Accessibility Guide for Maths and Stats Presentation Module Teams

Contents
1. Introduction ........................................................................................................................................... 3
2. Reasonable adjustments legislation ....................................................................................................... 4
3. Responsibilities of module teams ........................................................................................................... 4
4. Help available ........................................................................................................................................ 5
  4.1 Websites ........................................................................................................................................... 5
  4.2 People .............................................................................................................................................. 5
  4.3 Maths and Stats Accessibility Working Group ...................................................................................... 6
5. The role of the Module Team Accessibility Coordinator (MTAC) on the presentation team ........ 6
  5.1 Possible duties of the MTAC (Presentation) ..................................................................................... 6
  5.2 Current MTACs in Maths & Stats ........................................................................................................ 7
6. Requests for reasonable adjustments .................................................................................................... 7
7. Supporting students with print disabilities ............................................................................................ 8
  7.1 DAISY digital talking books .............................................................................................................. 9
   7.1.1 Which modules have DAISY books? ................................................................................................ 9
   7.1.2 How to find DAISY books on module websites ........................................................................... 9
  7.2 The Alternative Formats Team .......................................................................................................... 10
   7.2.1 Pronunciation guides ..................................................................................................................... 10
   7.2.2 Writing figure descriptions ............................................................................................................. 11
  7.3 Audio versions of TMAs and exams .................................................................................................... 12
  7.4 Errata ................................................................................................................................................ 13
  7.5 Screencasts and their transcripts ....................................................................................................... 13
8. Supporting students with other disabilities ........................................................................................... 13
  8.1 Inclusive practice in maths and statistics .......................................................................................... 14
  8.2 Dyslexia ............................................................................................................................................ 14
  8.3 Students who declare Mental Health as a disability ......................................................................... 14
  8.4 Deaf or hard of hearing ...................................................................................................................... 14
9. Useful software ..................................................................................................................................... 15
  9.1 Mathematical software ........................................................................................................................ 15
  9.2 Screen readers .................................................................................................................................. 15
10. Examples of good practice ................................................................................................................... 16
  10.1 TMA Accessibility Statements ......................................................................................................... 16
  10.2 Master set of accessible TMAs ......................................................................................................... 16
10.3 Examples of adjustments to TMAs ................................................................. 16
10.4 Website links and screen readers ................................................................. 17
10.5 Sharing case studies ...................................................................................... 17
11. Summary of links ............................................................................................ 17
12. References ......................................................................................................... 21
Appendices ............................................................................................................ 22
   Appendix 1  Figure description template from L2/L3 Maths project ................. 22
   Appendix 2  Process for producing figure descriptions for production modules .... 25
1. Introduction

Welcome to this Accessibility Guide for presentation module teams!

The aim of this guide is to provide useful resources to help presentation module teams support students with disabilities and additional requirements. It provides guidance on legislation, responsibilities, help available, the role of the presentation team accessibility coordinator, reasonable adjustments, student support, software, and some examples of good practice. The guide also includes a short section (Section 7.2.2) on writing figure descriptions which applies to production module teams.

Parts of this document discuss making module materials accessible. By ‘accessible’, we mean making reasonable adjustments to materials for students who are currently studying the module or who are anticipated to do so in the future.

Please note that this guide is an evolving document. So, if there is some information that you think is missing or incorrect, please let us know (chris.hughes@open.ac.uk or hilary.holmes@open.ac.uk) and we’ll try to change it as soon as we can.

In 2017/18 in our school, 3300 students declared a disability. The most common individual disability was mental health, followed by specific learning difficulties such as dyslexia.

![Disabilities of M&S students in 2017/18](image)

*Figure 1 disabilities of Maths & Stats students, 2017/2018*

For many of these disabilities, support is provided directly by the Disability Services Team, the Student Support Team (SST) and the student’s tutors (see Section 8). In the Maths & Stats SST, a student who has particularly challenging circumstances may have a named advocate in the advising staff across the UK, most likely an Educational Advisor or Senior Educational Advisor. In which case, this will be noted on VOICE and a discussion with this advocate is recommended. However, some disabilities such as visual impairments or other print disabilities may require additional support from module teams (see Section 7).

Student guidance on disability support is available from the Help Centre on StudentHome.

The [Accessibility for Mathematics and Statistics modules](#) website provides advice for disabled students and should be available from the Accessibility section of the Resources area of module websites, and also from a link in the Skills area of the [Mathematics and Statistics subject site](#). This
student guide provides generic information on the accessibility of the school’s undergraduate modules, such as module websites, printed materials, calculators, computer resources, audio, video and tutorial clips, and assessment. It also includes advice on writing mathematics. The student guide does not contain any information on module specific features, such as software, which should be provided by the module team as part of the module materials (either in the module guide, course materials or on the website). A reminder of where the module specific guidance can be found should be included in the Accessibility section of the module website.

2. Reasonable adjustments legislation
Disability is a protected characteristic under The Equality Act (2010). This means that

... universities must make reasonable adjustments so that disabled people are not disadvantaged relative to non-disabled people. Further, these adjustments should be made in anticipation of the needs of disabled people, rather than only on request. (McLaren, 2018)

Anticipating needs is very important. This is why the need to consider accessibility is built into the production process. All production teams are recommended to have a Module Team Accessibility Coordinator to advise on accessibility, sometimes with the support of the School Accessibility Coordinator and other specialists. This process provides a basic level of accessibility, but it is important to try to have made as many of our materials as accessible and inclusive as possible, before receiving requests from students. It is also crucial to ensure that there are routes through our qualifications in maths & stats which disabled students can study successfully.

In Maths and Stats, presentation teams should also have a Module Team Accessibility Coordinator (MTAC) who can respond quickly to requests for adjustments to be made at the start of (or during) the presentation, and to help develop and implement workable processes to improve our accessibility support (see Section 5). Currently, it is sometimes difficult to produce new adjustments that are needed during the presentation quickly enough for the student to complete the module successfully. The module team chair is the MTAC by default, but the role can be delegated to another team member.

Further legislation is being introduced. For example, The Public Sector Bodies (Websites and Mobile Applications) Accessibility Regulations came into force in September 2018 and this includes regulations on the accessibility of VLEs. To comply with this legislation, items on websites may need to be made more accessible (McLaren, 2018). New websites (i.e. those that went live from 23 September 2018 onwards) are required to have an accessibility statement, if elements of the content are not accessible, by 22 September 2019. Existing websites (i.e. those that went live before 23 September 2018) have longer to produce this guidance if it is needed: their deadline is 22 September 2020. The university has provided a website accessibility statement for the standard VLE platform. Module teams may still need to provide an accessibility statement for items on module websites which are likely to present accessibility challenges for some students. We are waiting for further University guidance on how this legislation affects M&S websites.

3. Responsibilities of module teams
Guidance on who is responsible for making reasonable adjustments has been provided by the Securing Greater Accessibility team (SeGA) in their Reasonable Adjustment Guidance for individual student requests document. This is a very useful document and states that it is the responsibility of the module team to provide an adjustment as necessary to:
• The format of teaching materials
• The means of delivery of these materials. The exception is where the student asks an Associate Lecturer to make an adjustment to their teaching delivery including any materials they create or technologies they use.
• The method of assessment, except for responsibility for making adjustments to examination arrangements which lies with Assessment, Credit and Qualifications.

Reasonable adjustments include providing alternatives to meet the learning outcomes where either existing materials, means of delivery, assessment methods or required software cannot be made accessible for a student.

The faculty is responsible for providing accessible routes for progression and senior management are responsible for ensuring that changes to teaching media and methods are inclusive.

4. Help available

4.1 Websites
Generic guidance on accessibility is available from the Securing Greater Access team on the SeGA website. This website includes a forum, advice on disabilities, information on supporting disabled students, legal obligations and requirements, accessibility case studies, accessibility contacts and guidance for module teams.

Accessibility advice for pre-production, production and presentation teams is available from the section Guidance for module teams. For example, the guidance for presentation teams includes advice on making reasonable adjustments, arranging non-medical helper access to websites and managing requests for print versions of online materials.

A useful website for advice on supporting disabled students studying maths or statistics is STEM Enable which is run by Emma Cliffe at the University of Bath. This site contains resources for students, lecturers, assistive technologists and disability practitioners.

Access2Science provides some general STEM accessibility resources.

The Sigma network has an email discussion list and some posts cover accessibility. The network also has a Special Interest Group on maths accessibility.

4.2 People
People who can help with accessibility of Maths and Statistics modules are:

• your Curriculum Manager (CM) who can gather information (for example about the adjustments needed) and liaise with other accessibility specialists within the school and faculty, as well as communicating directly with the student;
• the school’s Accessibility Coordinator, Libby Meade Libby.Meade@open.ac.uk, who supports the curriculum managers, refers issues to other units, liaises with other Accessibility Coordinators and makes requests to the Accessibility Referrals Panel when required;
• the school’s Academic Accessibility Lead, Chris Hughes Chris.Hughes@open.ac.uk, who can advise on adjustments to mathematical and statistical teaching materials, assessment, figure descriptions and pronunciation guides;
• Claire Gordon claire.gordon@open.ac.uk, an Educational Advisor in Maths & Stats and is a member of the Maths & Stats Accessibility Working Group;
• Maxine Squirrell (maxine.squirrell@open.ac.uk) who is the Senior Manager of the Disability Resources Team;

• Alan Marlow (alan.marlow@open.ac.uk), the Co-ordinator Audio Recording Technician in the Audio Recording Centre can advise and assist with matters relating to DAISY talking books (see Section 7.2);

• Geri Huzar (Library-Accessibility@open.ac.uk) who can advise on the accessibility of text books and other library resources and who also works with publishers to improve accessibility;

• Module Team Accessibility Coordinators (see Section 5.2).

Complex unresolved reasonable adjustment cases can be referred to the University’s Accessibility Referrals Panel (ARP) via the school’s Accessibility Coordinator.

4.3 Maths and Stats Accessibility Working Group
This group is chaired by the School’s Academic Accessibility Lead and attended by representatives from the school, the SST, Widening Access and Success Services (WASS), IET and the library. It meets three times a year and discusses current accessibility developments and longer-term accessibility projects with the aim of improving the support offered to disabled students.

5. The role of the Module Team Accessibility Coordinator (MTAC) on the presentation team

5.1 Possible duties of the MTAC (Presentation)
Some of the tasks that the module team accessibility coordinator may be asked to do are listed below. Many of the suggestions on the list have been obtained from examples of actions that either a module team or a CM has already taken to support a disabled student. It is unlikely that all these tasks would be needed in a single presentation and the CM may be able to help with some of these suggestions as well.

• Acting as a point of contact in the dissemination of accessibility legislation from the University and M&S Accessibility group to the module team.

• Creating the module accessibility statement for the module description on the Study@OU website and keeping it up to date.

• Checking module materials are suitable or an alternative is available for students with additional requirements. This checking also includes new materials for each presentation such as assessments and errata and should also include supplementary materials and items repeated on Discover your Module and Early Start programmes.

• Producing alternative versions of questions on assessment to accommodate reasonable adjustments.

• Advising on figure descriptions for TMAs and exams/EMAs.

• Creating module pronunciation guides for TMAs and exams.

• If DAISY books are available for the module, checking that they have all been uploaded onto the current presentation website. If the Daisy books are currently in production, they might not all be available at module start.
• Participating in student case conferences, on behalf of the module team chair, as necessary.
• Liaising with accessibility specialists, including staff at the Audio Recording Centre.
• Discussing academic needs with disabled students.
• Liaising with other module team accessibility coordinators to share good practice and provide continuity of care as students move through their qualifications.

Challenging situations can occur when a student with a visual impairment registers on a module, but the module team is unaware of this until just before or after the module start and then needs to make reasonable adjustments within a very short timescale. We hope that by introducing the SST advocate system, encouraging MTACs to liaise between modules and by trying to establish accessible routes through our qualifications as soon as possible, this situation will become less frequent. The CM can run a Circe query to find the PIs of all visually impaired students registered on a module and the details of the disability can then be checked on Voice, possibly by a curriculum assistant. A summary of the disabilities can then be passed to the MTAC who can check whether any further adjustments are needed to the module materials. It is also important that details of the adjustments made on one module are passed onto the MTACs of the modules that the student registers on next, so that the new module team has a starting point. However further adjustments may be necessary if the student’s disability has changed. Coordination with the Academic Lead for the school is encouraged.

5.2 Current MTACs in Maths & Stats
In some cases, it may be appropriate for a MTAC on a module to liaise with the MTACs of the modules the student has studied previously, to discuss which strategies and technologies are most helpful for the student and to ensure some continuity of care. It may also be useful to share approaches more generally. By default, the chair of the module is the MTAC, unless they have delegated the role to someone else. In November 2019, the following people agreed to take on the role of MTAC.

<table>
<thead>
<tr>
<th>Module</th>
<th>MTAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>M347</td>
<td>Rowan Thomas</td>
</tr>
<tr>
<td>MSc</td>
<td>Ben Mestel</td>
</tr>
<tr>
<td>ME620</td>
<td>Angie McConnell</td>
</tr>
<tr>
<td>ME627</td>
<td>Gerry Golding</td>
</tr>
<tr>
<td>MT365</td>
<td>Robert Brignall</td>
</tr>
</tbody>
</table>

Your CM can check for any updates to this list at "penelope\MCSUsers\MCS-Groups\Courses_Office\Course_&_Programme_Filing\Mathematics_Statistics_Programme\Maths_Stats_Programme\Accessibility UG and PG\Accessibility module leads.xlsx"

6. Requests for reasonable adjustments
Many adjustments are made quickly and effectively by the SST staff and the teams in Widening Access and Success Services (WASS) well before the start of the module. However, some adjustments may have complicated academic requirements or occur either close to module start or during the presentation. In these cases, it is often useful to hold a case conference on Skype between all the people involved in supporting the student, so that adjustments can be made as quickly as possible. There is a risk that otherwise adjustments will not be in place earlier enough for the student to be able to succeed on the module.
There are some guidelines on how to arrange such a conference in Section 5 of the Managing individual disabled student requests for Reasonable Adjustment document. This section outlines the different staff responsibilities, includes examples of case conferences and summarises the approach required as follows:

**Purpose:**

- To respond in a timely and appropriate way to a student request for reasonable adjustment where more than one area of the University is involved

**Actions:**

- To consider a comprehensive report that identifies the issues
- To work out solutions to the issues which can be delivered as reasonable adjustments
- To agree a plan of action to be sent to the student
- To agree who will follow up any actions agreed and will keep the student informed of progress

In M&S we have held several of these conferences and they have proved to be very helpful in arranging adjustments. Typically, these meetings have included representatives from the SST, WASS, a module team representative, a school accessibility person and either a staff tutor or an academic accessibility specialist. More specialised staff (for example, those working for exams and ALs) have also attended when appropriate. The student has usually been represented by an educational advisor, to ensure that their needs are met and so that the student only needs to discuss their situation with one person, rather than repeating it to several members of staff. Occasionally academics (including ALs) have also been in touch with the student directly to discuss technical support such as software requirements or exam arrangements.

7. Supporting students with print disabilities

If a student has a visual impairment or another print disability such as dyslexia, they may need to use a screen reader or access materials in an alternative format. For some maths and stats modules, students can request DAISY talking books (see Section 7.1). In MST125, visually impaired students are advised to learn how to use LaTeX to typeset documents, especially if they are intending to study further maths modules. An accessible LaTeX editor is available (Melfi et al, 2018).

Mathematical notation in PDF resources is not usually accessible by a screen reader. However, some students may be able to cope using a screen reader and then magnifying the mathematical text, or they may be able to read a large print, coloured pdf of the text. It is now urgent that accessible materials are provided for some of our Level 2 and Level 3 modules. However, at present, there does not appear to be either a quick or easy solution to the problem of making pdfs that contain mathematical notation accessible. A summary of the different approaches that are being investigated is available on the website, PDF accessibility and PDF standards.

If the pdf is of a sufficiently high quality, then the OCR scanning software, InftyReader can be used to scan the pdf and convert it into LaTeX, MathML or XHTML. ChattyInfty is an extended version of InftyReader and includes a talking maths editor which can input files in LaTeX and output files into various formats including Word 2007 and Word XML. However, errors can occur during the scanning. So, the output files need to be checked and manually corrected, which can be time-consuming.

An alternative approach is to use the LaTeX package axessibility and then edit the screen reader dictionary (Jaws or NVDA) to include natural maths language (see Armano et al, 2018).
Tactile diagrams and sonification (M140 and MU123) can also be used. Production of tactile diagrams is managed via LDS; our contact is andrew.whitehead@open.ac.uk. There is a limit on the number of tactile diagrams that can be produced for a module, so if you wish to provide these resources, discuss with your CM or the Academic Accessibility Lead first. Tactile diagrams can take a while to produce, as labels and captions may need to be translated into a shortened form of Braille. It is important for the module team to produce a list of diagrams which need a tactile equivalent, so that if these are required by a student, the production process can be started as soon as possible.

For up-to-date advice on supporting blind students, the blind math mailing list run by NFB (National Federation of the Blind, US) is recommended. However this list is difficult to search, so if you are looking for help on a particular topic, try the Blind Maths Gems site which has ordered the threads by topic. An account of teaching statistics to blind students is available within Godfrey and Loots, (2015) paper.

7.1 DAISY digital talking books
DAISY digital talking books, in which volunteers read and record the main study and assessment materials for a module, can be produced by the Alternative Formats Team. Some modules, such as MU123, have ‘audio only’ DAISY books. However, since 2014, ‘audio with text’ books have been produced, in which the printed text is displayed, and each section is highlighted as it is read. (see Accessible Audio Formats For Disabled Students). The Alternative Formats Team send out details of how to use the DAISY books using the free Amis software. Most DAISY books are available from module websites, but they can also be supplied on CD-Rom, DVD-Rom, USB stick or SD card to students who need to have them delivered in that way. DAISY books can be produced for module materials, such as units and guides, TMAs and exams.

7.1.1 Which modules have DAISY books?
An updated list of modules with DAISY books is available from: DAISY Talking Books on module websites.

In 18J, the following M&S modules had DAISY books:

Level 1: MU123, M140, MST124 and MST125

Level 2: M248, MST210

Level 3: ME625, ME627

Additionally, as of Summer 2019, a DAISY book for M208 is in production.

All the Level 1 and Level 2 DAISY books are available to all students on the module. However, ME625 and ME627 use set books and so for copyright reasons, the DAISY books of the set books are restricted to students with a disability.

7.1.2 How to find DAISY books on module websites
On most module websites, DAISY books (if they exist) can be found by clicking on the Resources tab, then Downloads, then scroll down this page and click on Module materials in DAISY digital talking book format. The Contents Checklist lists the items that are available (including TMAs). At the bottom of this checklist, there is a link to the instructions for downloading the DAISY books and using them. At the start of the presentation it is important to check that all DAISY materials on the checklist are available and to contact the Audio Recording Centre directly if any are missing.
7.2 The Alternative Formats Team

In the Alternative Formats Team, Paul Williams (<Paul.S.Williams@open.ac.uk>) is the Coordinator of Production Planning and the volunteer readers, and Alan Marlow (<Alan.Marlow@open.ac.uk>) assists with the management of the Audio Recording Centre (ARC) and can provide technical advice on the production of DAISY books.

If you would like to produce DAISY books for your module materials, either as part of the production or later, please contact the school’s Academic Accessibility Lead first. The first step in the process is to have a discussion between the Academic Accessibility Lead, the Directory of Teaching, the Audio Recording Centre and the Module Team. The Academic Accessibility Lead can advise on likely timescales and check with the ARC when it will be possible to start your recordings. For a 30-credit module, it typically takes 6-9 months to produce all the DAISY books needed for the module, so it is important to contact the Academic Accessibility Lead as early as possible. Before recording can start, the module team will also need to produce a pronunciation guide and the figure descriptions.

7.2.1 Pronunciation guides

A pronunciation guide is a list of the notation used in the module with a description of how it should be read in a consistent and unambiguous way so that its meaning is clear. It is needed for DAISY books, including assignments and exams, so it is a good idea to have this guide ready, for when it is needed. The module handbook gives a good indication of the notation in the module and serves as a natural starting point. At time of writing, the most recently produced (Spring 2019) pronunciation guide is for M208; please contact libby.meade@open.ac.uk or the Curriculum Manager, rachel.spanswick@open.ac.uk for details. MST210 also has a pronunciation guide, which may be useful as a starting point for other applied modules (please contact Robert.Hasson@open.ac.uk for details). In some cases, ALs can be contracted to undertake this work, but the financial considerations and training needed should be discussed as soon as possible, either with your Curriculum Manager or the School’s Accessibility Coordinator.

There is still quite a lot of debate as to how mathematics should be read, and whether it should be read character by character or as a mathematician would read it. The latter is quicker for the student but does not emphasise the notation that is used. Over the last few years, we have tended to read notation character by character when it is first introduced, or where the student may have not used the notation for a while. Then we have stated that it will be read as the mathematician’s version from then on. For example, the character by character reading of the coordinates of the point (2, -3) would be ‘left parenthesis 2 comma negative 3 right parenthesis’ but the mathematician’s version might be ‘the point 2 negative 3’ or ‘the point with coordinates 2 and negative 3’.

There are likely to be different versions of how a mathematician might read the notation as well. So far, we have followed the module’s pronunciation if it has been stated, or the pronunciation in Larry’s Speakeasy which was written by a blind mathematician in 1983: Handbook for Mathematics (Larry’s Speak Easy).

If there is any doubt as to how a mathematician would read it, the default position should be character by character.

Recently there has been more interest in text descriptions of mathematical notation, particularly for use by screen readers. There are now several different guides, some of which provide verbose, brief and superbrief descriptions. Examples are:
1. Steve Noble’s Guide
2. MathSpeak: MathSpeak English and MathSpeak grammar
3. ClearSpeak Rules and Preferences

You can also use MathML Cloud to input a LaTeX statement and receive a text description (and other forms) of the output. An example using Google Chrome as the web browser is shown below.

### Equation

<table>
<thead>
<tr>
<th>Description</th>
<th>Graphic Preview</th>
<th>Text/Markup</th>
</tr>
</thead>
<tbody>
<tr>
<td>integral Subscript a Superscript b Baseline x squared d x</td>
<td>integral Subscript a Superscript b Baseline x squared d x</td>
<td></td>
</tr>
<tr>
<td>[ \int_a^b x^2 , dx ]</td>
<td><img src="base64data" alt="MathML Image" /></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 2 demonstration of MathML cloud**

#### 7.2.2 Writing figure descriptions

Figure descriptions should already be available for the main module materials, as they should have been produced either as part of the production process as soon as the materials had been finalised or as part of the Level 2 and Level 3 figure description project. However, figure descriptions may be needed for assessment materials on any presentation.

The guidance on writing figure descriptions given below is most relevant for production teams but can be adapted for presentation teams.

There is some general guidance on writing figure descriptions and some templates for graphs and charts on the SeGA site.

Externally, there is further guidance at the Diagram Center.

The key features to consider when writing a figure description are:

- **Does the image need a description?**
  
  A description will be needed if the image contains essential information not in the text; the image is a graph or diagram; the image is a visual summary of a long section which has no text summary or if there is no caption.

- **What is the purpose of the image?**
  
  The image may give essential information, assess understanding, or just add interest or amusement. Different levels of detail are appropriate for these three purposes. For example, if the figure description is needed for assessment, does mathematical notation need to be described character by character to check if the student understands the notation? In some cases, for example questions on graphs, it is important to check that the description does not give away part of the answer.
• **How might a screen reader read it?**

Some mathematical symbols need to be written as words, for example. \( \pi \) as pi, - as minus and so on. The pronunciation may also be different depending on the context. For example, does \( f(3x-2) \) represent a function of \( 3x-2 \) or a product of \( f \) and \( 3x-2 \); does \( t^{-3} \) represent an inverse function or a reciprocal? See Section 7.3.1 for further advice on pronunciation, particularly where there may be potential ambiguities in spoken maths e.g. \( \frac{2}{3+4} \).

• **How will the student use it?**

Figure descriptions are time-consuming to use, so it is important to try to describe the main teaching point as simply as possible. It helps to start off with an overall description and then give the information in increasing levels of detail, so the student can choose how much of the description they read. There is no need to repeat the figure caption. If there are several images of a similar type, for example a line graph, it helps to devise a standard template. The student then quickly becomes familiar with the template and the template also makes it easier and quicker for the author to write consistent descriptions.

Figure descriptions should ideally be written in rich text format using styles so that students can read and navigate them easily. A template which was used for units on the 'L2 and L3 Figure Description' project is shown in Appendix 1. On websites, figure descriptions in structured content should be available from the Accessibility section of the website. Figure descriptions for TMAs may also be put in the Assessment section.

It is good practice for the academic author to write the figure description as they know the purpose of the graph or diagram and this also helps to encourage simple clear diagrams. However, tutors on the module (or a similar one) are sometimes employed to write the figure descriptions, especially for modules in production. Costing details can be obtained from the School’s Accessibility Coordinator.

When a team of tutors are employed to write figure descriptions, it is useful for them to work in twos or threes so that they can agree on templates and can check each other’s work. It is helpful to set up a forum for the figure description authors and an academic contact, such as the MTAC, for any queries, for example about pronunciation or which images should have descriptions. Further information about setting up a figure description team is available from the Academic Accessibility Lead.

At time of writing, the most recently produced figure descriptions for modules in production were:

- M337, produced by a team of 3 tutors in 2018
- M208, produced by a team of 4 tutors in 2018/2019
- M820, M821 produced by a team of 2 tutors in 2019

Note that on web pages, partially sighted students probably won’t use figure descriptions, but will need scalable diagrams.

### 7.3 Audio versions of TMAs and exams

There are two ways of producing audio versions of assessment material. Either a member of the module team agrees to go to the Audio Recording Centre and records and checks the assessment themselves or the module team asks the ARC readers to do the recording. The readers used for Maths and Stats modules all have a scientific or mathematical background but may not be familiar with the content of the module materials. If the volunteer readers are used, the module team will
need to provide figure descriptions of any graphs, diagrams or pictures and a pronunciation guide as to how the mathematical notation should be read.

For example, should the notation be read character by character to test whether the student understands the notation, or should it be read as a mathematician would read it? The recording will then need to be checked by the module team. Whichever method is chosen, it is important to agree a schedule with ARC to ensure materials are ready in time for when the student needs to use them. It is advisable to store these documents in the module’s exam SharePoint site and sent securely to ARC by the CM when required.

7.4 Errata
It is important that disabled students are notified of errata in a format appropriate to their needs, at the same time as other students are notified. For example, a web document or a Word 365 document with mathematical notation created using the inbuilt equation may be possibilities. If DAISY books are used on the module, it is important to contact the Audio Recording Centre to request that the errata are included.

7.5 Screencasts and their transcripts
It is essential that transcripts of screencasts are made available to students. For a student who can see the writing on the screen, but is unable to hear the narration, a transcript which captures the speech of the presenter and the participants is sufficient. However, if a student is unable to see the screen, the transcript will need to include a description of the mathematics as well. Ideally, the author of the screencast will provide a full, meaningful verbal description of each step that they are performing, and in which case the transcript will be, by default, similarly meaningful.

For example, consider the following question:

Solve the equation

\[ \frac{x}{x+2} = 1. \]

Now compare the following descriptions of the first few steps of solving this equation:

1. We begin by multiplying both sides of the equation by the term given in the denominator here, so that we receive the following.
2. On the left-hand side of the equation we have the fraction with numerator x and denominator x+2, and this fraction is equal to 1. So, let’s begin by multiplying both sides of this equation by the denominator of the term on the left-hand side, that is, by x plus 2. This gives us x on the left-hand side, and x plus 2 on the right-hand side.

In this case, the first description would only be suitable for students who can see the screen, whereas the second is also accessible to students who are unable to read what is on the screen. In some cases, the full mathematical description may lengthen the transcript considerably. It may then be decided that the shorter transcript is most likely to be needed, but a second transcript may be needed later.

8. Supporting students with other disabilities
Staff Tutors may need to support tutors and their disabled students with advice on teaching or studying maths. All tutors should have completed the mandatory training Equality Essentials. Guidelines on specific disabilities and further resources are available on TutorHome and via the student’s disability profile.
8.1 Inclusive practice in maths and statistics
An introduction to supporting maths students with autism, dyslexia and visual impairments is provided in Good Practice on Inclusive Curricula in the Mathematical Sciences.

8.2 Dyslexia
The Institute of Physics have produced a good practice guide, Supporting STEM students with dyslexia, which includes case studies, a checklist and some advice on supporting maths students with dyslexia. The Dyslexic Student and Mathematics in Higher Education describes some of the difficulties undergraduate students encounter with mathematics.

8.3 Students who declare Mental Health as a disability
Some students, particularly those studying qualifications from other schools, may experience maths anxiety. The University of Sheffield have produced three short pdfs on What is maths anxiety?, Student strategies for overcoming maths anxiety and Teaching strategies for helping students overcome maths anxiety. (Please see request to let the Mash Team know if you use the resources on their maths anxiety website.) For more general information on maths anxiety in schools see Cambridge University’s 2019 study, Understanding Mathematics Anxiety. Developing mathematical resilience is one strategy that may reduce anxiety. This includes encouraging students to develop a growth mindset, dispelling myths about learning mathematics, and helping students to realise that struggling is an important part of studying maths and statistics. In 2019, the American Mathematical Society and Mathematical Association of America produced a free e-book, Living proof- Stories of resilience along the mathematical journey which aims to inspire students to persist with problems they find difficult. Mental Health in the Mathematics Community describes three cases of mental health difficulties experienced by academics and suggests a few ways of how support can be offered.

Some students with mental health difficulties may need extra support for modules that involve group work.

The University’s mental health adviser, Emma Greenstein suggested useful resources for tutors supporting students with mental health difficulties in her presentation Academic tutor or accidental counsellor.

8.4 Deaf or hard of hearing
Ros Strickland, an S112 tutor, has successfully supported a Hearing-Impaired student on S112, by providing live captioning during Adobe Connect sessions. An excellent report which includes

- details of how the support was set up
- the people involved
- feedback from the tutors and the student and
- useful guides for using the AC caption pod for tutors and students

can be obtained from Ros’s Staff Tutor, Rob Janes (rob.janes@open.ac.uk).

It is important to ensure that a deaf or hard of hearing student does not become isolated, for example, by not being able to participate in breakout rooms. Captioning can be added to some Office 365 apps. Please contact Rafael Hidalgo (r.hidalgo@open.ac.uk) for further information.
9. Useful software

9.1 Mathematical software

Some mathematical software can be used to improve the accessibility of module materials. However, it is important to weigh up the time needed to learn how to use the software against the potential benefits.

1. **Desmos** is a free graphing calculator which includes sonification of graphs and other adjustments for visually-impaired students. It can be used with several screen readers including JAWS, NVDA and Windows Narrator.

2. **MathTalk** is speech recognition software that allows students to dictate mathematics. It is used with Scientific Notebook and Dragon Naturally Speaking. However, if a student wishes to use this for assessment and exams, it is important that the computer algebra engine is turned off.

   To turn off the engine in MathTalk, please click on Tools, Computation Setup and then select None in the ‘Current Engine’ drop-down box. The YouTube video titled [turning off engine in scientific notebook](https://www.youtube.com/watch?v=dQw4w9WgXcQ) illustrates how to do this.

3. Modules which use Maxima include accessibility guidance within their module guide. Adjustments that can be made are using the command-line interface, using the keyboard alone and changing colours and fonts. It may be possible to use DragonPad to dictate Maxima commands and then transfer them directly into the Maxima window. (We still need to test if this works!)

4. **MathTrax** is a sonification package that is used by visually impaired students on MU123 to investigate graphs and solve equations.

9.2 Screen readers

Print-disabled students may already be familiar with one screen reader or some other assistive technology, such as the DAISY books. Ideally new presentation materials, such as TMAs and errata, should be presented in a format that means they can continue using that technology.

Screen readers that are recommended for accessing mathematical content are:

- **JAWS** which can be used either free in demo mode for 40 minutes at a time (after which the computer needs restarting) or as a paid full version.

- **NVDA** which is free software and currently supports MathML in Microsoft Internet Explorer, Google Chrome and Mozilla Firefox and MathType in MS Word and PowerPoint. It is necessary to install MathPlayer 4 and MathType, although it is not clear if MathPlayer will continue to be supported by Design Science.

- **ChromeVox** is free and can be used to access maths on the web via the Google Chrome browser.

- Documents prepared with the inbuilt equation editor in Word 365 can be read by the Word screen reader, ReadAloud. For details see [Preparation of accessible Office 365 documents](https://support.office.com/en-us/article/preparing-office-365-documents-for-screen-readers-87e50069-5760-42a0-ab07-c46e59f85a6c).

Further information (from 2019) on the preferences of screen reader users is available from the [WebAim Survey](https://webaim.org/).
10. Examples of good practice

10.1 TMA Accessibility Statements

It is useful to include an accessibility statement on the front of each TMA, so that if a student has a disability which makes it difficult for them to either access a question or complete it, they know who to approach for help. This is particularly useful if a student has not previously notified the university of their disability. An example of such a statement is:

*If you have a disability that makes it difficult for you to attempt any of the questions on this TMA, then please contact your Student Support Team or your tutor for advice.*

A similar statement for the Tutor Notes might be:

*If a student has difficulty completing any part of a TMA question due to a disability or being in prison and reasonable adjustments are not already in place, then please contact the Module Team <email address> as soon as possible, copying in your staff tutor. They will consider whether any adjustments can be made to the question or whether another approach, such as submitting a special circumstances form, is advisable.*

Please note that SiSE students may not have reliable or any access to computers, so these students may need to be provided with accessible alternatives to those questions that use some mathematical software, such as Maxima.

10.2 Master set of accessible TMAs

If similar assignments are set on each presentation, then it may be possible to produce a set of assignments, designed as reasonable adjustments, which can be used repeatedly over several presentations. However, it is important to first check what the student’s needs and capabilities are, even if they appear to have a disability that is similar to that of another student. Students with similar disabilities may require very different adjustments.

If the module has DAISY books for assignments, it is important to notify the Audio Recording Centre that the accessible assignments, rather than the standard assignments, need recording. Tutors will also need to be kept informed and given copies of both the accessible assignments and the corresponding tutor notes.

An alternative and more inclusive approach is to reword the TMA questions to improve their accessibility directly, for example, by including phrases such as ‘or otherwise’.

10.3 Examples of adjustments to TMAs

Suppose a question asks a blind student to sketch a graph. Possible approaches are:

- ask the student to describe how to sketch the graph, as if to a fellow student;
- ask the student to use German film to create a raised sketch which could be sent to the tutor by post or photographed;
- rewrite the question to assess some feature related to the graph or topic.

For example, on the 18J presentation of M140, TMA03 asked students to use Minitab to plot a scatterplot and then interpret it. One student was unable to access Minitab with their assistive technology. The adjustment made asked the student to either use Excel to create the scatterplot or describe what features they would expect to visualise in the scatterplot. Detailed key sequences for creating the scatterplot were provided and the student could produce both the scatterplot and a description of the features if they wished.
On MST210, the following instructions were used as an adjustment to the TMAs:

*Important: for any question that asks you to draw a diagram, you may instead choose to provide a written description, or otherwise to provide a computer-drawn version of the diagram. Any questions that involve the use of Maxima have ‘or otherwise’ in their instruction; this might mean, for example, that you perform the calculation by hand or using other software, if this is your preference.*

On M303, the following statement has been used:

*Sketch, by hand or otherwise, the set, using a separate diagram for each set. If you are unsure how to represent something on a diagram, or unable to sketch it, then please describe what you mean in words. You are also free to use a combination of sketching and writing.*

It may also be appropriate to suggest that the student submits a [special circumstances form](#) to notify the Module Review Panel of their difficulties.

10.4 Website links and screen readers

Students who use screen readers may generate a list of the links on a webpage to get an idea of what is on the page. So, it is important that links have meaningful titles such as [MST125 Diagnostic quiz](#) rather than links such as ‘Click [here](#)’. If the link is to a download, it is helpful to include ‘download’ and the file size in the link title, as students may not wish to download the file.

10.5 Sharing case studies

Examples of good practice and lessons learned are always welcomed by the Maths & Stats Accessibility Working Group. This enables us to share good practice and identify areas that need to be improved. For example, a recent case highlighted the need for module teams, ALs and forum moderators to be more aware when a student raises a potential accessibility issue in a module forum, even if the student does not have a declared disability. It is important that everyone involved is aware of the urgency of this type of request and also aware of the procedures that should be followed when a [disclosure](#) has been made. This case also highlighted that some adjustments, in this case increasing the font size of the handbook, would help several students not just the student for which the adjustment was made. Curriculum managers can notify exams in November (for June exams) that different formats are acceptable. An alternative approach would be to change the format for everyone.

11. Summary of links

The following is a summary of the links in this document:

5. Accessible LaTeX editor: https://services.szs.kit.edu/szslatex/
7. Amis Software: http://www.DAISY.org/amis/download
10. ChromeVox: https://www.chromevox.com/
11. ClearSpeak Rules and Preferences:
    https://docs.wiris.com/_media/en/mathtype/mathtype_desktop/accessibility/clearspeakrulesandpreferences.docx
18. Disclosure: http://www2.open.ac.uk/tutors/disabled-students/guidelines-on-disclosure-and-confidentiality
19. Downloading and playing DAISY talking books:
22. Equality Essentials:
23. Good Practice on Inclusive Curricula in the Mathematical Sciences:
    http://www.mathcentre.ac.uk/resources/uploaded/inclusivecurricula.pdf
24. Guidance for module teams:
25. Guidance on Module Team Accessibility Coordinator:
26. InftyReader: http://www.inftyreader.org/
27. JAWS screen reader: http://www.freedomscientific.com/Products/software/JAWS/
28. Larry’s Speakeasy: 
29. Living proof - Stories of resilience along the mathematical journey: 
31. Mathematics and Statistics subject site: 
   https://learn2.open.ac.uk/course/view.php?id=206217&cmid=1173067
32. MathML Cloud: https://www.mathmlcloud.org/
33. MathPlayer from Design Science: 
34. MathSpeak: MathSpeak English and Mathspeak grammar
35. MathTalk: https://mathtalk.com/
37. Module Team Accessibility Coordinator (Production): 
38. NVDA screen reader: https://www.nvaccess.org/
39. Practical strategies for reducing maths anxiety: 
   https://www.sheffield.ac.uk/mash/anxiety
40. PDF Accessibility and PDF standards: http://www.tug.org/twg/accessibility/
42. Reasonable adjustment guidance: 
43. SeGA: https://openuniv.sharepoint.com/sites/units/iet/iet-sega
44. SeGA, Figure description templates: 
45. Sigma network: http://www.sigma-network.ac.uk/
46. Sigma mailing list: 
   https://www.jiscmail.ac.uk/cgi-bin/webadmin?A0=SIGMA-NETWORK
47. Special circumstances form: https://csr-eweb-live.open.ac.uk/Vantage/SpecialCircumstances
48. STEM Enable website maintained by Bath University: 
   http://stemenable.referata.com/wiki/Welcome_to_STEM_Enable
49. Steve Noble’s Guide: 
50. Student Support Tool: http://csr-iweb-live.open.ac.uk/Vantage/SST/ReportingTool
51. Supporting STEM students with dyslexia:
52. Templates for graphs and charts:
53. The Dyslexic Student and Mathematics in Higher Education:
54. Topics in Practical Methods for STEM Accessibility: http://access2science.com/
55. Turning off engine in Scientific Notebook:
   https://www.youtube.com/watch?v=ch0PU4QXIfc
56. Tutor support for disabled students: http://www2.open.ac.uk/tutors/disabled-students/tutor-resources
57. Understanding Mathematics Anxiety:
   https://www.repository.cam.ac.uk/bitstream/handle/1810/290514/Szucs%2041179%20Main%20Public%20Output%20March%202019.pdf?sequence=1&isAllowed=y
59. Website accessibility at The Open University:
   http://www.open.ac.uk/about/main/strategy-and-policies/policies-and-statements/website-accessibility-open-university
60. Writing figure descriptions:
   https://learn3.open.ac.uk/mod/oucontent/view.php?id=148479&section=1.15
12. References


Appendices

Appendix 1  Figure description template from L2/L3 Maths project

Template for Figure Descriptions

Please use the template on the next page for the figure descriptions for your module. This template includes heading styles so that students can quickly navigate to the section they need. An example is included for MST125 on the following page. The styles used are as follows:

Heading 1
This is used for the Unit number.

Heading 2
This is used for Subsection (or if these are not used, Section) numbers.

Heading 3
This is used for the page number, immediately followed by the descriptions of the figures that appear on that page. It should be included immediately below a Subsection (or Section) heading where one happens to start on that page.

Heading 4
This is used for the figure description titles. Two examples of figure description titles have been included in the template, one for a numbered figure and one for a figure description within an activity. You may need to add other types here, for example, a figure within an example, or a margin figure.

Applying styles

In Word, you can apply a heading style by either

On the Home tab, find the Styles section, click on the heading style you want and then type the required text. Return to Normal text by clicking on the Normal option

or

Select the text that you want as a heading, then on the Home tab, find the Styles section and click on the heading style you want.

Figures without a description

If you decide within your writing pair that a figure doesn’t warrant a description, please include its heading in a separate list of figures, so that the module team can check that all figures have been considered and that no extra descriptions are needed.

Saving the file(s)

It would be helpful if you could save the final version in Rich Text Format (rtf).

Please either submit one file for all the figure descriptions for the module, or one per unit. Either way, please ensure the files are clearly labelled.

You don’t need to compile a Contents list because, if the heading styles have been applied correctly, the list can be created by the OU’s editors. Many thanks for all your help with this!
<Module code> Description of essential visual items

The module team have identified the following visual elements of the module as those requiring descriptions.

Unit [number]
Section / Subsection X
Page A
Figure Y
Please write description here.
Page B
Activity Z
Please write description here.
MST125 Description of essential visual items
The module team have identified the following visual elements of the module as those requiring descriptions.

Unit 1
Subsection 1.1
Page 8
Figure 1
Please write description here

Page 9
Chart of interval notation
Please write description here

Page 11
Figure 2
Please write description here

Figure 3
Please write description here

Page 12
Figure 4
Please write description here

Activity 4 (b) (i)
Please write description here

Page 13
Activity 4 (b) (ii)
Please write description here

Subsection 1.2
Page 14
Figure 5
Please write description here

And so on ...

Unit 2
Section/Subsection 1.1
And so on ...
Appendix 2  Process for producing figure descriptions for production modules

For each unit,
- authors work in pairs;
- initially authors create and agree templates for commonly occurring diagrams or graphs to speed up production and ensure consistency;
- assign a primary author who creates the figure description, hands to secondary author;
- assign a secondary author who critiques the figure description, hands to primary author;
- primary author implements changes, and hands to MTAC (or other academic) to resolve any queries;
- MTAC hands to CM for handover to LTI;
- MTAC checks figure description on website.

It is recommended that both primary and secondary authors are awarded a minimum of 3 DL days per unit.