attention to the value that came from the original design and this brought people back to the original design[...] the original extraction of the key issues changed the nature of that meeting; it made it much more effective."

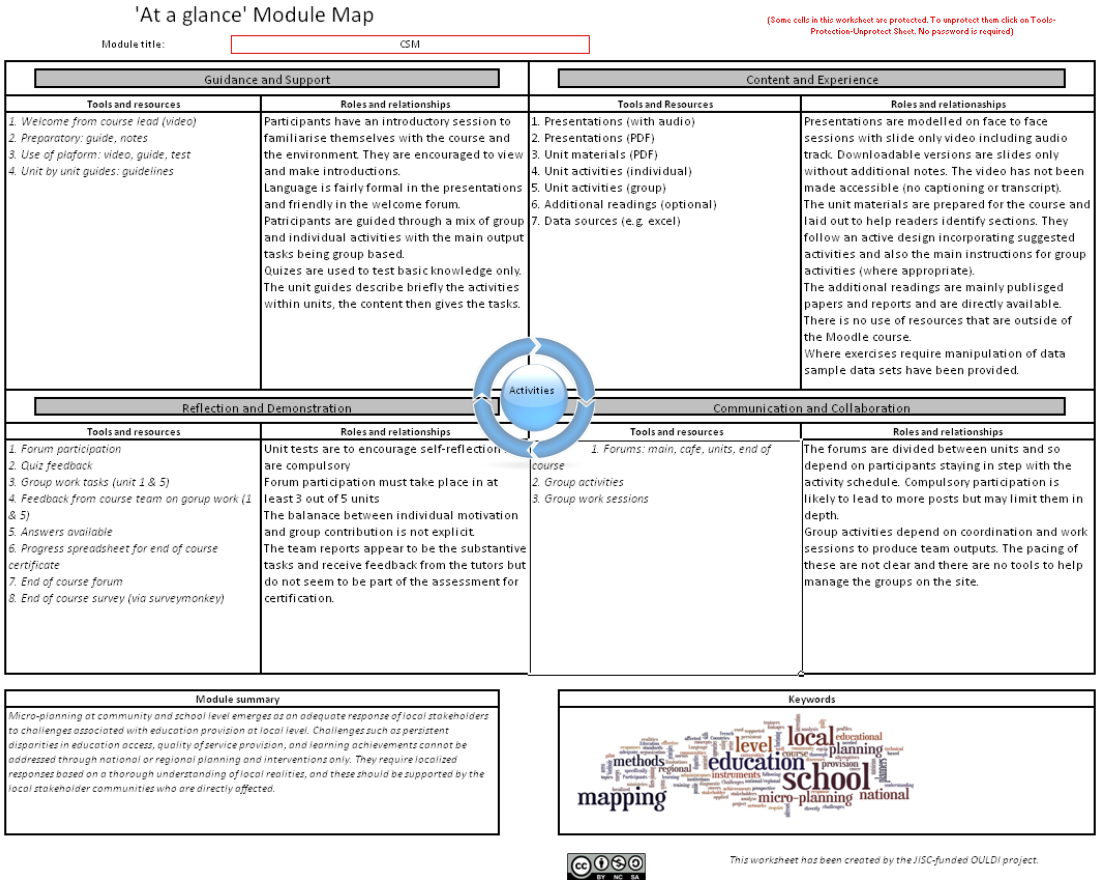
However - largely perhaps because it was never intended that the document would be used in that meeting - the representations were not considered key project documents and once the planning meeting was over they went almost entirely unused, and the team went back to a focus on content rather than learning and learner experience:

"Perhaps one weakness was that we didn't really follow through enough by keeping that document as a key document for that group. They were too busy in a sense so it has dropped back into that background position [...]. I think actually some of the power of the representations have not been used as much as they could have been. I could be wrong, but I don't think so. I think that almost just the way it happened because it wasn't planned into the week and perhaps if we'd been thinking more about it we could have made sure there was the chance to fully explain to people how it worked. So people got back onto the content level – they felt more secure, everything went better but it wasn't "Oh yes, lets go back and see whether we are doing things in the context of the representation". It would be worth checking with a number of people to see whether they did pick them up but my feeling – well its more that a feeling because I did raise it in a later meeting as to whether the document was being used - but actually only the summaries were being drawn on."

As a consequence of this Patrick thinks that, although the representations and report can be seen to have impacted on that initial face-to-face meeting, it is unlikely that it will have had any clear and measurable impact on the final OER design. Patrick regrets not pushing the document forward later in the process:

> *"I do think though that it really was a very good review document [but] I know I used it directly more than other people. I don't know whether there's a lesson from that, whether there's a lesson that it still needs yet another layer of simplification or communication support to get to people, or whether it was just an artefact of the way that we were working with people in the US [...] we chose at that point to not push the documents as the key thing because people were very busy, but if we'd revisited it in a couple of weeks time to say "could you go back to...". It might have taken very little to just go back and see if this representation could help them move forward and I think that was missed"*

Patrick also reported that seeing the approach in action had influenced his own approach to working with materials. Some months later, Patrick was asked to give feedback on another module for a different project and decided to independently use the OULDI 'Module Map'[11] and report structure to provide a framework for his review.



'At a glance' Module Map

(Some cells in this worksheet are protected. To unprotect them click on Tools-Protection-Unprotect Sheet. No password is required)

Module title: CSM

Guidance and Support

Tools and resources	Roles and relationships
1. Welcome from course lead (video) *2. Preparatory: guide, notes* *3. Use of plaform: video, guide, test* *4. Unit by unit guides: guidelines*	Participants have an introductory session to familiarise themselves with the course and the environment. They are encouraged to view and make introductions. Language is fairly formal in the presentations and friendly in the welcome forum. Patricipants are guided through a mix of group and individual activities with the main output tasks being group based. Quizes are used to test basic knowledge only. The unit guides describe briefly the activities within units, the content then gives the tasks.

Content and Experience

Tools and Resources	Roles and relationships
1. Presentations (with audio) 2. Presentations (PDF) 3. Unit materials (PDF) 4. Unit activities (individual) 5. Unit activities (group) 6. Additional readings (optional) 7. Data sources (e.g. excel)	Presentations are modelled on face to face sessions with slide only video including audio track. Downloadable versions are slides only without additional notes. The video has not been made accessible (no captioning or transcript). The unit materials are prepared for the course and laid out to help readers identify sections. They follow an active design incorporating suggested activities and also the main instructions for group activities (where appropriate). The additional readings are mainly publisged papers and reports and are directly available. There is no use of resources that are outside of the Moodle course. Where exercises require manipulation of data sample data sets have been provided.

Activities

Reflection and Demonstration

Tools and resources	Roles and relationships
1. Forum participation *2. Quiz feedback* *3. Group work tasks (unit 1 & 5)* *4. Feedback from course team on gorup work (1 & 5)* *5. Answers available* *6. Progress spreadsheet for end of course certificate* *7. End of course forum* *8. End of course survey (via surveymonkey)*	Unit tests are to encourage self-reflection are compulsory Forum participation must take place in at least 3 out of 5 units The balanace between individual motivation and group contribution is not explicit. The team reports appear to be the substantive tasks and receive feedback from the tutors but do not seem to be part of the assessment for certification.

Communication and Collaboration

Tools and resources	Roles and relationships
1. Forums: main, cafe, units, end of course *2. Group activities* *3. Group work sessions*	The forums are divided between units and so depend on participants staying in step with the activity schedule. Compulsory participation is likely to lead to more posts but may limit them in depth. Group activities depend on coordination and work sessions to produce team outputs. The pacing of these are not clear and there are no tools to help manage the groups on the site.

Module summary

Micro-planning at community and school level emerges as an adequate response of local stakeholders to challenges associated with education provision at local level. Challenges such as persistent disparities in education access, quality of service provision, and learning achievements cannot be addressed through national or regional planning and interventions only. They require localized responses based on a thorough understanding of local realities, and these should be supported by the local stakeholder communities who are directly affected.

Keywords

This worksheet has been created by the JISC-funded OULDI project.

He found the template easy to use and useful for structuring a review:

> *"I found the process very helpful in giving a framework for understanding the material. Without something like this I would have kept on going round the course while filling in the template enabled me to know when I had analysed it enough to pick out how it was working and areas for improvement".*

5.2 Rebecca Galley

Rebecca Galley is principle project officer for the Open University Learning Design Initiative (OULDI[12]) project. Rebecca has extensive experience as an educator working in a variety of college and workplace contexts, including 'Returners' groups (i.e. students returning to education or work) before lecturing in education in an HE in FE context. She has been working on the OULDI project for three years and has been very much engaged with the development and piloting of the OULDI representations set, including delivering workshops and supporting teams in the use of the templates. As a result of her role on OULDI, she and a colleague were asked by the Principle Investigator of an international project - which was taking an established and well received distance learning introductory maths module and re-designing it into a US-facing OER - to do some mapping of the existing module for

[12] For more about the OULDI project see http://www.open.ac.uk/blogs/OULDI/

benchmarking purposes and then follow this up with a review of the redesign module to enable identification and monitoring of design decisions and changes. She had already conducted two other reviews of existing university modules using the representations, and had found them to be a useful way of structuring a review:

> *"There are a number of ways one can look at a module or curriculum offer and the OULDI representations are by no means the only ones we could use, but these three do seem to offer a useful framework for just checking through some of the key aspects from a student perspective [...] so this was a slightly new way of using the tools but I was fairly sure that they would work well"*

Previously though, the reviews had been conducted alongside members of the module team, and a significant part of the impact of those reviews was that module team members felt that they had a much better understanding of what the module was about and what the future redesign focus should be. Rebecca was concerned that if the team was not involved themselves in the review process there was a risk that they wouldn't be able to make good use of the representations. She felt this was a particular issue for this project because some learning design work had already been done on another of the project's modules by other members of the OULDI team and this work had not been used at all:

> *"In particular both [colleagues X and Y] have done a fair amount of learning design work on [this] and the other [OER project] module but in both cases it was almost entirely disregarded so I guess I was concerned that what we were being asked to do would actually be used!"*

Early in the process Rebecca was also alerted to the fact that there might be some confusion in the US team about what the design review might be for:

> *"The[OER] project manager suggested that we make it really clear that the review we were doing wasn't a quality control activity as she had noticed that there was already some misunderstandings in the team about what the review would do. There is a quality kite-mark used in the US for instructional design and it was really important that the team didn't think this was something similar"*

To help ensure that the representations would be used and understood by the OER project team, Rebecca decided to write a 'wrap-around' report for each module to communicate and explain what she had done, and what each review might suggest. In addition she wrote a reflective log of her activity so that she could capture both the process and any emerging challenges.

It was decided that she would take the Module Map and Learning Outcomes Views and her colleague would take the Pedagogy Profile. She would then review the representations and

identify any key features of the module and any emerging potential 'design challenges'. She started with the Module Map and it quickly became clear that the tutor role was an important feature of the module's design. She commented in her reflective log:

> *"I have been 'retrofitting' [the original module] into the Module Map. It took most of the day but I think it should be really useful to the [project team] as they do the redesign. In particular the role of the tutor is *so* significant in this module but I believe that the intention is to redesign the module so that students can study on the module by themselves. If they don't do a good job there is a real risk that student motivation will be low and attrition high"*

She noted down a series of questions she was using to interrogate the Module Map representation of the module:

- *Who or what is at the centre of the pedagogical structure? Students, tutors, or content?*
- *How is content presented to students? In themes, study blocks or sequential activities?*
- *How do students navigate through the materials? Does the tutor guide them, do they make their own choices, or is the content laid out as a structured pathway?*
- *How are the needs of students that are more or less confident than the average provided for through activities?*
- *Are there repeated activity patterns evident? What might be the impact of any repetition on student experience?*
- *How do students communicate with each other and with their tutor? What impact might this communication have on the learning and teaching experience?*
- *How do students know they are learning? Can they prove progression to themselves and others?*
- *How do they know what they need to improve and how to improve? Do students set their own learning goals or are they set by others?*
- *The OER will need to work without a tutor. What is the role of the tutor in the original module? What might happen if that role is simply removed?*

As she worked on the Module Map she became aware that she was finding it hard to stay objective, and she found herself tending making assumptions about what the learners would be like and how they would experience the materials:

> *"It's been quite hard not to have my old [college] students in mind while I've been reviewing this module though of course the US students will be different (i.e. they are students who have already successfully got a place at college, they have a different educational 'history' etc)".*

She then used the Pedagogy Profile representation completed by her colleague to review the module, and again noted down the questions that she used:

- *Are there any significant differences between the profile and what might be expected for a module of this type? What are these, and can they be accounted for? How might they impact on learning and teaching?*
- *What are the expected skills and expectations of learners in relation to the ways they study and learn (for students studying this original module and the students studying the new one)? How far do these cohere (or not) with the activities as represented in this profile (i.e is there a gap between existing skills and required skills)? What might be the impacts on learning and teaching?*
- *Does the pedagogy profile 'fit' with students envisioned next steps? For example if students are likely to be required to become increasingly independent or active learners, are there enough opportunities to practice working in this way?*
- *Are students used to a particular type of learning activity? Does this module move learners towards similar or different types of activity? What might the impact on learning and teaching be?*
- *Does the workload look reasonable? Is it evenly distributed across the module? If not, what might the impacts on learning and teaching be?*

She recognised that this representation in particular can be quite difficult to complete and relies on the person mapping the module understanding what the primary intent of an activity is in relation to what it is expected students will do and how long they might take:

> *"The categories relate to what it is anticipated that students do to learn rather than what might or might not be happening at a cognitive level, and can only begin to represent what was intended not what actually might happen. For example when students are instructed to discuss an issue or share ideas in a forum, the intention is that they communicate with each other but in practice the majority of students might just read what others have written (assimilation) or write a statement a which doesn't link to the wider discussion (productive). The representation also shows roughly how student study hours are distributed across the module, and how much time remained for 'self-directed' study i.e. a time management task, recapping learning, etc, but to be*

fair we can only really best-guess at how long they will take to complete an activity based on experience."

She then attempted to complete a Learning Outcomes View of the module but found this very difficult and generally unproductive:

"What I initially attempted to do is group the activity level outcomes under module outcomes headings to see if there were any gaps or a pattern between what was taught and what was planned and assessed. However, the activity level outcomes really do not fit with the module level outcomes in this way, and the exercise became a bit too subjective to be useful. [Colleague Y] and I briefly reviewed the fit between the two different sets of outcomes and module descriptors across a variety of documents, and felt that the activity level outcomes offered a much better fit with the broader aims and intent of the module than the module level outcomes. This is why we suggested keeping the activity level outcomes and reworking the module level ones"

Again she detailed the questions she found herself using to review the module from a constructive alignment perspective:

- *How well are learning outcomes, tasks and assessment intentions (formative and summative) communicated to students? What is the impact of this on learning and teaching?*
- *How clear is the alignment between outcomes, activity and assessment? At what level does alignment primarily occur? Module level, unit level or activity level?*
- *Is the notion of alignment used to explain the purpose of activities and assessment tasks to students? What is the impact of this on learning and teaching?*
- *How might students experience any non-alignment, particularly if studying the module as an OER without tutor support?*
- *Are there any implicit or 'hidden' outcomes? How well do these align with activities and assessment? Can these be made explicit? What would the impact be?*

Several months later, Rebecca was asked to conduct a review of the redesigned module, and she followed the same procedure, and used the same questions, to ensure that the reviews would be comparable. She was surprised to see how different the redesigned module was from a pedagogical perspective – the module had shifted from a broadly student-led experiential cycle structure to a linear content-driven instructional model - and found it really difficult to report objectively about the changes made and their potential impacts:

"I have found it unusually hard to stay objective about the design changes in my reporting (although I hope I've managed it), and I think this is in part because of

cultural expectations/ assumptions I have about what good pedagogy 'ought to' look like, and where the power should sit in the learning and teaching process".

Overall, Rebecca found that the representations exceeded her expectations in terms of what she felt they could reveal to her about a module's key learning and teaching features, but warns that the reviewer's beliefs, knowledge and experiences of education will still significantly flavour any expert review – that the representations provide a useful framework but do not in themselves serve to make the review more or less objective or reliable.

"I found it fascinating what the representations revealed about each module and the differences (and indeed similarities) between them. In fact I think it's fair to say that they worked better than I imagined they would as a way of benchmarking and comparing modules. It's always been a bit of a concern of mine that actually the representations themselves wouldn't show that much and that it was the process that they informed that was key [...] I should say though that staying objective was really difficult and I know that despite my best efforts my own preconceptions and beliefs will have coloured both the way I completed the representation templates and the review itself. Maybe this isn't a bad thing - and perhaps that is what you are asking for when you ask for an expert review - but I think it needs to be recognised because it impacts on how these representations should be shared with others, and how far they can be considered to be 'reliable' representations of a learning event".

6. Impact analysis

***Success criteria 1**: To apply standardised representational frameworks to the pedagogical review of a module and to determine the effectiveness and sharability of these.*

Evidence from the pilot showed that the representations lent themselves well to being used for an expert review of the pedagogical structure and features of a module. Furthermore, they might be considered 'valid' tools to use in that they appeared to effectively reveal key 'student experience' aspects of the curriculum for detailed review. However, it has been found that the ways that the representations are created and understood are highly likely to be 'flavoured' by individuals' educational perspectives and belief systems. That is, they are likely to be created and understood differently by different people, or in different contexts, or even at different points in the design process. This is not an issue if the documents are used to focus and support design discussion and dialogue, or where the representations are used with detailed contextualising 'wrap-around' information, however there are some indications that the representations are not sufficiently structured to ensure objectivity or reliability to the extent that they can be used to make 'absolute statements' about what a

module is like, or for it to be assumed that everyone will take the same understandings about the module away with them after studying the representations.

Success criteria 2: *To develop a set of guidelines to support others using the OULDI representations for review and evaluation.*

Evidence from the pilot suggested that the design review approach used by the OULDI project officer was broadly effective in capturing the key pedagogical structure and features of the module for review and evaluation, although it became clear that review activity is best conducted in collaboration with someone with a working knowledge of the module to ensure that all relevant information is used and the representations are perceived to be 'fair'. The questions outlined by the project officer appear to be useful in structuring an interrogation of each of the representations and will be included in guidelines developed to support others interested in using the OULDI representations in this way.

7. Conclusions and recommendations

Overall, the representations were found to have worked effectively as frameworks for benchmarking and review purposes, although they should not be thought of as entirely objective tools. In addition, they were found to be of interest to associated groups and were seen to be effective in improving a shared understanding of the structure of a design and confidence in design decisions, however the importance of ensuring that their purpose and potential use was more widely understood at the point of sharing was apparent.

7.1 Critical success factors

A number of factors have emerged as being important in enabling the positive impacts this pilot has had, and minimising barriers to uptake and implementation.

7.1.1 Objectivity vs subjectivity

Different stakeholders in the design process will interpret the categories and vocabulary of the representations in different ways. In addition, pre-established pedagogical principles, philosophies and experiences are likely to impact on how representations are interpreted and evaluated. It is therefore important to ensure where possible that approaches and understandings are negotiated and agreed with a range of design stakeholders. Where this is not possible, care should be taken to document the reasons for potentially controversial decisions on the representation document itself (in case it becomes separated from the wrap-around text).

7.1.2 Communication

Feedback highlights the importance of ensuring that the aims, purpose, uses and limitations of the representations are also made clearly explicit, both to ensure that they are not

misinterpreted, and to provide example of appropriate use. One US-based project team member suggested a visual explanation would be useful to support the representations:

> *"I think a directed video of doing an evaluation might be a quick way of helping folks understand what you mean. Also specific examples for each of the categories (assimilative, productive, etc.)"*
>
> **B2S project team member (US based)**

7.1.3 Timing

The timing of the representations seems to impact on how the representations are understood and used, for example, teams appear to find it more difficult to make use of the representations when they have commenced production:

> *"When you are in the middle of course production, you have hundreds and hundreds of things to do and it is really pressured. So, when somebody says "can you do a pedagogy profile?" you have to balance the benefit you'll gain by doing that against other tasks"*
>
> **B2S Senior Academic (UK based)**

Where possible, representations should be produced so that they can inform and support the early design decision making process.

7.1.4 Ownership of designs

Representations are able to have most impact where they are adopted by the design team and used as working documents through the process. Where possible, representations should be developed in collaboration by the design team, or at least be commissioned directly by them.

7.2 Recommendations for B2S/ institution

- The representations appear to be effective in benchmarking and reviewing design decisions and change. It is likely to be useful to conduct another review of the second iteration redesign to support ongoing evaluation.
- The design team is likely to find that use of the representations in the design process will focus and structure the second iteration of the redesign process, ensuring more emphasis on the whole learning and teaching experience, rather than primarily the structure and presentation of the content
- As the university moves forward with embedding use of the representations via the CBM project, care should be taken to ensure that there is shared understanding across all stakeholders of how the representations may be used and their limitations

- Clearer guidance and examples should be embedded in the representation templates
- Space and guidance for articulating the mapping process and any potentially controversial decisions should be added to the representation templates (this is already in place to some extent in the Pedagogy Profile Excel template)

7.3 Recommendations for the sector

- The OULDI representation set, and particularly the Module Map, provides a useful and valid framework for a review and evaluation of a course or module. Although care should be taken to use the representations as objectively and transparently as possible.
- There are indications that the OULDI representation set may be a useful way of describing OERs that are courses so that potential users can more readily see what they contain and how they are structured but more work would need to be done to understand whether this is the case:

"That I think for OER that are courses and are intended to operate as a course (versus just being materials on the web) than there's more value to this kind of evaluation. It can help point out where additional support is needed, or is not provided in the materials".

B2S project team member (US based)

References

Biggs, J (1999) Teaching for quality learning at university (Buckingham: Open University Press)

Boyatzis, R. E. (1998). *Transforming qualitative information: thematic analysis and code development*. London: Sage.

Conole, G. (2007), 'Describing learning activities: tools and resources to guide practice' in H. Beetham and R. Sharpe (Eds), Rethinking pedagogy for a digital age, pp. 81-91.

Conole, G. (2008) 'Capturing practice: the role of mediating artefacts in learning design', in Handbook of Research on Learning Design and Learning Objects: Issues, Applications and Technologies, in L. Lockyer, S. Bennett, S. Agostinho, and B Harper (Eds), 187-207, Hersey PA: IGI Global.

Joffe, H. and Yardley, L. (2004). Content and thematic analysis. In *Research methods for clinical and health psychology*, ed. D. F. Marks and L. Yardley, 56-68. London: Sage.

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Thanks is given to the Bridge to Success team.

Appendices

Appendix 1: Design review of *'Starting with Maths'*, September 2011

Review and report prepared by Rebecca Galley and Andrew Brasher

OULDI-JISC project team, IET, Open University

Executive Summary

Summary of context

This expert review has been prepared by two members of the Open University Learning Design Initiative (OULDI[13]) project team. The purpose of the review is twofold, firstly it intends to provide a set of benchmark representations to support the B2S project evaluation team in tracking and evaluating any changes made to the module, and secondly it hopes to support the Bridge to Success (B2S) design team in the redesign of the print based module *Starting with maths* as they repurpose it for an online, open US context. It should be noted that this review is not a quality control activity and should not be considered as such.

Summary of method

This is a 'top-level' pedagogical review of the structure of the module design. The review and recommendations have been made of the basis of an examination of student-facing core module documents and materials only, as it is these documents and materials that the B2S design team have taken to work with. Feedback on the learning and teaching experiences of the module chair, tutors and students might be used to triangulate findings and recommendations.

Three learning design representations were chosen to enable review from three different pedagogic perspectives. These were:

- Module Map (Appendix 1)
- Pedagogy Profile (Appendix 2)
- Learning Outcomes View (Appendix 3)

Summary of recommendations

- That the B2S team considers producing guidance and support material for students about using the forum and/or other appropriate online collaborative spaces.
- That the B2S design team considers either embedding library activities more securely into module activity, or removes these entirely.

[13] http://www.open.ac.uk/blogs/OULDI/

- That the B2S design team explicitly considers the design problem of how students will be supported in - and rewarded for - recognising their progress not only in understanding and applying the mathematical concepts, but also in developing confidence, resilience and problem solving skills. This might include for example use of scaling exercises (i.e. 'Catching Confidence' grids), benchmarking assessments, adaptive quizzes, reflective logs etc.
- That the B2S design team considers incorporating adaptive online activities, or branching learning-pathways to better respond to variations in student confidence levels and ability, so that more able students can be stretched without feeling an impact on their learning workload.
- Whereas it is recognised that students will vary quite significantly in how long they will take to complete a task, more guidance on timings may positively help student plan their learning and reflect. The B2S team might consider adding approximate timings to core and additional activities.
- As the module is redesigned for the independent online student, it is probable that student-to-student or student-to-other(s) communication and collaboration activities will become important in the structure of the design. Consideration should be given to the specific pedagogical purpose of this activity so that clear guidance and support can be produced, and appropriate tools chosen. For example, communication and collaboration activities might be developed to explicitly support students in recognising their progress, building problem solving strategies, developing confidence etc. A traditional threaded forum may not necessarily be the most appropriate place for this type of activity.
- That the B2S design team considers how online and independent students will be supported in asking themselves timely critical questions in relation to their maths practice (i.e. What do I know and what do I want? Would a diagram help? What's the same and what's different about this problem...? etc), reflect on learning, articulate progress, plan goals and next steps.
- To make it easier for students to plan their time, consider spreading activity across the full 20 weeks so that weekly activity is more often closer to 5 hours in total each week.
- That the B2S design team considers explicitly allocating 10-15% of total study time (i.e. 10-15 hours in total) to self-directed study to allow students to participate in forum activity, plan their study schedule, review tricky concepts etc. Inexperienced students may require some guidance about how they can use this time.

- That the B2S design team reviews the distribution of activity type and consider how far this might change as the module moves online and open. For example, will there be more finding and handling information, adaptive or communication and collaboration activities? If so, what type of activity will be reduced and how will this be achieved?
- That the B2S design team considers replacing the existing module level outcomes with new ones which align more closely to the themes expressed in the activity level outcomes. Please note that if this is done, then the formative and summative assessments will also have to be adjusted to ensure that they fully monitor and evidence progress and achievement of any new module level outcomes.

Introduction

Starting with maths is a 10 credit module which sits in the Open University's '*Openings*' programme. All modules in this programme share the same set of generic learning outcomes which focus on developing students' study skills and confidence. This module is designed for learners wishing to become more confident in using maths in a variety of different situations. Three core themes are articulated in the module guidance:

- improving students' mathematical skills including using a calculator effectively
- developing problem solving strategies so that students know what to do when they get stuck
- practicing general study skills to help students become effective learners

The pedagogical design of the module is deliberately different from that which many students experienced at school, where the emphasis was on learning mathematical techniques. Instead, *Starting with Maths* concentrates on solving real-life problems in the way a mathematician might, by using the techniques as a tool and considering a variety of different approaches. It describes various problem–solving strategies that students can use, and encourages students to explore ideas and ask themselves questions.

There are three key elements to the module: the module materials, the tutor support and the assessment. The core module content is contained in the main printed texts – *Starting with maths*, and the *calculator booklet*. Although the module materials are the student's main source of guidance, the tutor is recognised as having an important role to play in supporting the student's learning, and particularly in helping students to develop confidence in their mathematical ability, manage their anxiety around maths and develop strategies for solving problems. Tutorials are conducted on a 1-1 basis via telephone, and each student receives approximately 2 hours of individual tutorial support across the 20 week programme. A primary feature of this module is the ongoing dialogue between the student

and the tutor which starts with the learning plan and is developed further through the tutorials, feedback on the assessment and the learning review.

The Open University's Open Learning: Bridge to Success (B2S) project will combine resources from *Starting with maths* with other free educational content to create an entirely online and open learning module re-designed to equip struggling US college students with the basic maths and learning skills they need to continue in education. The new module will be freely available to any student wishing to study it, and will be designed to ensure that students can successfully complete the module independently and without tutor support.

The purpose of this review is twofold, firstly it intends to provide a set of benchmark representations to support the Bridge to Success (B2S) project evaluation team in tracking and evaluating any changes made to the module, and secondly it hopes to support the B2S design team in the redesign of the print based module *Starting with maths* as they repurpose it for an online, open US context. It should be noted that this review is not a quality control activity and should not be considered as such.

Method

This 'top-level' pedagogical review of the module design was conducted by two members of the OULDI-JISC project team who are experienced educators with expertise in learning design. The following module materials were used to inform the review:

- Module Timetable
- Module book: Starting with maths
- Assignment booklet
- Calculator booklet
- Exercise booklet
- Learning plan form
- Learning plan review form
- 'Study at the OU' Module webpage
- Module webpage
- Tutor marking guidelines

Three learning design representations were chosen to enable review from three different pedagogic perspectives. These were:

1. **Module Map (Appendix 1):** a top level representation of the module which lists all the module's individual learning and teaching artefacts, and groups them according to the way in which they contribute to four aspects of learner activity (Guidance and Support, Content and Experience, Communication and Collaboration and Reflection and Demonstration). In this review the representation has also been used to map learning roles and relationships around each of these aspects as a way of making explicit the ways that *Starting with Maths* tutors support students. For example the way in which it is anticipated that tutors will work with students to help them reflect on learning and plan their learning maths, develop basic study skills etc. This representation gives a flavour of the whole module i.e. what it is like to learn on this module, and what the key aspects of this module currently are.

2. **Pedagogy profile (Appendix 2):** an overview of the distribution of tutorial and directed-study activities across the module against a learner activity taxonomy developed by Conole (2008[14]). This representation shows how students spend their time on the module, and provides an opportunity to review student workload. It should be noted that although this tool shows the distribution of student activity (i.e. what students are *doing*), its focus is on observable activity, and does not necessarily reflect the students' internal learning process.

3. **Learning Outcomes View (Appendix 3)**: a mid-level view of the module which enables a review of how far stated learning outcomes are aligned with learning activity and assessment of learning. This representation indicates how far the module design provides sufficient opportunity to practice, get feedback and demonstrate specified skills, knowledge and attitudes. It will also identify any gaps or nonalignment.

Results

Guidance and support

The tutor role is highly supportive and individualised in this module. Both students and tutors are required to engage positively and collaboratively in the development of students' confidence in their mathematical ability and problem solving. In particular, tutors are required to help students plan their work, think about the ideas explored in the module, stimulate reflection by asking critical questions, and recognise and praise students' learning and progress. The highly student-centred support provided by the tutor is likely to be difficult to replicate in an open online environment, but may well be critical in building a student's confidence, helping them to

[14] Conole, G. (2008), New schemas for mapping pedagogies and technologies, Ariadne article, July 2008, http://www.ariadne.ac.uk/

overcome barriers, developing their mathematical understanding and problem-solving skills and keeping their motivation high.

- *Recommendation: That the B2S design team explicitly considers the design problem of how students will be supported in - and rewarded for - recognising their progress not only in understanding and applying the mathematical concepts, but also in developing confidence, resilience and problem solving skills. This might include for example use of scaling exercises (i.e. 'Catching Confidence' grids), benchmarking assessments, adaptive quizzes, reflective logs etc.*

The module uses a good range of support and guidance documents which are available in a number of formats. Students studying this module at the OU will also have access to extensive support and guidance at a university level. There are some small inconsistencies and overlaps where documents have been added over the lifetime of the module, for example the 'Hello and welcome from *Starting with Maths*' message appears to be only available to learners who visit the module website, but access to a computer is not currently a requirement of the module. This message seems to be the only guidance documentation available around the availability, use and purpose of the optional module forum other than in the forum itself. If the B2S decide to use a forum or other online collaboration tools as part of the new module, they will need to produce new student support materials for this:.

- *Recommendation: That the B2S team consider producing guidance and support material for students about using the forum and/or other appropriate online collaborative spaces.*

Library guidance and support materials are linked to, but do not appear to be embedded in module activity and as they are online are not available to all students. In addition there is no clarity about the degree of requirement for students to engage with these.

- *Recommendation: That the design team considers either embedding library activities more securely into module activity, or removes these entirely.*

Content and Experience

Starting with Maths aims to develop students' understanding of mathematical ideas and develop their confidence in using and applying mathematics, as well as understanding its importance in the world for solving problems and making decisions. The pedagogical design of the module is deliberately different from that which many students experienced at school, where the emphasis was on learning mathematical techniques. Instead, *Starting with Maths* concentrates on solving real-life problems in the way a mathematician might, by using the techniques as a tool and considering a variety of different approaches. It describes various problem–solving strategies that students can use, and encourages students to explore ideas and ask themselves questions. It also introduces students to a wide experience of mathematics through historical aspects, as well as

modern uses and developments and unsolved problems, as further motivation for studying the subject.

There is a good variety of content materials utilising different formats and activity types (case studies, puzzles, historical snapshots etc). Many activities are differentiated to allow more confident students to try more difficult tasks but these are in addition to core module activity.

- *Recommendations: That the design team considers incorporating adaptive online activities, or branching learning-pathways to better respond to variations in student confidence levels and ability, so that more able students can be stretched without feeling an impact on their learning workload.*

The module is designed to start gently and gradually build both in difficulty and workload. It is recognised that it can be difficult to judge how long students might take to complete an activity, however there is very little guidance for students about how long individual activities might take. As this module is adapted for an online, unsupported context, approximate timings should be provided to students so that they can independently plan and organise their study time:

- *Recommendation: Whereas it is recognised that students will vary quite significantly in how long they will take to complete a task, more guidance on timings may positively help student plan their learning and reflect. Consider adding approximate timings to core and additional activities.*

Communication and collaboration

As detailed above, dialogue with the tutor is built in to the design of the module. This 1:1 communication with the tutor takes place via phone, email and feedback on TMAs and the learning plan and review. Opportunities for peer-to-peer communication and collaboration are not explicitly built into learning activity in this module, and are therefore not fully recognised or utilised as part of the learning experience. However, students are able to communicate and collaborate socially with each other in the optional module and *Openings* forums.

- *Recommendation: As the module is redesigned for the independent online student, it is probable that student-to-student or student-to-other(s) communication and collaboration activities will become important in the structure of the design. Consideration should be given to the specific pedagogical purpose of this activity so that clear guidance and support can be produced, and appropriate tools chosen. For example, communication and collaboration activities might be developed to explicitly support students in recognising their progress, building problem solving strategies, developing confidence etc. A traditional threaded forum may not necessarily be the most appropriate place for this type of activity.*

Reflection and demonstration

Critical reflection on learning and progress is a key aspect of this module, and appears to be very well supported by tutors, the TMAs, and by the learning plan and learning review process.

- *Recommendation: That the design team considers how online and independent students will be supported in asking themselves timely critical questions in relation to their maths practice (i.e. What do I know and what do I want? Would a diagram help? What's the same and what's different about this problem...? etc), reflect on learning, articulate progress, plan goals and next steps.*

Learning activity and workload

This 10 credit module amounts to approximately 100 hours study in total. Overall, approximately 16 weeks are given to study and 4 weeks to assessment. The basic 16 week schedule assumes an average of 5 hours a week, but the pace and workload vary depending on the needs and circumstances of each individual student. The tutor helps the student to set short-term goals and negotiate cut-off dates for the assessment. It is a flexible system that gives the student some responsibility for their own learning. Students do have to complete the final summative assessment within 20 weeks. The studying is not spread formally across all 20 weeks, partly to allow the student to plan their own study, but also to ensure that the student has plenty of time to complete the summative assessment of the module. Whilst this flexibility can be seen as a positive attribute in *Starting with Maths* where students are well guided and supported by a tutor, it may well be experienced as confusing and unpredictable to a student studying independently without support. For example an analysis of the activities allocated for each week showed significant differences in time each unit might take from approximately 10 minutes in week 20 to approximately 7.2 hours in week 15 (although it should be noted that these hours are approximate and based on documentation – tutors and past students would have a better idea about whether this is actually the case).

- *Recommendation: To make it easier for students to plan their time, consider spreading activity across the full 20 weeks so that weekly activity is more often closer to 5 hours in total each week.*

The breakdown of activity for the module is approximately:

26.9	hours reading, watching, listening to module material
2	hours finding and handling data
2	hours in communicative activity (tutorials)
28.7	hours completing mathematical problems, writing, drawing, listing etc
26.9	hours applying and practicing mathematical concepts in a 'real' context
0	hours exploring and experimenting with concepts in a simulated environment
13.5	hours completing assessment tasks (TMAs and EMA)

- *Recommendation: That the design team reviews the distribution of activity type and consider how far this might change as the module moves online and open. For example, will there be more finding and handling information, adaptive or communication and collaboration activities? If so, what type of activity will be reduced and how will this be achieved?*

Constructive alignment (of learning outcomes, activity and assessment)

There are two sets of learning outcomes: 8 module level outcomes (which are based on generic *Openings* learning outcomes but interpreted in a mathematical way) and 40 activity level outcomes. The module's assessment schedule has been designed to measure how far students have achieved the module level outcomes, and the activity level outcomes are detailed at the end of each chapter to help students recognise and reflect on their learning.

The reviewers attempted to align the activity level outcomes with the module level outcomes and assessment schedule for benchmarking purposes (see Appendix 3), however it became apparent that there is no significant alignment between the two sets. It was felt by the reviewers that the generic Openings module level outcomes did not express the nature and purpose of this module in a way that was easy for students to understand or interpret. For example module level learning outcome 5 refers to the students' use of 'words' rather than mathematical language:

> "*write clearly and appropriately in an academic style...avoid slang and colloquialisms...this outcome is about the words [...used] in your answer*"

Over time, the module team has developed a number of additional documents to help tutors tie the unit level outcomes more closely to the assessment (scriptmarker guidelines, tutor induction materials, chairs letter to tutors), for example for outcome 5 above, tutors are instructed to emphasise the effective use of mathematical language in their interactions with students and in their marking. However in the absence of a tutor, this lack of clear alignment may become a significant issue for the module as it is redesigned for open use and reuse, both in terms of supporting the student in constructing meaning from what they do to learn, and in taking responsibility for their own learning, and also in better communicating the nature and purpose of the module, and specific parts of the module which will make it easier for others to reuse and repurpose activities and materials., It is recommended that the B2S team, who have no need to use the generic Openings learning outcomes, revise the module level learning outcomes entirely for clarity.

- *Recommendation: That the design team considers replacing the existing module level outcomes with new ones which align more closely to the themes expressed in the activity level outcomes. Please note that if this is done, then the formative and summative*

assessments will also have to be adjusted to ensure that they fully monitor and evidence progress and achievement of any new module level outcomes.

A brief review of the activity level outcomes suggested that they might quite naturally fall into 4 module level themes which may inform a new set of module level outcomes:

1. Understanding mathematical concepts
2. Developing confidence in applying and communicating mathematical concepts in a variety of contexts
3. Developing clear and appropriate strategies for mathematical problem solving
4. Developing a logical and reasoned approach to reading and writing mathematical text and notation

Conclusion

This review has highlighted a number of areas for detailed consideration and reflection through the redesign of this module for an online and open context. In particular, detailed consideration should be given by the design team to the impact of the removal of the tutor role on the module's pedagogic structure and students' learning experience, and how key aspects of this role might be delivered through other means to ensure that student motivation, critical reflection on learning, and progression is maintained throughout the module.

As the module moves from being print-based to being open and online, it is likely that the distribution of student activity will change. Care should be taken to explicitly consider both the pedagogical impact of new materials and activities, and the impact on student workload i.e. are the new materials and activities pedagogically as well as media 'rich'? Do they offer good learning value in terms of student time spent on them?

A realignment of module level outcomes, activity and assessment is likely to have a significant impact on the online, open version of the module in a number of ways, although it is recognised that the necessary adjustment of assessment materials will take additional design and production time. Firstly, in the absence of a supporting tutor, it will enable students to take responsibility for their own learning and work strategically to achieve the learning outcomes. Students inevitably look at their assessment and focus on learning activities which will optimise their assessment performance. It is important therefore to make sure that the assessment (formative and summative) very obviously does test the learning outcomes that we want students to achieve. Secondly, it will make it easier for others to use, reuse and repurpose activities and materials from the module if there is clarity about the structure, purpose and focus of chapters and the module as a whole.

This review has been focused at a top level, and has not looked in detail at the fine grain of the structure (for example navigation and activity sequencing) however it is hoped that its

recommendations will be of value to the design team as they move forward with the redesign of the Starting with Maths module.

Appendix 1.1 Module Map of 'Starting with Maths'

'At a glance' Module Map

This worksheet has been created by the JISC-funded OULDI project.

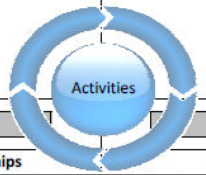
Course/ module title: Y162-11K

Guidance and Support

Tools and resources	Roles and relationships
1. 'What do I do first?' Openings leaflet (PDF and printed copy) *2.Module timetable (PDF, Word and printed copy)* *3.'Start here' (Video on DVD and PDF transcript)* *4.'Fitting it all in' (Video on DVD and PDF transcript)* *5.'Working with your tutor' (Video on DVD and PDF transcript)* *6.'A sense of acheivement' (Video on DVD and PDF transcript)* *7. 'Hello and welcome from the Y162 Module team!' module website message (online, optional)* *8. Library Guide: using your online library (online only, not integrated and optional)* *9. One stop search and helpsheet (online only, not integrated and optional)* *10. Library Training via Elluminate (online only, not integrated and optional)*	16:1 tutor ratio. Approx 2 hours 1-1 tutor time in total (telephone) Tutor role 'to help support learning', and in particular to: - help learners develop confidence in mathematical ability and strategies for problem solving - help learners plan their work and think about the ideas explored in the module - encourage students to ask themselves questions about their learning experience

Content and Experience

Tools and Resources	Roles and relationships
1. Starting with maths (PDF and printed copy) *2. Calculator booklet (PDF and printed copy)* *3. Exercise booklet (PDF and printed copy)* *4. Additional resources booklet (PDF and printed copy)* *5. Graph paper (PDF and printed copy)* *6. 'Views on mathematics' (Audio on DVD and PDF transcript)* *7.' A brief history of numbers' (Audio on DVD and PDF transcript)* *8. 'Designing the website' (Audio on DVD and PDF transcript)* *9. Online activities (optional)* *10. OU Library (optional)*	Three themes run through the module. These are: 1. improving mathematical skills, including use of a calculator 2. developing your approach to problems 3. helping you become an effective learner. No prior knowledge or experience is assumed Module materials start gently and gradually build up to degree-level study Activities are differentiated i.e. opportunities are provided to build on existing knowledge and understanding where it exists (e.g. via margin notes/ prompts) Module designed to encourage an active approach to studying i.e. learners encouraged apply learning to actual examples Variety of activity formats (case studies, puzzles, historical snapshots and more recent mathematical discoveries)



Reflection and Demonstration

Tools and resources	Roles and relationships
1. The learning plan (RTF, PDF, Word and printed copy) *2. The learning review (RTF, PDF, Word and printed copy)* *3.Assignment booklet (online, PDF and printed copy)* *4. List of module learning outcomes (in assignment booklet)* *5. TMA01 (formative) all module outcomes 1-8* *6.TMA02 (formative) all module outcomes 1-8* *7.EMA (summative) all module outcomes 1-8* *8. 7 x Study checklists - unit level learning outcomes (in 'Starting with maths')* *9.Tutor marking guidelines - includes introduction to the learning outcomes, learning plan and review, feedback process, TMAs and EMA (not available to students)*	Critical reflection on learning and progress is a key aspect of this module. Tutors will: - comment on and help with learners' written work (in particular after the TMAs in writing and by telephone) - work with learners to produce an end of module study plan Learners will: - apply learning to actual examples - reflect on learning and discuss progress with tutor - work with tutor to produce an end of module study plan - learn to ask themselves questions such as ' What do I know and what do I want?', 'Would a diagram help?' 'What's the same and what's different about this problem...?' etc.

Communication and Collaboration

Tools and resources	Roles and relationships
1. Telephone (required, landline preferred) *2. Module forum (optional)* *3. Openings forum (optional)* *4. Email (optional)* *5. Television (optional)*	1-1 telephone tutorials (Week 1, and ? - other tutorial times not specified??). In total these amount to approx 2-hours 1-1 time per student in total . Written feedback is given after TMAs on script and on the PT3 form Email communication between learner and tutor is optional. There are no face-to-face learning or teaching opportunities. Peer to peer communication and collaboration is optional via the forums (forums only mentioned in 'Hello and welcome' module website message)

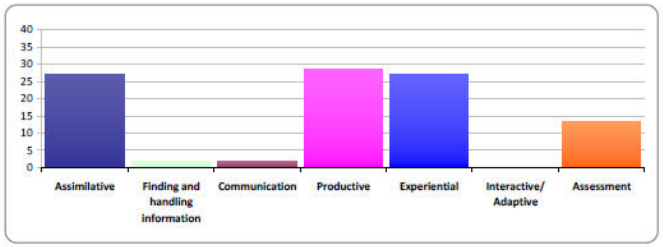
Module summary
This Openings course introduces a range of key ideas (including using a scientific calculator effectively), to help learners tackle everyday mathematical problems at home, work, or in your further studies. Case studies, activities, puzzles, historical snapshots and more recent mathematical discoveries are included, as well as advice on studying generally.

Keywords
Maths, study skills, confidence, calculator, Openings, problem solving

Appendix 1.2 Pedagogy Profile of 'Starting with Maths'

'As is' Pedagogy Profile representation

Course/module title: Y162-11K

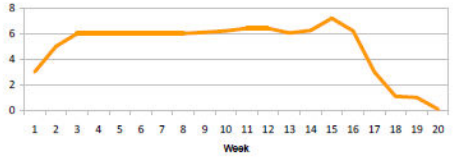


Course/module hours (as stated in course/ module guide)

Contact/ teaching hours	15.5	e.g. classroom/online tutorial activities, lectures, exams
Directed study	84.5	e.g. reading and research, revision, assignment writing, discussion forums, reflective diaries, data analysis
Self-directed study	0	e.g. administrative tasks, refreshing skills, extra reading, extension activities (usually 10-20% of total hours)
Total stated module/course hours	100	

Week	Assimilative	Finding and handling information	Communication	Productive	Experiential	Interactive/ Adaptive	Assessment	Total per week
1	3							3
2	2	0.5	0.2	1.3	1			5
3	2.4		0.3	2.3	1			6
4	1.3		0.2	2.2	2.3			6
5	1.5			2	2		0.5	6
6	1.3		0.1	2.3	2.3			6
7	1.3		0.1		0.6		4	6
8	1.3		0.1	2.3	2.3			6
9	1.3			2	2.3		0.5	6.1
10	1.3			2.3	2.6			6.2
11	1.3		0.1	2.5	2.5			6.4
12	1.3		0.1		1		4	6.4
13	1.3	0.75		2	2			6.05
14	1.3	0.75	0.2	2	1.5		0.5	6.25
15	1		0.2	2	2		2	7.2
16	1		0.2	1.5	1.5		2	6.2
17	1			2				3
18	1		0.1					1.1
19	1							1
20			0.1					0.1
								Total actual
Total	26.9	2	2	28.7	26.9	0	13.5	100
	Assimilative	Finding and handling information	Communication	Productive	Experiential	Interactive/ Adaptive	Assessment	

Approx total study hours per week



Notes

The standard course calendar is 16 weeks with approximately 6 hours each week. The remaining 4 weeks essentially provide a buffer for later submissions of the EMA. There isn't a formal breakdown for the times for different components, but Hilary'sestimates for the different components (based on the timetable and experience) are as follows:

Assignments: 12 hours
Tutorials: 2 hours
Getting started, Learning Plan and Review: 6 hours
Core Text, including Calculator Booklet and Exercise Booklet: 80 hours

Using the above figures, and a read through of the chapters indicate the breakdown should be roughly :

2 hours finding and handling information
27 hours assimilative
2 hours communication time (with the tutor) over the course.
28 hours productive
27 hours experiential
13.5 hours assessment (5 each for TMAs, 4.5 for EMA).

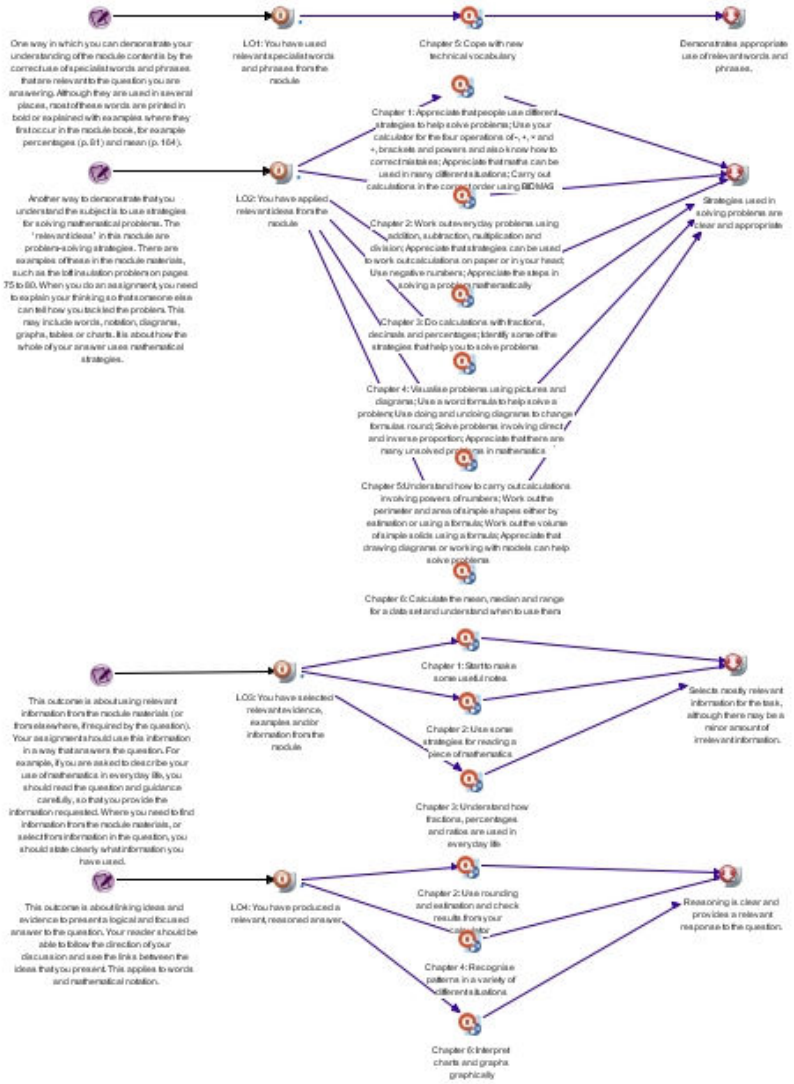
These figures have been spread out across the weeks to fit roughly with the content and guidance in the chapters of the core text and other resources.

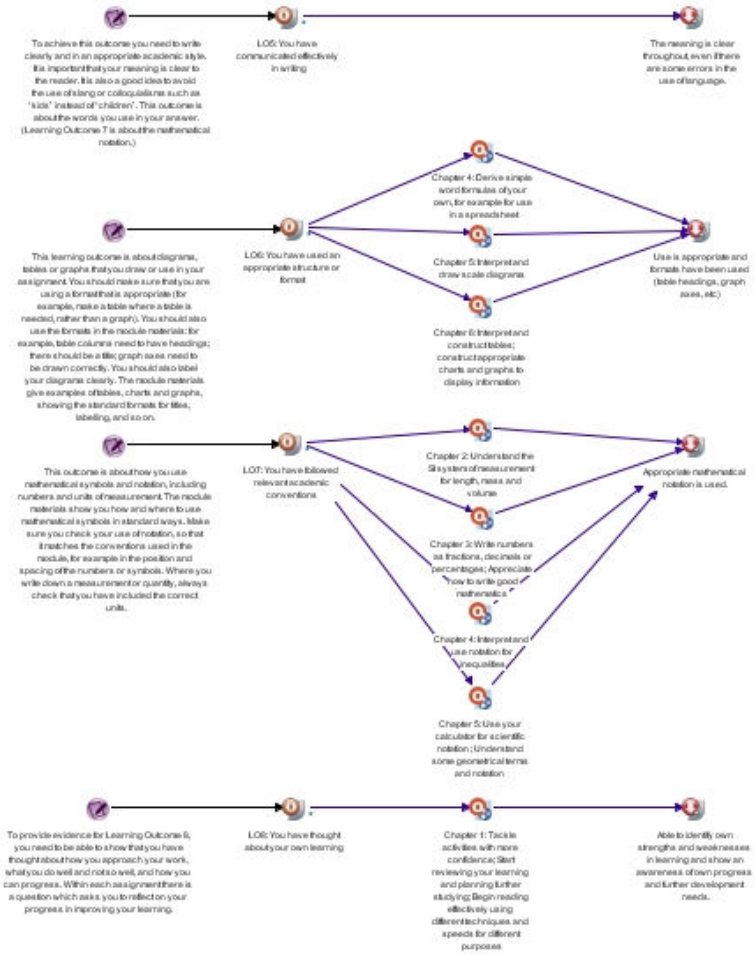
Key

Category	Process outcomes (learners will...)
Assimilative	e.g. Read, Watch, Listen, Think about, Observe, Review, Study
Finding and handling information	e.g. List, Analyse, Collate, Plot, Find, Discover, Access, Use, Gather, Order, Classify, Select, Assess, Manipulate
Communication	e.g. Communicate, Debate, Discuss, Argue, Share, Report, Collaborate, Present, Describe, Question
Productive	e.g. List, Create, Build, Make, Design, Construct, Contribute, Complete, Produce, Write, Draw, Refine, Compose, Synthesize, Remix
Experiential	e.g. Practice, Apply, Mimic, Experience, Explore, Investigate, Perform, Engage
Interactive/ Adaptive	e.g. Explore, Experiment, Trial, Improve, Model, Simulate
Assessment	Include summative (graded) assessment only here e.g. Write, Present, Report, Demonstrate, Critique

This worksheet has been created by the JISC-funded OULDI project.

Appendix 1.3 Learning Outcomes view of 'Starting with Maths'


One way in which you can demonstrate your understanding of the module content is by the correct use of specialist words and phrases that are relevant to the question you are answering. Although they are used in several places, most of these words are printed in bold or explained with examples where they first occur in the module book, for example percentages (p. 61) and mean (p. 164).
LO1: You have used relevant specialist words and phrases from the module
Chapter 5: Cope with new technical vocabulary
Demonstrates appropriate use of relevant words and phrases.
Chapter 1: Appreciate that people use different strategies to help solve problems; Use your calculator for the four operations of -, +, × and ÷, brackets and powers and also know how to correct mistakes; Appreciate that maths can be used in many different situations; Carry out calculations in the correct order using BIDMAS
Another way to demonstrate that you understand the subject is to use strategies for solving mathematical problems. The 'relevant ideas' in this module are problem-solving strategies. There are examples of these in the module materials, such as the toll tunnel problem on pages 75 to 80. When you do an assignment, you need to explain your thinking so that someone else can tell how you tackled the problem. This may include words, notation, diagrams, graphs, tables or charts. It is about how the whole of your answer uses mathematical strategies.
LO2: You have applied relevant ideas from the module
Chapter 2: Work out everyday problems using addition, subtraction, multiplication and division; Appreciate that strategies can be used to work out calculations on paper or in your head; Use negative numbers; Appreciate the steps in solving a problem mathematically
Strategies used in solving problems are clear and appropriate
Chapter 3: Do calculations with fractions, decimals and percentages; Identify some of the strategies that help you to solve problems
Chapter 4: Visualise problems using pictures and diagrams; Use a word formula to help solve a problem; Use doing and undoing diagrams to change formulae round; Solve problems involving direct and inverse proportion; Appreciate that there are many unsolved problems in mathematics
Chapter 5: Understand how to carry out calculations involving powers of numbers; Work out the perimeter and area of simple shapes either by estimation or using a formula; Work out the volume of simple solids using a formula; Appreciate that drawing diagrams or working with models can help solve problems
Chapter 6: Calculate the mean, median and range for a data set and understand when to use them
This outcome is about using relevant information from the module materials (or from elsewhere, if required by the question). Your assignment should use this information in a way that answers the question. For example, if you are asked to describe your use of mathematics in everyday life, you should read the question and guidance carefully, so that you provide the information requested. Where you need to find information from the module materials, or select from information in the question, you should state clearly what information you have used.
LO3: You have selected relevant evidence, examples and/or information from the module
Chapter 1: Start to make some useful notes
Chapter 2: Use some strategies for reading a piece of mathematics
Chapter 3: Understand how fractions, percentages and ratios are used in everyday life
Selects mostly relevant information for the task, although there may be a minor amount of irrelevant information.
This outcome is about linking ideas and evidence to present a logical and focused answer to the question. Your reader should be able to follow the direction of your discussion and see the links between the ideas that you present. This applies to words and mathematical notation.
LO4: You have produced a relevant, reasoned answer
Chapter 2: Use rounding and estimation and check results from your calculator
Chapter 4: Recognise patterns in a variety of different situations
Chapter 6: Interpret charts and graphs graphically
Reasoning is clear and provides a relevant response to the question.


To achieve this outcome you need to write clearly and in an appropriate academic style. It is important that your meaning is clear to the reader. It is also a good idea to avoid the use of slang or colloquialisms such as 'kids' instead of 'children'. This outcome is about the words you use in your answer. (Learning Outcome 7 is about the mathematical notation.)
LO5: You have communicated effectively in writing
The meaning is clear throughout, even if there are some errors in the use of language.
Chapter 4: Derive simple word formulae of your own, for example for use in a spreadsheet
This learning outcome is about diagrams, tables or graphs that you draw or use in your assignment. You should make sure that you are using a format that is appropriate (for example, make a table where a table is needed, rather than a graph). You should also use the formats in the module materials: for example, table columns need to have headings; there should be a title; graph axes need to be drawn correctly. You should also label your diagrams clearly. The module materials give examples of tables, charts and graphs, showing the standard formats for titles, labelling, and so on.
LO6: You have used an appropriate structure or format
Chapter 5: Interpret and draw scale diagrams
Chapter 6: Interpret and construct tables; construct appropriate charts and graphs to display information
Use is appropriate and formats have been used (table headings, graph axes, etc.)
This outcome is about how you use mathematical symbols and notation, including numbers and units of measurement. The module materials show you how and where to use mathematical symbols in standard ways. Make sure you check your use of notation, so that it matches the conventions used in the module, for example in the position and spacing of the numbers or symbols. Where you write down a measurement or quantity, always check that you have included the correct units.
LO7: You have followed relevant academic conventions
Chapter 2: Understand the SI system of measurement for length, mass and volume
Chapter 3: Write numbers as fractions, decimals or percentages; Appreciate how to write good mathematics
Chapter 4: Interpret and use notation for inequalities
Chapter 5: Use your calculator for scientific notation; Understand some geometrical terms and notation
Appropriate mathematical notation is used.
To provide evidence for Learning Outcome 8, you need to be able to show that you have thought about how you approach your work, what you do well and not so well, and how you can progress. Within each assignment there is a question which asks you to reflect on your progress in improving your learning.
LO8: You have thought about your own learning
Chapter 1: Tackle activities with more confidence; Start reviewing your learning and planning further studying; Begin reading effectively using different techniques and speeds for different purposes
Able to identify own strengths and weaknesses in learning and show an awareness of own progress and further development needs.

Appendix 2: Design review of *'Succeed with Math'* (SWiM), February 2012

Review and report prepared by Rebecca Galley

OULDI-JISC project team, IET, Open University

Executive Summary

Summary of context

This review has been conducted by a member of the Open University Learning Design Initiative (OULDI[15]) project team to support the Bridge to Success (B2S[16]) design team in the design of the new module *Succeed with Math (called SWiM)*. It will focus of the pedagogical design and structure of the module which has combined resources from the Open University's introductory module *Starting with maths* with other free educational content to create an entirely online and open learning module for US college students. It should be noted that this review is not a quality control activity and should not be considered as such.

Summary of method

This is a 'top-level' pedagogical review of the structure of the module design. The review and recommendations have been made of the basis of an examination of core module documents and materials only, and feedback on the learning and teaching experiences of students might be used to triangulate findings and recommendations.

Three learning design representations were chosen to enable review from three different pedagogic perspectives. These were:

- Module Map (Appendix 2.1)
- Pedagogy Profile (Appendix 2.2)
- Learning Outcomes View (Appendix 2.3 - unit 4 example)

Summary of recommendations

- *Monitor student perceptions of the way they are guided through their learning, student motivation and confidence levels through the module, and successful learning outcomes*
- *Ensure that anticipated module outcomes are explicitly stated in the 'Welcome' section in unit 1, including those relating to confidence and changes in attitudes e.g. maths anxiety*
- *Review some of the language and phrasing used in the study guide text*
- *Ensure that unit outcomes are explicitly stated at the start of each unit, as well as used to support student reflection at the end*

[15] http://www.open.ac.uk/blogs/OULDI/
[16] http://b2s.aacc.edu/

- *Review the pedagogical purpose of optional activities, and remove those with no clear purpose*
- *Make clear information about the purpose and anticipated impact of optional material available to students*
- *Use a regular and repeated unit task structure with clear beginning, middle and end cues so that students can orientate themselves through study sessions*
- *As students are not known or supported by a tutor, and may come from vulnerable groups, care should be taken that module content does not have the potential to worry or exclude learners*
- *Produce, and make available in a variety of formats, guidance and support material about learning groups and/or other appropriate online collaborative spaces*
- *Provide students with opportunity and tools to benchmark their initial maths-confidence levels, set personal learning outcomes and measure the development of their maths-confidence in relation to a number of contexts (i.e. with peers, with family, at home, at college) at key points through the module.*
- *Make unit quizzes expected not optional*
- *Make the 'Check your learning' activity a feature of every unit*
- *Ensure alignment between quiz and 'check your learning' questions and the stated learning outcomes in each unit*
- *Collate quiz answers and/ or 'Check your learning' activities into a chart showing where students have repeatedly answered questions correctly and where they need more practice*
- *Create an end of module assessment quiz and a mechanism for congratulating students when they achieve a pass mark*
- *It is recognised that some topics might take longer to learn than others, however some guidance should be given about the relative length of each unit*
- *Ask a range of students how long they spend on each unit*
- *Add approximate timings to core and optional activities*
- *Consider re-writing module guidance to say that the module will take approximately 100 hours*

Introduction

SWiM is an 8-unit module designed to "*prepare adults to successfully and confidently transition to a college environment*". The module's core content is contained within an online study guide,

which is also available in a printable format. In addition, units 1, 2b, 3, 6, 7 and 8 are available in ePub and Word formats creating some opportunities for more flexible and mobile learning. The module combines resources from the Open University's introductory module *Starting with maths,* with other free educational content to create an entirely online and open learning module.

The new module is freely available to any student wishing to study it, and has been designed with the aim that students will be able to successfully complete the module independently and without tutor support. It should be noted that some of the US colleges piloting the module have chosen to use the online module as part of a blended approach with some face-to-face sessions running alongside online activity to support students; however, this review assumes no tutor support for students studying the module. In common with the original introductory module, SWiM aims to both teach core mathematical concepts and help students to develop confidence in their mathematical ability, manage their anxiety around maths and develop strategies for solving mathematical problems.

An early design review of the module revealed a number of potential design problems that it was felt the B2S design team would need to solve. It was anticipated that the most challenging of these would be created by the removal of embedded tutor support. For example, in the absence of a tutor:

- How would students be supported in recognising their progress not only in understanding and applying the mathematical concepts, but also in developing confidence, resilience and problem solving skills? And how would progress be rewarded?
- How would online students be supported in asking themselves timely critical questions in relation to their maths practice (i.e. What do I know and what do I want? Would a diagram help? What's the same and what's different about this problem...? etc), reflect on learning, articulate progress, plan goals and next steps.
- How would intrinsic and extrinsic motivation be supported and sustained throughout the learning journey to ensure that good completion rates were maintained?

The purpose of this review is to identify and articulate the pedagogical design and structure of the new B2S module, and highlight any potential design issues or areas for further evaluation as it is used in a US, open learning context. It will also attempt to reveal how far emerging design problems have been solved by the design, and draw out the ways in which this has been achieved. It should be noted that this review is not a quality control activity but instead seeks to inform the design process and will suggest areas for particular design consideration, reflection and further evaluation to the B2S design team.

Method

This 'top-level' pedagogical review of the module design was conducted by a member of the OULDI-JISC project team. The online study guide[17] and linked online materials were used to inform the review. Three learning design representations were chosen to enable review from three different perspectives. These were:

1. **Module Map (Appendix 1):** a top level representation of the module which lists all the module's key learning and teaching artefacts, and groups them according to the way in which they contribute to four aspects of student activity (Guidance and Support, Content and Experience, Communication and Collaboration and Reflection and Demonstration). In this review the representation has also been used to map learning roles and relationships around each of these aspects as a way of making explicit the pedagogical purpose or impact of these artefacts. For example the way in which students journey through the material, reflect on and apply their learning, develop basic study skills etc. This representation gives a flavour of the whole module i.e. what it is like to learn on this module, and what the key aspects of this module currently are.

2. **Pedagogy profile (Appendix 2):** an overview of the distribution of directed-study activities across the module against a student activity taxonomy developed by Conole (2008[18]). This representation shows how students spend their time on the module, and provides an opportunity to review student workload. It should be noted that although this tool shows the distribution of student activity (i.e. what students are *doing*), its focus is on observable activity, and does not intent to reflect the students' internal learning processes.

3. **Learning Outcomes View**: a mid-level view of the module which enables a review of how far stated learning outcomes are aligned with learning activity and assessment of learning. This representation indicates how far the module design provides sufficient opportunity to practice, get feedback and demonstrate specified skills, knowledge and attitudes. It will also identify any gaps or nonalignment. **Appendix 3** shows how far outcomes, activities and assessments are aligned in unit 4 as an example.

Results

Guidance and support

The most significant design difference between *Starting with maths* and the SWiM module appears to be the way that students are guided through - and engage with - the learning materials, and their role in the processes of learning and teaching. *Starting with maths* was found to have a broadly cyclical experiential structure - students try mathematical problems, reflect-on and conceptualise their learning journey, and set goals, try the next set of problems. SWiM appears to have used a more linear instructional model – students are guided step by step through a

[17] http://labspace.open.ac.uk/module/view.php?id=7654
[18] Conole, G. (2008), New schemas for mapping pedagogies and technologies, Ariadne article, July 2008, http://www.ariadne.ac.uk/

sequence of progressively more complex mathematical concepts via a series of prompts and problems. The primary mechanism for supporting and guiding students through SWiM is the online study guide. The language and images used in the guide aim to support and encourage learners, and overt instructions about the learning process are given so that students are able to better understand and prepare for learning challenges:

> *"As we begin to work with fractions, remember that you will eventually (if you haven't already) get stuck. Use your resources and keep climbing!"* section 3.7 lines 10-12

This instructional approach to supporting and guiding students is likely to reassure anxious or less confident students because it is likely to be perceived as less 'disruptive' or challenging than more active learning approaches, but it may be found that it is less effective in enabling deeper learning i.e. in relation to the internalisation of mathematical attitudes, skills and understanding, especially in the case of weaker students who can find it harder to create meaning from passive methods.

- *Recommendation: Monitor student perceptions of the way they are guided through their learning, student motivation and confidence levels through the module, and successful learning outcomes*

The online study guide begins with a *Welcome* section which details possible reasons that students might take the module, an outline of what topics will be covered in each section, some of the key navigational features and some advice on study practices. It should be noted that the *Welcome* section does not explicitly detail what students will learn by studying the module, in fact these are not explicitly articulated anywhere in the module materials, rather they are implicit in the 'overview of topics' (section 1.0.1). Both students and colleges are likely to find module level learning outcomes very useful in helping them understand what might be learned by studying the module.

- *Recommendation: That the anticipated module outcomes are explicitly stated in the 'Welcome' section in unit 1, including those relating to confidence and changes in attitudes e.g. maths anxiety*

A brief review of the activity level outcomes during the design review of the module suggested that learning outcomes quite naturally fall into 4 module level themes and these continue to appear to be appropriate module level outcomes for SWiM:

5. Understand and use core mathematical concepts
6. Develop confidence in applying and communicating mathematical concepts in a variety of contexts
7. Apply clear and appropriate strategies for mathematical problem solving

8. Apply a logical and reasoned approach to reading and writing mathematical text and notation

Unit level outcomes have been identified and shared with students, but not until the end of each unit section. This is likely to make it hard for students to know what the purpose of learning activities are until after they have been completed. A number of studies into online learning have shown that pedagogical approaches that encourage students to assume greater control over their learning goals and collaborate proactively in achieving these goals are more likely to promote intrinsic motivation in students, a factor which appears to have a significant impact on learning (see i.e. Chen and Jang 2010a[19] and b[20]).

- *Recommendation: That unit outcomes are explicitly stated at the start of each unit, as well as used to support student reflection at the end*

The design team has used opportunities in the text – particularly at the beginning and end of units – to linguistically tie students to learning outcomes in particular, affective domain outcomes such as confidence and 'appreciation'. For example "*Remember your confidence will continue to increase the more you practice*" (section 3.6 lines 4-5 and 5.0.1 lines 8-9) "*You will see how to describe patterns mathematically...*" (section 6.0 line 7) and "*Remember, your mathematical skills will develop and grow stronger over time*" (section 4.5 line 10). This is a well recognised developmental facilitation technique that intends to reassure, motivate and encourage students but it is generally recognised that it should be used with caution. In this online context, where there is no learning contract and little is known about students' setting, language, and background issues it unlikely to be as appropriate or as effective as other, less contentious, strategies for keeping students motivated and on track.

- *Recommendation: Review some of the language and phrasing used in the study guide text*

There are many materials that have been included as optional, however very little guidance and support is given to students about the benefits and disadvantages of engaging in optional materials (with the exception of the pre- and end-of unit quizzes where the benefits are clearly stated). This means that students are likely to find it difficult to make informed and 'appropriate-for-them' decisions about whether or not to engage in the material, and this may impact on students' ability to manage their learning in a way that meets their needs. For example more than 7 hours of MU120 materials are linked to, but no guidance is given about how long these optional activities might take, or indeed what learners are likely to achieve if they invest this time. Often it

[19] Chen, K.C., and Jang, S. J. (2010) Motivation in online learning: Testing a model of self-determination theory. *Computers in Human Behaviour,* 26(4), 741-752

[20] Chen, K.C., Jang, S.J., and Branch, R.M. (2010). Autonomy, Affiliation, and Ability: Relative Salience of Factors that Influence Online Student Motivation and Learning Outcomes. *Knowledge Management and E-Learning: An International Journal (KMandEL),* 2(1), 30-50.

is not even clear whether optional material is intended to reinforce learning (practice for less-confident students) or extend it (challenge for more confident students).

- *Recommendation: Review the pedagogical purpose of optional activities, and remove those with no clear purpose*
- *Recommendation: That clear information about the purpose and anticipated impact of optional material is available to students*

One of the potential design problems highlighted by the review of *Starting with maths* was how students could be supported to ask themselves timely questions in relation to their maths practice, make connections between concepts and transfer skills learnt to more unfamiliar problems in the absence of a dedicated tutor. This problem appears to have been effectively resolved through the use of hint reveals at key points in problems. Students are able to access the level of support that they need, and hints are well structured to encourage critical maths thinking and effective mathematical and study practices.

In addition to the online study guide, students are encouraged to discuss and share their learning with family and friends. The development of personal learning support networks is likely to build student resilience, and motivation which extends beyond their time studying on this module. Sharing and demonstrating maths learning with others is also likely to improve confidence and deepen learning. There are some excellent examples where 'dissemination' tasks have been built into activities into activities, e.g. "*Here's a multiplication and division puzzle you can baffle your friends and family with*" section 2.5.13 line 3 and the '*Party Puzzle'* section 2.8.2.

Content and Experience

Learning materials are presented in a variety of rich media formats in addition to text (images, videos, pencasts, web articles). Student activity includes a mixture of assimilative (reading and watching), productive (making notes, completing a mix of mathematical problems, writing, drawing, listing), experiential (exploring, investigating and applying mathematical concepts in a 'real' context) and completing assessment tasks (quizzes and 'check your learning' activities).

Students are strongly encouraged to keep detailed notes in a math notebook and use their notebooks as a learning resource during their study. This is likely to be an effective strategy for fostering a sense of independence and self-reliance even after they finish the module. Clear guidance is given in Unit 1 in relation to how notebooks might be organised and maintained.

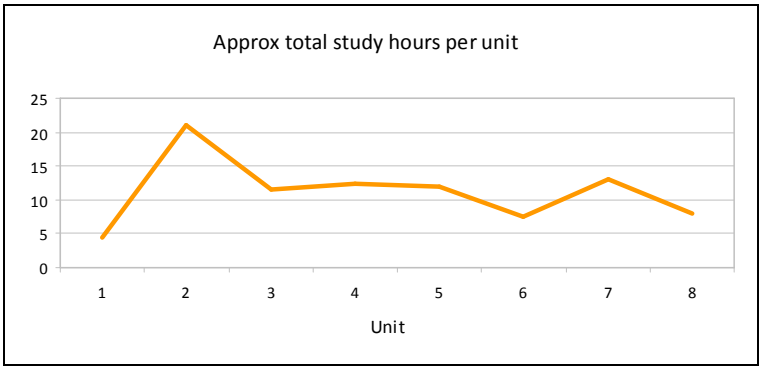
Extensive use is made of CC licensed web based materials, including teaching materials, games, quizzes and videos. This is very likely to significantly enrich the students' learning experience; however care should be taken to ensure that these open resources are appropriate for adult learners. For example, some of the maths activity websites used have clearly been designed for children (e.g. http://www.mathsisfun.com/ http://www.math-play.com/

http://www.mrnussbaum.com/) and some web based activities used may be considered childish or otherwise off-putting to adult students, especially those who are sensitive or feel ashamed about their maths ability.

Similarly, some maths problems have a gender or culture specificity that may distract some students from the maths in the problem (e.g. section 3.3.4 *Negative numbers used in football*) or may otherwise disturb students (e.g. section 5.1.13 *Activity: How serious is bowel cancer becoming?* and 5.2.1 *Activity: Is your Heart Health at Risk*).

- *Recommendation: As students are not known or supported by a tutor, and may come from vulnerable groups, care should be taken that module content does not have the potential to worry or exclude learners*

The review of student activity (see Appendix 2) showed that units vary significantly in terms of the amount of time they take to complete, and do not appear to have any regular or repeated structure as might commonly be expected where instructional approaches are used.



Students may find it difficult to know where they are in their learning, and may find this disorientating and de-motivating. It is recognised that students will have varying levels of maths skill and will work at different speeds, however students are likely to find it helpful to know approximately how long a unit or tasks are likely to take so that they can plan their study and gain a better sense of where they are in units.

- *Recommendation: Use a regular and repeated unit task structure with clear beginning, middle and end cues so that students can orientate themselves through study sessions*
- *Recommendation: A**dd approximate timings to core and optional activities.***

Communication and collaboration

As detailed above, students are encouraged to discuss and share their learning with friends and family and this in itself is likely to offer opportunities for students to develop and extend their learning, and re-conceptualise or reposition themselves as competent and confident mathematicians. In addition, it appears from the module home page that there are a number of learning groups associated with this module however, no guidance could be found which provides

students with information about how they might join or set up a learning group, or what the benefits of this might be for them. (Although, it should be noted that there are two other guidance and support artefacts linked to from the module home page: '*How to get the most from this module'*, and '*FAQ*'. When the reviewer attempted to access these documents, the links did not work. It is possible that information about learning groups and the 'Learning Tools' listed on the right hand side of the module homepage are located in these documents).

- *Recommendation:* ***Produce, and make available*** *in a variety of formats,* ***guidance and support material about participating in learning groups and/or other appropriate online collaborative*** *spaces*

Reflection and demonstration

As discussed above, critical reflection on learning and progress, and individual goal setting were key aspects of the original *Starting with maths* module, and were well supported by tutors, formative and summative assessment strategies, and through the learning plan template and learning review process. These are not such prominent features of the new module, and the design team has chosen not to use any of the *Starting with maths* reflection and planning tools and activities. In SWiM, the primary mechanism for tracking learning and progress is the student math notebooks. Students are encouraged to make colour coded notes in their notebooks about how well they feel they understand the material (for example using a 'traffic light' system). This activity is not compulsory or embedded in student tasks but students who do this will be able to visually track the development of their mathematical understanding and skill (i.e. over time they are likely to see progressively fewer red sections in their notebooks and more green) and this is likely to be motivating, as well as promoting deeper learning and engagement with the concepts. Embedded opportunities for reflection and planning have been missed e.g. although students are invited to complete a 'Self-reflection questionnaire' before they start the module – which asks for perceived levels of maths-confidence – they are not then supported or encouraged to set their own personalised learning outcomes in relation to these, and no further opportunities are explicitly presented to review confidence levels through the module.

- *Recommendation: Provide students with opportunity and tools to benchmark their initial maths-confidence levels, set personal learning outcomes and measure the development of their maths-confidence in relation to a number of contexts (i.e. with peers, with family, at home, at college) at key points through the module*

Pre-unit and end-of unit quizzes are well positioned to enable learners to gauge their maths knowledge but are optional and do not appear to be applied in a developmental or motivational way i.e. students cannot see 'at a glance' where they have improved or even met learning outcomes, or which mathematical processes they still need to improve or practice.

- *Recommendation: Collate quiz answers and/ or 'Check your learning' activities into a chart showing where students have repeatedly answered questions correctly and where they need more practice.*

Quizzes do not appear to be coherently aligned to the learning outcomes of the unit they belong to (see constructive alignment section below). Units 3, 4, and 5 also have a 'Check your learning' activity which gives students an extended opportunity to demonstrate skills learnt in those units, and it is felt these are likely to work better in enabling students to demonstrate their learning to themselves, and improve confidence.

- *Recommendation: Make unit quizzes expected not optional*
- *Recommendation: Make the 'Check your learning' activity a feature of each unit*

There is no end of module assessment opportunity and no final opportunity to recognise and celebrate progress and achievement. This is likely to be de-motivating and disappointing for students after 80+ hours of independent and challenging study.

- *Recommendation: Create an end of module assessment quiz and a mechanism for congratulating students when they achieve a pass mark*

Learning activity and workload

This module aims to deliver approximately 80 hours of directed study time; however an analysis of student activity for this module suggests that there is approximately 90 hours of directed student study activity material, not including optional material other than pre- and end-of unit quizzes. In addition, it is likely that student will spend an additional 10-20% of time on 'self-directed' study, for example administrative tasks or optional activities such as refreshing skills, extra reading, extension activities etc, amounting to a total of 99-108 hours study (although it should be noted that these hours are approximate and based on documentation and students would have a better idea about whether this is actually the case).

- *Recommendation: Ask a range of students how long they spend on each unit*
- *Recommendation: Consider re-writing module guidance to say that the module will take approximately 100 hours*

As noted above, units vary significantly in their length (between 4.5 hours and 21 hours). This issue has been partially resolved by breaking longer units into two parts; however in practice these parts merge into each other. For example, they do not contain their own learning outcomes or assessment opportunities at the end, but move students seamlessly into the next part. Students may find unexpectedly long units de-motivating (although the converse of that might also be true, that students find unexpectedly short units motivating!)

- *Recommendation: It is recognised that some topics might take longer to learn than others, however some guidance should be given about the relative length of each unit*

The breakdown of student activity for the module is approximately:

27.5 hours reading, watching, listening to module material

2 hours finding and handling data

0 hours in communicative activity

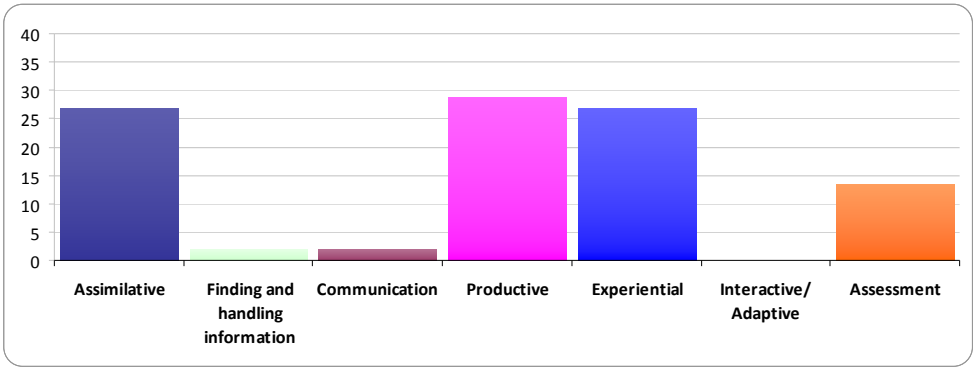
28.5 hours completing mathematical problems, writing, drawing, listing etc

20 hours applying and practicing mathematical concepts in a 'real' context

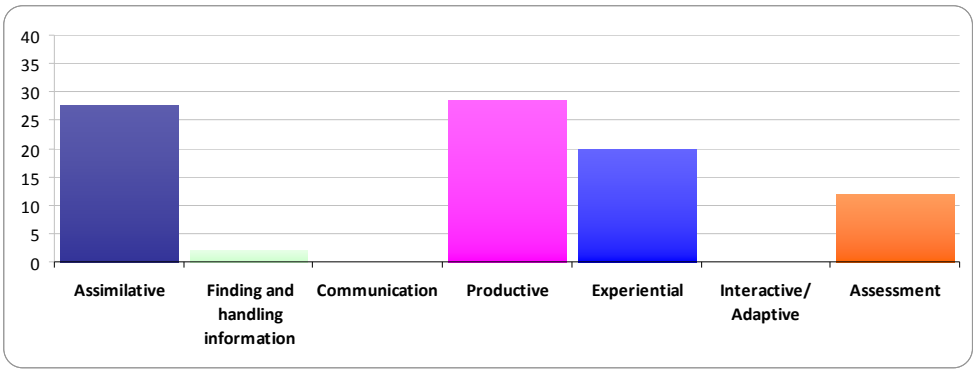
0 hours exploring and experimenting with concepts in a simulated environment

12 hours completing assessment tasks (quizzes and 'Check your learning' activities

Interestingly, despite redesign and development, and transfer to a significantly different learning context and pedagogic approach, the profile of student activity hours has not significantly changed from the original *Starting with maths* module profile:



Student activity profile: Starting with maths



Student activity profile: SWiM

Constructive alignment (of learning outcomes, activity and assessment)

As has been discussed above, no module level learning outcomes have been explicitly defined by the design team, and unit level learning outcomes are only shared at the end of units as 'checklists'. Instructional approaches often structure learning and teaching around clearly stated learning outcomes and aim to coherently align learning outcomes, activity and assessment. The anticipated benefit of such clear alignment is that students are supported in constructing meaning from what they do to learn, and in taking responsibility for their own learning. It should also make it easier to communicate the nature and purpose of the module, and specific parts of the module, to stakeholders (including students).

A review of SWiM revealed that there is generally good alignment between unit level outcomes and unit activities (see i.e. Appendix 3 'Alignment of outcomes to activity'). However, there are fewer examples of good alignment between unit level learning outcomes and assessment tasks and it was therefore not possible to demonstrate a coherent alignment between learning outcomes, activities and assessment. For example in Unit 4 (see Appendix 3 'Alignment of outcomes to assessment'), there appears to be alignment between only 3 out of the 7 unit level learning outcomes and formative assessment and demonstration tasks. There are no opportunities in the self-check activities or end of unit quizzes to perform calculations with decimals - only fractions - despite decimals being given equal weighting to fractions in the unit aims and study checklist (unit outcomes). In addition, no opportunities are given in the quiz or self-check activities to demonstrate or articulate learning across the affective domain (i.e. confidence, attitudes to mathematics) or problem-solving skills. Overall, it was felt by the reviewer that the existing assessment strategy does not sufficiently monitor and evidence the stated student learning and development aims of the module.

- *Recommendation: Ensure alignment between quiz and 'check your learning' questions and the stated learning outcomes in each unit*

It should be noted that it was also not possible to demonstrate the constructive alignment of *Starting with maths'* outcomes, activities and assessment however it is disappointing that the opportunity for improving this was not taken through the SWiM design process, particularly as a more instructional format has been chosen. This may be found to be a significant issue for the module in terms of supporting students' deeper learning, in communicating the nature and purpose of the module to others, and enabling others (i.e. colleges) to reuse and repurpose specific activities and materials from the module; clear alignment would make it easier for others to see how things fit together.

Conclusion

This review has highlighted a number of areas for detailed consideration, further evaluation and reflection.

There are a number of ways in which the redesign of the module has led to improvements to the design which are likely to be felt by learners. In particular:

- *The use of hint reveals at key points in problems is likely to enable students to access the level of support that they need. Hints are well structured to encourage critical maths thinking and effective mathematical and study practices.*
- *Strong encouragement is given to students through the study guide text and through activities, to discuss and share their learning with family and friends. The development of personal learning support networks is likely to build student resilience, and motivation which extends beyond their time studying on this module.*
- *Students are strongly encouraged to keep detailed notes in a math notebook and use these as a learning resource during their study. This is likely to be an effective strategy for fostering a sense of independence and self-reliance.*
- *A rich variety of media formats in addition to text (images, videos, pencasts, web articles games) have been used. These are likely to stimulate students, although care should be taken to ensure that materials are accessible to all learner groups.*
- *Lots of optional activities have been added to the module which will provide students with opportunities to reinforce and extend their learning. However students will require explicit guidance in relation to these. Some students may feel that they should engage with all optional materials and find themselves unable to because of their learning level, or restrictions on their time.*

There has been a shift in the way the module intends to engage learners and support learning; broadly, from an experiential model to an instructional model. As it has been redesigned, the module has had the features and mechanisms which support reflection and planning removed (learning plan, learning review, study checklist templates, end of module study plan etc) however the features and mechanisms most commonly associated with an effective instructivist approach do not appear to have replaced them (explicit learning outcomes, coherently aligned activities and assessment opportunities, repeated and reinforcing task sequences etc). It is recognised that the reviewer comes from a UK education perspective and US students may be more familiar with the instructional approach used, and the tone and phrasing of the online study guide. Further evaluation may find that students do not find these issues as problematic as the reviewer perceives them to be.

No peer-to-peer collaboration or communication tasks using the learning groups have been embedded into activities, and yet this aspect of learning is often a key and significant part of students' overall learning experience. It will be interesting to see whether students develop or request mechanisms or strategies to fill this void, for example whether formal or informal online or face to face study group will be requested or emerge over time. That a number of the pilot

colleges have decided to use the online module as part of a blended approach may indicate that the absence of collaboration and discussion opportunities has been felt, and this would be an interesting aspect to evaluate further and monitor over time

Appendix 2.1 Module Map of 'SWiM'

'At a glance' Module Map

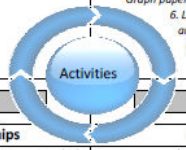
Course/ module title: Succeed with math

Guidance and Support

Tools and resources	Roles and relationships
1. Welcome to Succeed with math (introduction) *2. Study guide (online and prinable version, approx 87,000 words)* *3. How to get the most from this course (unable to open)* *4. FAQ (unable to open)* *5. Learning groups (optional)* *6. Online timer (optional)*	Students are taken sequentially step-by-step through increasingly challenging learning activities. Language and images used are supportive and encouraging. Learners are not made explicitly aware of what they will be learning at the beginning of each unit and the unit titles do not clearly indicate what will be studied. Little guidance is given about the benefits and disadvantages of engaging in optional materials. Units are of different lengths and no guidance is given in relation to approximate timings for units or activities. Activity hints are structured to encourage critical thinking, and some are staged so that students are able to access the level of support they need for that question. Although student groups and forums appear to be available, these are not mentioned in the guidance and support materials.

Content and Experience

Tools and Resources	Roles and relationships
1. Math notebook (students own) *2. Study guide activities* *3. Additional online activities e.g* *puzzles.com* *mrnussbaum.com* *mathsisfun.com* *math-play.com* *BBC Skillswise* *gapminder.org* *3. Online calculator* *4. Podcast teaching (You Tube)* *5. Pencast explanations (Adobe)* *5. Printable materials (pdf) e.g.* *Paper ruler (vendian.org)* *Hexagon paper* *Tangram paper* *Bathroom planning grid* *Graph paper* *6. Links to open MU120 units (optional, amounts to approx 7-10 further hours of study)*	Learning Materials are presented in a variety of rich media in addition to text (images, videos, pencasts, web articles) Use is made of CC licenced web based materials, including teaching materials, games, quizzes and videos. Students are encouraged to keep detailed notes in a math notebook and use these throughout their learning. Student activity includes a mixture of assimilative (primarily reading and watching), productive (making notes completing mathematical problems, writing, drawing, listing), experiential (exploring, investigating and applying mathematical concepts in a 'real' context) and completing assessment tasks (quizzes and 'check your learning' activities).



Reflection and Demonstration

Tools and resources	Roles and relationships
Self-reflection questionnaire *Pre-unit quiz (optional)* *Check your learning activity (Units 3, 4, 5 only)* *End-of unit quiz (optional)* *End-of unit Study checklist (learning outcomes)* *What do you think of this course (evaluation questionnaire)*	Students begin with a self-reflection questionnaire which captures some information about student perceptions of their maths skill, and feelings about maths but students do not have an opportunity to complete a similar questionnaire at the end of the module. Students are encouraged to benchmark their math knowledge at the beginning of each unit and again at the end using the quizzes. Some units also provide an extended opportunity to practice knowledge learned in 'Check your learning' activities. Students are encouraged to reflect on their learning against the learning outcomes at the end of each section but these reflections are not written down, or supported explicitly (i.e. through tracking sheets or templates) Students do not identify their own personal learning outcomes at the beginning of the module There is no opportunity to mark or celebrate distance travelled at the end of the module

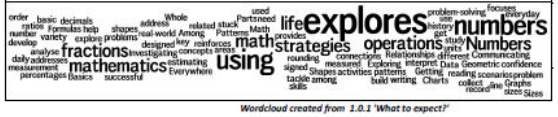
Communication and Collaboration

Tools and resources	Roles and relationships
Learning groups (optional) *Family and friends (embedded)*	Students are not encouraged to engage in learning discourse with other learners, although strong encouragement is given to discuss learning with family and friends and there are some examples where sharing maths learning is embedded in student tasks.

Module summary

Succeed with Math will help you review key math concepts, and then apply these concepts to real world applications. Units available include: Math and You, Getting Down to the Basics, Numbers Everywhere, Parts of the Whole, Relationships Among Numbers, Exploring Patterns and Formulas, Investigating Geometric Shapes and Sizes, and Communicating with Data, Charts and Graphs.

Keywords

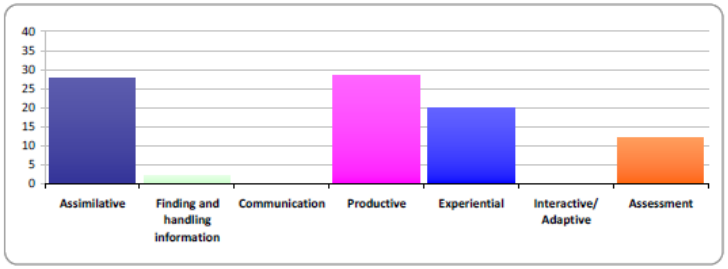


Wordcloud created from 1.0.1 'What to expect?'

Appendix 2.2 Pedagogy Profile of 'SWiM'

'As is' Pedagogy Profile representation

Course/module title: Succeed with math



Unit	Assimilative	Finding and handling information	Communication	Productive	Experiential	Interactive/ Adaptive	Assessment	Total per week
1	2.5			0.5	1		0.5	4.5
2	6			8	5		2	21
3	2.5			3.5	3		2.5	11.5
4	4			4.5	2.5		1.5	12.5
5	3.5			3.5	2.5		2.5	12
6	3			2.5	1		1	7.5
7	3			5.5	3.5		1	13
8	3	2		0.5	1.5		1	8
								Total actual
Total	27.5	2	0	28.5	20	0	12	90
	Assimilative	Finding and	Communication	Productive	Experiential	Interactive/	Assessment	

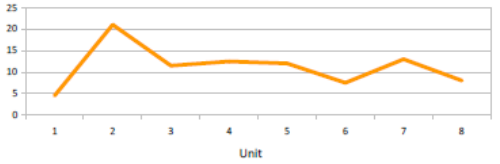
Key

Category	Process outcomes (learners will...)
Assimilative	e.g. Read, Watch, Listen, Think about, Observe, Review, Study
Finding and handling information	e.g. List, Analyse, Collate, Plot, Find, Discover, Access, Use, Gather, Order, Classify, Select, Assess,
Communication	e.g. Communicate, Debate, Discuss, Argue, Share, Report, Collaborate, Present, Describe, Question
Productive	e.g. List, Create, Build, Make, Design, Construct, Contribute, Complete, Produce, Write, Draw, Refine,
Experiential	e.g. Practice, Apply, Mimic, Experience, Explore, Investigate, Perform, Engage
Interactive/ Adaptive	e.g. Explore, Experiment, Trial, Improve, Model, Simulate
Assessment	Include summative (graded) assessment only here e.g. Write, Present, Report, Demonstrate, Critique

Course/module hours (as stated in course/ module guide)

Contact/ teaching hours	n/a	e.g. classroom/online tutorial activities, lectures, exams
Directed study	90	e.g. reading and research, revision, assignment writing, discussion forums, reflective diaries, data analysis
Self-directed study	n/a	e.g. administrative tasks, refreshing skills, extra reading, extension activities (usually 10-20% of total hours)
Total stated module/course hours	90	

Approx total study hours per unit



Notes

This module has 8 units which are not intended to map to weeks of study and do not have approximate timings allocated to them. The profile is therefore approximate and timings should be checked against learner experience.

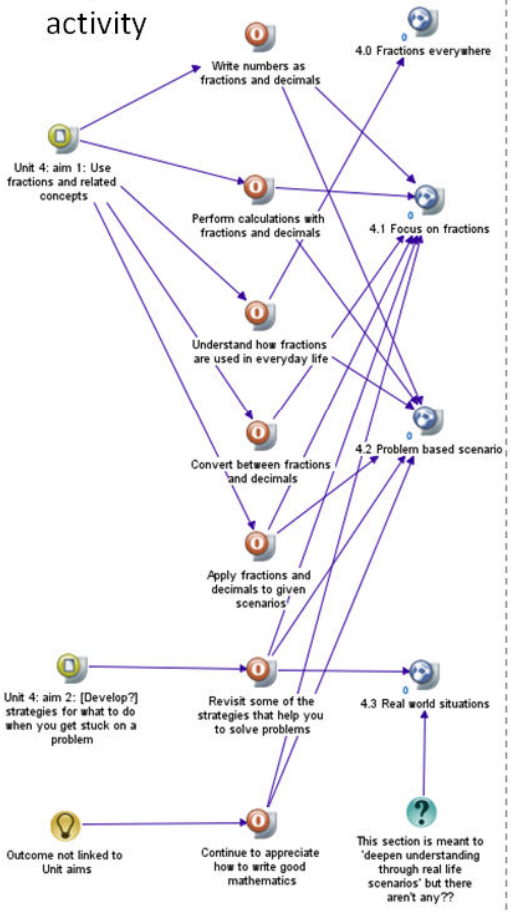
A read through of the units indicate the breakdown should be roughly :

2 hours finding and handling information
27.5 hours assimilative
0 hours communication time
28.5 hours productive
20 hours experiential
12 hours assessment (including pre-quiz, self-check and post-quiz).

Appendix 2.3 Learning Outcomes view of 'SWiM'

Succeed with Math Unit 4: Parts of the Whole

Alignment of outcomes to activity



Alignment of outcomes to assessment