



## Foreword

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In July 2002 the published report of the Post-16 e-learning Task Force entitled Get on with IT stressed the important role that ICT has to play in post-16 education, recommending that the concept of Curriculum Online for Schools should be expanded into post-16 learning in the form of NLN Online.

The report defined e-learning as learning with the help of information and communications technology tools. These tools may include the Internet, intranets, wireless networking, PC (personal computer) based technologies, handheld computers, interactive TV and also the use of e-technology to support traditional delivery, for example, using electronic whiteboards and video conferencing.

*"E-learning should have a central role in an FE strategy; we believe that e-learning provides a flexible tool available to all colleges, companies and individuals that can lead to the achievement of consistent standards. If it is genuinely accessible to all, the Task Force believes e-learning can make a vital contribution to the achievement of the Government's learning targets."*

Extract from Get on with IT - the report of the Post-16 e-learning Strategy Task Force (published in July 2002).

The DfES identified three different elements necessary for the successful delivery of e-learning:

- Infrastructure - hardware and connectivity;
- Development of the skills required by both learners and teachers to embed the use of information and communication technologies effectively into their learning and teaching; and
- High quality content.

The NLN Materials Team based at Becta has been procuring and managing the creation of high-quality e-learning materials since the National Learning Network was first launched in 1999.

The working practices and methodologies developed and implemented by the NLN Materials Team in order to ensure that the e-learning materials for the NLN are of the highest quality possible are set out in this document. We hope this will lead the way in forming a set of national standards to ensure that materials of a consistently good quality are available for use in teaching and learning across all sectors.

### A note about terminology used in this document

This document has been produced at a time of change for the National Learning Network (NLN). In spring 2003 the Joint Implementation Group (JIG) produced its outline action plan for its post-16 e-Learning Strategy for England, which was approved by the Secretary of State. The NLN Transformation Board was then set up to take the NLN through the next phase of its existence. As a result, some of the terminology used within this document may change ('e-learning' will become more widely used than 'ILT' for example), however, the underlying principles will remain relevant.

## Background

### About the National Learning Network

The National Learning Network (NLN) is a national partnership programme designed to increase the uptake of Information and Learning Technology (ILT) across post-16 education in England.

The initiative began in 1999 with the aim of helping to transform post-16 education. To date, the Government's investment in the NLN totals £156 million over a five-year period. Established initially for the benefit of further education and sixth form colleges, the programme of work is now being rolled out to the wider post-16 education sector.

By supporting the NLN, the Government aims to promote the key objectives of its education agenda:

- Raising standards
- Widening access
- Improving employability
- Improving competitiveness for business

The NLN is an integrated strategy, building on key partnerships within the post-16 sector, which is providing a robust network infrastructure and a wide-ranging programme of support, information and advice, as well as the development of ILT materials for teaching and learning.

The organisations listed below are the key partners in the NLN:

- Becta
- JISC
- LSC
- LSDA
- NIACE
- DfES
- NILTA
- UKERNA

In spring 2003 the Joint Implementation Group (JIG) produced its outline action plan for its post-16 e-Learning Strategy for England, which was approved by the Secretary of State, and is supporting the work of Success for All and the Skills Strategy. The NLN Transformation Board was then set up to take the NLN through the next phase of its existence. Broadly, its remit is to:

- Provide strategic advice to the Learning and Skills Council (LSC), including advice on the use of funds, on e-learning and associated matters for the post-16 sector and to report regularly to the council;
- Oversee the implementation for the post-16 e-Learning strategy as detailed in the final action plan of the JIG, to reflect evolving needs of the whole post-16 sector in England, as directed by the DfES/LSC e-Learning Policy Steering Group.

For additional information about the National Learning Network and its partners please visit the NLN website at [\[www.nln.ac.uk\]](http://www.nln.ac.uk).

## Background

### About the NLN Materials Team

The NLN Materials Team based at Becta is at the forefront of procuring and managing the development of high-quality electronic learning materials.

Since the NLN programme first began in 1999, the NLN Materials Team has been responsible for commissioning and managing the development of over 800 hours of electronic learning materials across a wide range of subjects, working in partnership with subject matter experts in FE colleges and commercial developers.

Access to the learning materials is available through the NLN materials website at [\[www.nln.ac.uk/materials\]](http://www.nln.ac.uk/materials).

The team is not only responsible for the development of the material but also for its successful uptake and embedding into the curriculum. To this end a range of dissemination and implementation activities is co-ordinated and managed by the team (see page 41 for further details). The skill set of the team is therefore wide ranging and includes:

- Strategic leadership
- Project management
- Teaching and learning in the classroom and online
- Development of e-learning material
- Technical expertise (including IMS and SCORM)
- Website development and online databases
- Publishing and PR
- Administration

### About Becta

Becta (British Educational Communications and Technology Agency) is the Government's lead agency for ICT in education. It supports the UK Government and national organisations in the use and development of ICT in education to raise standards, widen access, improve skills and encourage effective management.

*Becta has five strategic objectives:*

- To provide leadership and expert advice to the UK Education Departments, their agencies and initiatives in support of their ICT policy development
- To provide and promote a comprehensive national source of practical advice and support to schools, colleges and education authorities
- To develop technical and educational standards for ICT use in education and provide information to users and policy makers on progress towards them
- To study the evolution of technology and evaluate and assess the educational use of both established and emerging technologies
- To continue to develop Becta as an effective customer-focused organisation with efficient systems and creative, expert staff.

## Developing standards for e-learning

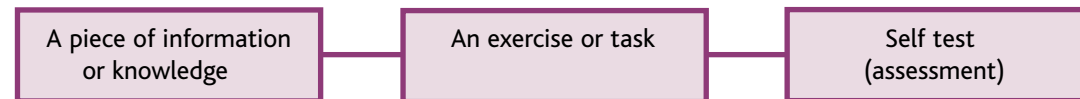
### Introduction

This document sets out the processes and procedures that the NLN Materials Team has developed and successfully implemented in order to manage the creation of highly engaging, interoperable and accessible learning materials.

In developing its standards and procedures for the NLN materials development programme the NLN Materials Team has drawn on best practice from across the industry and education.

### Format of materials

In response to the needs of FE tutors and learners the materials developed for the NLN programme have been created as 'learning objects' - short episodes or units of learning lasting around 10-20 minutes. Definitions of a 'learning object' abound but within this programme of work a learning object focuses on one or occasionally two learning objectives and comprises all of the following three elements:



These elements are used to develop a clear learning strategy but not necessarily in a linear format. The assessment component (typically a self-check) ensures that learning has actually taken place. Creating well-structured and stand alone learning objects offers far greater flexibility, allowing them to be embedded along with other resources into existing teaching and learning.

The NLN approach has not been to produce whole courses but to use the technology for topics that lend themselves to online learning. For instance, to enable visualisation of difficult concepts, simulate dangerous or expensive activities or experiments, encourage decision-making and problem solving, and stimulate discussion.

## Pedagogy

### Introduction

The pedagogic criteria for the NLN Materials are based on the constructivist approach to learning and map to Robert Gagnés Nine Steps of Instruction, which underpin our suppliers' instructional design.

These are:

- (1) gaining attention (reception)
- (2) informing learners of the objective (expectancy)
- (3) stimulating recall of prior learning (retrieval)
- (4) presenting the stimulus (selective perception)
- (5) providing learning guidance (semantic encoding)
- (6) eliciting performance (responding)
- (7) providing feedback (reinforcement)
- (8) assessing performance (retrieval)
- (9) enhancing retention and transfer (generalisation).

The interaction of the learner with the materials is one of the most significant factors affecting how the learner progresses and is considered central to the design of the NLN materials. The materials also enable differentiation in subject, level, learning styles, learning rates and access to learning. They also support students with special needs, as far as possible.

A great deal of research has gone into teaching and learning theories over the years. It is now recognised that learners learn in different ways and that by looking at different styles of learning tutors can maximise the learning potential of their students through making simple adjustments to their teaching style and lesson plans.

One theory of learning that is now being applied extensively in teaching and learning situations is that of Multiple Intelligences (MI Theory). Dr Howard Gardner, professor of education at Harvard University, developed the theory of multiple intelligences in 1983. It suggests that the traditional notion of intelligence, based on IQ testing, is far too limited. Initially Dr Gardner proposed seven different intelligences to account for a broader range of human potential in children and adults. This has since been revised in 1999 to reflect nine different intelligences; however most classroom based activity using Multiple Intelligences theory tends to focus on the first seven.

The NLN learning materials support the use of Multiple Intelligences theory in the classroom in a variety of ways and further information on using the NLN learning materials to meet the needs of different learning styles in a lesson are explored in the online resource commissioned by the NLN Materials Team entitled Using the NLN materials - a Practical Guide, which is available to use online on the NLN materials website at [[www.nln.ac.uk/materials](http://www.nln.ac.uk/materials)].

### The NLN Model

*The following pedagogic criteria are expected to be met within the design of the NLN materials:*

- the learning objectives should be clearly stated for the benefit of tutors and independent learners
- the content should take the learner from the known to the new learning in appropriately sized stages
- the content should follow a clear strategy to achieve learning, but need not be linear in design

- the content should help the learner to reflect on, review and digest new learning and not just regurgitate facts
- the content should demonstrate how new knowledge and skills can be applied to real problems
- the content should be accurate, valid, up-to-date and without errors
- the material should stimulate and motivate the learner
- the materials should include activities for the learner and keep the learner involved
- the design should stimulate responses from the learner
- the materials should provide a variety of strategies to accommodate different preferences in learning style
- the language should be appropriate for the target audience
- the materials should provide useful and supportive feedback based on the learners' responses
- media (eg video clips, sound files, animations) should be appropriate to the learning objectives and not be used gratuitously
- appropriate help facilities should be provided for the learner.

**In developing materials the design team must draw on:**

- knowledge of subject matter
- knowledge and understanding of the target audience
- knowledge of how the subject is taught
- subject experts to write content at a level appropriate to the target audience
- knowledge of students' problems in learning the subject
- ability to identify suitable topics and tasks for multimedia-based online learning
- feedback from potential users (both tutors and students)
- knowledge and understanding of issues relating to learning online.

### Public/Private partnerships

The NLN Materials Team has encouraged (and in some cases brokered) partnerships between commercial developers and FE colleges to achieve high quality in both content and design. This has created a powerful and highly successful strategy to combine design and technical expertise with the in-depth knowledge of the subject and how it is taught, as well as an understanding of learners and their needs.

### Examples of NLN partnerships

Commercial supplier	FE partner	Subject(s)
ACT e-learning	Newark and Sherwood College	Sports and Recreation
desq	Language Development Network, based at Shipley College	Communication in the Workplace
Epic	Sussex Downs College	English, Physics and Social Studies
theWorkshop	COLEG (Colleges Open Learning Exchange Group) and SFEU (Scottish Further Education Funding Unit)	Care, Childcare and Social Care

Frequent trialling of the learning materials throughout development is a mandatory requirement for all suppliers.

### Tutor Documentation

Detailed documentation for the tutor/learner support team is produced by the supplier to support the effective use of the materials. Detailed instructions are given to suppliers to assist them in putting together this documentation.

### The NLN Model - Structure of Tutor Documentation

1. Supplier and partners - background and approach *Include:*
  - brief details of the lead organisation and any partner organisations
  - details of the pedagogical and technical approach (ie why you have taken the approach you have).
2. Aims and objectives *Include:*
  - why topics were chosen for online learning
  - what benefit the materials bring to teaching the topic
  - details of subject(s) and level(s), the number of hours produced - a list of individual learning objects should be appended.
3. Target audience *Include:*
  - details of the age group the materials are designed for
  - the level of study and the environment the materials are aimed at (eg specific vocational contexts and details of any qualification mapping).
4. Overview of content *Include:*
  - a description of the content (more detailed than in the 'Aims and Objectives' section) and its structure
  - detailed description of the learning objects
  - description of help files etc
  - examples and screenshots would also be useful.

5. Orientation *Include:*

- screenshots of the home page showing main navigation buttons etc, trackers, 'how to' and 'help' sections (if not already covered elsewhere in this document)
- describe how to adjust audio, colours etc and navigate round each learning object
- describe any special features that have been included to improve usability (eg a Braille printable accessibility sheet).

6. Feedback *Include:*

- details of how feedback is given to users at various points; and
- how this could be used to assist in the learning process.

7. Using the product *Include:*

- methods of use - ideas and suggestions for use; comments on any anticipated outcomes; any ideas on follow-up work; ideas for integration with other curriculum area
- preparations for use - skills or knowledge prerequisites, technical instructions (installation requirements, launching etc)
- use in the curriculum - details of how the resource may be used by the tutors to maximise its potential (any specific mapping of individual learning objects against qualification requirements should be appended) and the level of user support required
- possible methods of customisation by the tutor - if the materials are designed so that they may be adapted or modified by the tutor, this section should detail how changes can be made.

8. Accessibility information *Include:*

- details of any specific accessibility guidelines adhered to, details of audio facilities available, use of screen readers, keyboard access etc.

9. Publication and copyright information *Include:*

- copyright information and details of sources for individual learning objects (where appropriate)
- acknowledgements and credits (if appropriate).

## Accessibility: Design

### Introduction

Standards for usability and accessibility are evolving all the time and, ultimately, with such diverse uses and users of the web, conflicts between the standards will be inevitable. Developers, however, are expected as far as possible, to comply with the NLN guidelines and standards to enable optimum accessibility to and usability of the materials that are developed. Potential learners will include those with physical, language or cognitive disabilities, and those who are blind or visually impaired and people who are hard of hearing or deaf. Some learners may have multiple disabilities.

*All NLN materials should:*

- Be Bobby approved. See [[www.cast.org/bobby/index.html](http://www.cast.org/bobby/index.html)].
- Conform to the W3C Web Content Accessibility Guidelines, 'Double A' minimum, 'Triple A' preferred [[www.w3.org/TR/WAI-WEBCONTENT/full-checklist.html](http://www.w3.org/TR/WAI-WEBCONTENT/full-checklist.html)].
- Recognise the working document IMS Guidelines for Developing Accessible Learning Applications [[www.imsglobal.org/accessibility/accwpv0p6/imsacc\\_wpv0p6.html](http://www.imsglobal.org/accessibility/accwpv0p6/imsacc_wpv0p6.html)].

*In particular, attention must be paid to the six principles for accessibility in online learning:*

- Allow for customisation based on user preference.
- Provide equivalent access to auditory and visual content based on user preference.
- Provide compatibility with assistive technologies and complete keyboard access.
- Provide context and orientation information.
- Follow IMS specification and other relevant specifications, standards and/or guidelines.
- Consider the use of XML.

### The NLN Model - Accessibility in design

#### Screen design

Screens should be uncluttered, and data and information should be ordered consistently, so as not to confuse students with learning difficulties. Developers should ensure that screen elements share similar appearance, location, and behaviour. The learner interface should be consistent throughout.

#### Colour

- Use appropriate colours that all individuals can recognise, taking into account colour blindness
- Use high-contrast colours such as white on a black background, so that the text is clear to the learner
- The use of more than five colours (including black and white) may be confusing
- Where possible, use strong shapes as well as colour, to help learners discriminate between objects/images.

## Other

- Use associated text labels with graphical images.
- Present the key information at the top of each page.
- Ensure all links and frames are identified/named logically and clearly - a blind person may navigate using these.
- Links to other pages or related resources need to be easy to find. Try to ensure that there are no more than three levels of menu before reaching the content. If links or resources are difficult to find then this will discourage learners, de-motivate them and they may lose their way. Ensure that the most used links come first so that if learners are using the tab key they will meet these first.
- Limit the number of links per page to about 20. Make sure there is space between the links.
- Try to minimise the number of hypertext links that appear in a single line of text. In preference to this use vertical lists of links.
- Menu options should be self-explanatory and limited in number.
- The material should be broken down so that between five and nine points are made at a time. This will avoid information overload and ensure that the learner can access the materials in bite-size chunks. Lengthy sections should be broken down into chunks and paragraphs should be kept short. Bulleted and numbered lists should be used rather than lists in prose.
- Label graphical images with text.
- Icons should be clearly visible and named logically and clearly. The user should be able to customise them.
- Try to avoid using text as a bitmapped image - screen readers cannot read the text contained in images.
- Any interactive content that requires the learner to press a key should not be time limited.
- Animations that use text should show the text long enough for a slow reader to read it. Essentially, this should be under learner control. Learner control should also be available for selection of sound and its alternative representation.
- Document metatags should be used to improve searching. Ensure the search facility is forgiving in terms of spelling.
- In order to ensure that version control is kept up to date, and so that a record of changes made can be kept, each new version of the learning material software prior to the final 'release' version must display the date, version number and the date it was created. This information should be clearly displayed on the first available screen, along with any copyright message.

## Text format

Text should be a mixture of upper and lower case letters and should be left aligned with a ragged right edge. The length of a line of text should be between eight and twelve words maximum (8 words if using 14 pt size). The screen should not be more than half full of text. Do not specify the text in pixels as it is difficult to magnify - use absolute references to text size.

### **Potential problems that should be avoided include:**

- Italic text - some learners may find this difficult to read.
- Try to ensure that the text is not too small or too large. The clarity and legibility of information depends upon the visual contrast between fonts, text blocks, headlines and surrounding white space.
- Underlining text - this is also difficult to read and some learners may think the text is a hyperlink.
- Tables for formatting, because the cell contents may be presented in a wrong or misleading order. Tables to control text width may not work if a larger (or smaller) font is selected; it is generally better to let the learner control the window size.

- Flashing text - especially for dyslexic and epileptic learners. It is recommended that neither animated nor moving graphics are used, unless the animation is necessary to illustrate important information, such as animation demonstrating how a machine works. It is best to place the animation on a different page, or to set it up to start only when activated by a mouse click or keystroke.
- Upper case text should be avoided, even in headings because it is not accessible to all groups of learners. Unnecessary capitalisation should be avoided. The minimum size of character to be used for body text should be appropriate to the display resolution.

### **Other considerations include:**

- The size of text and graphics affects usability as well as accessibility. For those with visual impairments, magnification can make the difference between being able or unable to use the application.
- Where multimedia is used, displaying more than three rows of text at once may prove impractical, as the viewer may have difficulty reading the captions and keeping up with the video.
- There needs to be an easy-to-use facility to print, copy and save the desired portion of text (as a text file - not html) or a picture.
- Provide information for learners to change their default settings.

Information about changing your browser settings to increase legibility can be found on the following website - [[www.lighthouse.org/text\\_only/t\\_about\\_browser.htm](http://www.lighthouse.org/text_only/t_about_browser.htm)].

## Navigation

- There must be keyboard access for all menus, controls and buttons, in the form of single key. Note that these may already exist in an application and any additional keystrokes should be consistent and compatible.
- Some learners using a screen reader will navigate via links and frames lists - make sure links and frames are labeled logically and meaningfully.
- Pages should be broken down into meaningful self-contained segments, which do not overflow onto the next page; this will enable the learner to absorb the information contained in the segment before progressing.
- Units should be structured into small elements in order that learners can easily leave and return to the current point, using a book-marking facility or a system of menus.
- Buttons or keystrokes should be provided for ease of navigation to allow the learner to exit the current section, move upwards within a hierarchy of menus and, from the top level, to exit the material. It should be difficult for the learner to close the application down accidentally (by exiting a current section) - there should be a logging off procedure.
- The learner should have access via buttons or keystrokes to help and/or hints on the materials and technical issues.
- The learner should be provided with the facility to play, pause, stop and restart any audio or video associated with the current screen, to ensure that they can control their own speed of progress through the material.
- Progress indicators (breadcrumbs) should be located at the top of the screen. A progress bar shows the learner how far through the material he or she is. Learners should know where they are within the package at all times.
- All buttons should be located in the same position on all screens for ease of navigation.
- The Back button allows learners to review screens that have already been viewed by moving backwards through the material, screen by screen. It is also used to enable learners to have another attempt at the tutorial questions.
- The Menu will take the learner directly from any tutorial screen to the menu screen.

- Where the material has more than one menu, this button will take the learner back to the previous menu in the hierarchy. Avoid rollovers for navigation - this may be impossible for those with motor difficulties or those using keystrokes.
- A Test button may be included within the learning material to allow the learner to move directly to the assessment.
- Avoid colour-dependent navigation, with instructions such as 'Click on the Green button'.
- Where larger buttons are used, the amount of screen space available for the learning material is reduced. It is often a good idea to use different versions of buttons: 'available' (out), 'selected' (in), and 'unavailable' (greyed out).

## Titles

- Titles or headings ensure that users always know where they are within the package.
- Choose a suitable point size for headings that is clear but not too imposing.
- Do not crowd the screen with too many headings.

*The learner should also be provided with an introduction to the learning material - possibly through the use of an introduction screen, to include at least the following:*

- the purpose of the material
- who the material is aimed at
- any prerequisites
- learning objectives
- the structure of the material
- how to get the best from the material
- how to report any problems
- a full list of included materials
- estimated required study time
- estimated elapsed time required to complete the material
- any materials (books, software, etc) to be supplied by the learner.

## Menus and sign posting

- No more than three menu depths should be used, to avoid complexity.
- 'Completed', 'started' and 'not started' flags should be used on menu screens. An instructional prompt should be included on menu screens.
- The learner should be reminded when required to click on the Menu button.

## Use of graphics

It is important to remember that graphical images should be used for instructional, motivational, or attention-focusing effects, and not simply for the sake of including them on the screen. Every item on the screen should earn its place. Graphics should be crisp and clear. When graphics are used there should be a text alternative to the image.

## Multimedia mix

- Sound and video should be used with caution and only when they aid understanding.
- Video and audio tracks can be used, and multiple text tracks may be included within the clip. Multimedia materials can also be used to overcome problems of accessibility, particularly for use by students with special educational needs.
- Learners who are deaf and hard of hearing can benefit from the use of captioned movie clips in learning materials. Deaf students/tutors can view captioned clips and follow the soundtrack visually rather than aurally. For maximum accessibility transcripts should always be used in conjunction with audio-only clips.
- Many people who have special needs cannot download, use or access plug-ins easily.
- Where an applet is used to play a video clip, a text description should be provided.
- Fully accessible courseware will have an auditory and visual impact.
- Try to ensure that at the specified minimum bandwidth there is a delay of no more than ten seconds in the loading of an image or animation. Audio effects should be free from extraneous noise, such as unnecessary hiss and page turns etc, which can be distracting to some groups of learners.
- Macromedia Flash - the next version will include some accessibility features [[www.macromedia.com/macromedia/accessibility/](http://www.macromedia.com/macromedia/accessibility/)].
- The following site has some examples of accessible media rich materials - [<http://ncam.wgbh.org/richmedia/showcase.html>].

## Assessments and activities

This is an area where many learners are often excluded due to inappropriate design. The following suggestions will help to make the material more inclusive:

- Drag-and-drop should be usable by mouse or keyboard.
- Multiple choice questions can be difficult for learners to engage with. Avoid too much scrolling – it may be appropriate to open a new window for each question.
- Ensure different sources of information are available separately.
- Avoid information that is available only in graphic format, eg a pie chart.
- Provide alternative activities, for example it would be inappropriate to ask a blind person or someone with a motor disability to draw a spider diagram. However, remember that equivalent access is preferable to alternative access.

Remember the above are only notes. Please refer to standards and guidelines and test your learning material with all groups of learners.

## Accessibility: Technical requirements

All e-learning materials accepted by the NLN Materials Team for the National Learning Network are required to meet the following guidelines as appropriate, to ensure they are as accessible and usable to as many learners as possible. The guidelines were developed in conjunction with the Royal National College, Hereford and Techdis.

### The NLN Model - Technical Accessibility Standards

#### 1. Standards

- 1.1. Conform to the W3C Web Content Accessibility Guidelines, 'Double A' minimum, 'Triple A' preferred [[www.w3.org/TR/WAI-WEBCONTENT/full-checklist.html](http://www.w3.org/TR/WAI-WEBCONTENT/full-checklist.html)].
- 1.2. Comply with WAI guidelines for CSS, XML or any media for the creation of material - see [[www.w3.org/WAI/](http://www.w3.org/WAI/)].
- 1.3. Validation of materials should be carried out by a variety of methods including:
  - 1.3.1. HTML WC3 (Strict) or similar e.g. XHTML. Style sheets [<http://jigsaw.w3.org/css-validator/>].
  - 1.3.2. A range of other appropriate tools such as the Wave, A-prompt, Lift (detailed list available at: [[www.science.plym.ac.uk/warp/eval/evaluationtools.html](http://www.science.plym.ac.uk/warp/eval/evaluationtools.html)]).
- 1.4. Provide an Accessibility statement in HTML (or clear link to) at the beginning of the learning unit.

#### 2. System settings

- 2.1. The material must not interfere with any existing accessibility features built into the operating system.
- 2.2. The material must allow the use of specialist assistive software such as screen readers and voice recognition.

#### 3. User preferences

- 3.1. Allow users to customise, based on preference.
- 3.2. Allow the user's browser to override the CSS presentation of fonts, colours and text size.
- 3.3. Provide equivalent access to auditory and visual content based on user preference.
- 3.4. Try to use appropriate colours that all individuals can recognise, taking into account colour blindness.
- 3.5. Provide information for learners to change their default settings.
- 3.6. The user must be able to override default fonts for printing and text display.
- 3.7. The user must be able to adjust or disable flashing, rotating, or moving text to the extent that it does not interfere with the use of the material.
- 3.8. Colours that are more accessible for dyslexic users, such as light pastels for backgrounds, should be provided, avoid pure white. See [[www.techdis.ac.uk/](http://www.techdis.ac.uk/)] for further information.

#### 4. File formats

- 4.1. Make downloadable documents (that will need editing by the user) available in Rich Text Format (RTF).

- 4.2. Where downloadable documents are in PDF format an additional RTF download should be offered as PDF documents present accessibility difficulties.

#### 5. Screen design

##### 5.1. Text:

- 5.1.1. Keep overall information density to less than 50 percent of the screen area.
- 5.1.2. Use headings consistently by the use of text formatting (or heading levels).
- 5.1.3. Use a Sans-Serif font (e.g. Arial, Verdana etc.) to increase readability.
- 5.1.4. Textual content should not be contained within bitmap graphics. Screen readers cannot read the text contained in images. These are also bad for screen magnifiers as text becomes pixelated.
- 5.1.5. Painted or graphic text is not accessible; provide standard system text for all text elements.

##### 5.2. Use frames carefully. Frames can cause accessibility difficulties if not used in line with the guidance available above.

##### 5.3. When using disjointed rollovers consider the cognitive burden associated with the effect of the spatial visualisation and visual-motor co-ordination. Therefore avoid continuous changes in the users visual focus (from action to result).

##### 5.4. Icons:

- 5.4.1. All icons must have text labels associated or the material must allow the user to select text only buttons.
- 5.4.2. Icon use must be consistent throughout the material.
- 5.4.3. Pull-down menu equivalents must be provided for all icon functions.
- 5.4.4. All buttons should be located in the same position on all screens for ease of navigation (refer to the NLN advice document).

##### 5.5. Keyboard access to pull-down menus must be provided.

##### 5.6. Graphics and Colours:

- 5.6.1. Patterned backgrounds must not be used behind text or important graphics.
- 5.6.2. Label graphical images with text (see below for use of Alt Text and Longdesc).

#### 6. Navigation

- 6.1. Ensure ALL textual hyperlinks are underlined.
- 6.2. Ensure all links and frames are identified/named logically and clearly - a blind person may navigate using these.
- 6.3. Menu options should be self-explanatory and limited in number.
- 6.4. There should be an easy-to-use facility to print, copy and save the desired portion of text (as a text file - not html) or a picture.
- 6.5. Avoid colour-dependent navigation, with instructions such as 'click on the green button'.
- 6.6. Keyboard Navigation:
  - 6.6.1. Provide compatibility with assistive technologies and complete keyboard access.
  - 6.6.2. Provide keyboard equivalent commands for all functions of the material.



- 6.6.3. All actions that are required or provided by the material must be accessible by keystrokes. This includes, but is not limited to, mouse actions, buttons, scroll windows, text entry fields and pop-up menus.
- 6.6.4. Clear and precise instructions for the use of the keyboard equivalents must be provided as part of the user documentation.
- 6.6.5. The use of keystrokes must be logically progressive, (ie down arrow followed by the enter key).
- 6.6.6. The material must provide a logical tabbing order between text entry fields.

## 7. Assessment

- 7.1. Timed response should be avoided. However, if timed response is required, the user/tutor should be able to modify the timing parameters.

## 8. Use of rich media

- 8.1. Video and animation:
  - 8.1.1. All relevant video and animation must have an alternative description.
  - 8.1.2. Where sound accompanies a video this should be captioned.
  - 8.1.3. Video and animation should avoid strobe and flashing effects.
- 8.2. Sounds:
  - 8.2.1. A visual equivalent must be provided for all audio alerts.
  - 8.2.2. Existing operating system sound features must be supported.
  - 8.2.3. The user must be able to disable or adjust sound volume.
  - 8.2.4. Any information that is presented in an audio format must also allow the user to access a real-time text description.
  - 8.2.5. Do not automatically play audio files, give the user control of playback and do not make audio files the main content delivery method.
  - 8.2.6. If an audio track is provided the user should have the ability to turn it off.
- 8.3. Running audio and video should not interfere with the user's ability to navigate the learning object.

## 9. Documentation requirements

- 9.1. Documentation should include a statement about the areas of disability supported in the learning material and to what level. If it has been impossible to provide an accessible alternative, an explanation must be provided. For each area of disability there should be a list of the specific functions and tools enabled - eg motor difficulties elements such as keyboard navigation would be listed, whereas under visual impairment the list of screen readers the materials have been tested against should be listed.
 

The four areas of disability described by Techdis are:

  - Hearing Impairment
  - Visual Impairment
  - Physical Disability
  - Dyslexia
- 9.2. A description of all common navigation metaphors used (i.e. More, Next, Expand, Play). These should correspond exactly to any audio/text descriptions used for this navigation type in the learning materials.

- 9.3. A description of how to create additional learning aids for use with students with disabilities from the learning materials, and how these can be incorporated into the teaching using the learning materials. Examples could be keyboard overlays, tactile drawings etc.

## Common interactivity types - suggested alternatives

When considering the navigation and handling of interactivity it is useful to use Common Activities as identified by question and text interoperability specification (QTI) as the starting point. They identify five common question types with a number of subtypes:

- 1) Logical Identifier
- 2) Connect-the-Points
- 3) String
- 4) Numerical
- 5) Logical Group

Each of these question types, with the exception of Logical Group, has image and text subtype.

- ▶ 1) **Logical Identifier**  
*The purpose of the logical identifier type is to identify the truth of a given statement.*
  - (a) **Standard True/False (Text)**  
*Should be relatively easy to display in an accessible way, a standard alternative is probably not needed.*
  - (b) **Standard Multiple Choice (Text)**  
*Should be relatively easy to display in an accessible way, a standard alternative is probably not needed.*
  - (c) **Standard Multiple Choice (Images)**  
*Depends on the purpose of the assessment and an underlying text element should be considered where appropriate for blind and partially sighted users.*
  - (d) **Standard Multiple Choice (Audio)**  
*Depends on the purpose of the assessment and an underlying text element should be considered where appropriate for deaf and hard of hearing users.*
  - (e) **Standard Multiple Response (Text)**  
*Should be relatively easy to display in an accessible way, a standard alternative is probably not needed.*
  - (f) **Multiple Choice with Image Hot Spot Rendering**  
*Depends on the purpose of the assessment and an underlying text element should be considered where appropriate for blind and partially sighted users.*
  - (g) **Multiple Response with Multiple Image Hot Spot Rendering**  
*Depends on the purpose of the assessment and an underlying text element should be considered where appropriate for blind and partially sighted users.*
  - (h) **Multiple Choice with Slider Rendering**  
*The navigation of a slider control could be controlled using + and - keys to move the slider backwards or forwards.*
  - (i) **Standard Order Objects (Text)**  
*The ordering is the key part of this exercise and can be represented by providing a number of numbered ordered (either visible or hidden) boxes into which the answers can be typed.*
  - (j) **Standard Order Objects (Image)**  
*Depends on the purpose of the assessment and an underlying text element as described above should be considered where appropriate for blind and partially sighted users.*

## ▶ 2) Connect-the-Points

The purpose of connecting the points, as described in the QTI Best Practice document [www.imsglobal.org/question/qtiv1p2/imsqti\_asi\_bestv1p2.html], is to identify a pattern, either a visual pattern or a pattern of numbers. Connect-the-points depends on purpose, if the purpose is to show spatial awareness or to identify shapes then alternatives may not be possible. If the purpose is to show a pattern of numbers, such as a line of best fit then this can be described with a none visual alternative.

If a non-visual pattern (ie a statistical pattern) is being represented then a method for describing that pattern should be provided. So a number field could be used to input the ratio of the line of best fit or the student could move a line of best fit up or down along the axis using X and Y or + and -.

Connect-the-points could also theoretically be used to describe logical grouping which is covered under drag-and-drop.

## ▶ 3) String

- (a) Standard Fill-in-Blank (Text)
- (b) Standard Multiple Fill-in-Blank (Text)
- (c) Standard Short Answer

These should all be relatively easy to display in an accessible way, a standard alternative is probably not needed.

## ▶ 4) Numerical

- (a) Standard Fill-in-Blank (Decimal)
- (b) Standard Fill-in-Blank (Integer)  
*These should be relatively easy to display in an accessible way, a standard alternative is probably not needed.*
- (c) Numerical Entry with Slider  
*The navigation of a slider control could be controlled using + and - keys to move the slider backwards or forwards.*

## ▶ 5) Logical Group

- (a) Drag-and-Drop (Images)  
*Drag-and-drop can be used to display a number of different exercises including ordering, logical grouping  $a=1$   $b=2$   $c=3$  etc and image and geo-spatial comparison (ie build a map of Europe). For logical grouping this can be rendered with a text alternative using copy and paste to replicate drag-and-drop for keyboard users.*

## Key interactions

A number of key interactivity types can be identified from the question types listed above. These include sorting and grouping, increasing and decreasing along a scale, selecting items, entering text and identifying patterns. Most of these interactions can be rendered with accessible alternatives where the nature of the context allows it. For the most part these interactions can be represented with good text descriptions. However, with some interactions such as ordering, thought should be given to how the ordering can be presented for keyboard navigation.

## Ordering

Present standard order as an ordered series of filling in the blanks or providing a list which can be reordered by either:

- (1) Selecting the ordered item and entering its place in the order eg Tuesday = 2  
Wednesday = 3.
- (2) Selecting the ordered item and using + and - keys to move the item either up or down in the order.

## Moving along a scale

+ and - could be used to increase or decrease one place on the scale. So, for example in a simulation of a sound wave, + could be used to increase the wavelength and - to decrease it.

## Common navigation types

The need for common navigation metaphors applies only to interactive multimedia objects embedded within HTML pages. This is caused by the HTML page intercepting keystrokes before the embedded simulation / multimedia object. For example using the TAB key will move between objects on an HTML page rather than between fields within a Flash or Shockwave object. We therefore suggest three standard alternatives for moving between fields and objects within a multimedia object.

### Key Navigation

ctrl + right - 'tab' forwards to the next input field or element within the simulation.  
ctrl + left - 'tab' back to the previous input field or element within the simulation.  
ctrl + down - select the currently highlighted input option.

## Technical - interoperability

### Introduction

The NLN Materials Team expects all suppliers to work to 'open standards' to enable interoperability and sharing of materials as it is necessary for the materials produced for the NLN to interact with other packages including virtual learning environments (VLEs). The equipment required to run the learning materials must reflect the specification outlined in our Technical Guidelines. To enable interoperability, materials must conform to industry specifications also outlined in our Technical Guidelines.

Since the NLN materials produced to date have been developed for Further Education, they have been designed to run within a standards compliant VLE to meet the needs of colleges. It is the VLE and not the content that provides progress tracking, bookmarking, navigation, a notepad, print option, and a calculator.

The following technical guidelines for developers of web-based materials have been produced in order to ensure that all content developed conforms to the current industry specifications and standards, enabling learning materials and course management systems from different vendors to work together seamlessly.

### The NLN Model - Technical Guidelines

#### General

- Materials must be free of run-time software licences, and compatible with Internet Explorer and Netscape browsers version Level 4 and above.
- The learning materials must take a consistent approach to layout and interaction but the NLN Materials Team does not require a standard NLN look and feel to the design and does not issue screen templates.
- All content should be portable across different client and server platforms, client and server versions of operating systems and client web browsers, in order to ensure cost effectiveness, avoid duplication and minimise development time.
- It should run with the same behaviour in all environments, have a consistent user interface, and must interact with a range of management systems which manage the delivery of the materials to the learner, administers learning content, reports on, and provides facilities for, the tracking of the learner's progress for the benefit of the student and the instructor.
- Content should not allow any server side scripts or executables to be run (eg Java servlets) or meta file formats that require additional server side functionality.
- Learning material design should conform to the Institute for IT Training's Standards for E-Learning Materials, details of which can be found on the IITT's web-site at [[www.iitt.org.uk/public/standards/e-learningmatsstand.asp](http://www.iitt.org.uk/public/standards/e-learningmatsstand.asp)].
- Developers need to be aware that the JISC Committee for Integrated Environments for Learners (JCIEL) MLE Steering Group has developed a technical specification for Managed Learning Environments. Further information and relevant documentation is available at [[www.jisc.ac.uk/jciel/mlsg/](http://www.jisc.ac.uk/jciel/mlsg/)].
- Where suppliers already market a type of MLE/VLE, it is vital that they recognise the need for materials developed under contract to stand free of this environment.

### Learning content interaction

- Content must be accessible through the use of metadata standards for identifying and locating it, and durable across different versions of operating systems, browsers, and other supporting systems software.
- A unit of content (learning object) will consist of one or a couple of closely related learning objectives with appropriate instructional content, and contain a means for assessing that the learning objective has been met.
- It should be tagged with metadata in the content package to identify attributes such as subject, level, owner, terms of distribution. IMS Metadata tags will ensure that content is accessible through search facilities employed by the Internet.
- Content should be broken down into logical sections that are exposed to VLE navigation through correct content packaging, using IMS Content Packaging specification.

### Standards and specifications to be adopted

- When developing materials for the National Learning Network, developers are required to recognise emerging standards in their learning materials development. There are several major bodies currently developing specifications, which are expected to be submitted to the IEEE Learning Technology Standards Committee [<http://ltsc.ieee.org/index.html>] for approval as standards.
- The Advanced Distributed Learning (ADL) initiative [[www.adlnet.org/](http://www.adlnet.org/)] is accelerating the development of e-learning specifications from leading contributors. ADL has developed a common framework in which the efforts of the other players fit. This framework is called the Shareable Content Object Reference Model (SCORM). Version 1.2 of SCORM is available in the early period of the contracts and developers are expected to adopt the specification in the development of materials.
- The US-based IMS Global Learning Consortium [[www.imsglobal.org/index.html](http://www.imsglobal.org/index.html)], with contributing members from academic, corporate, non-profit, and government organisations, is one of the most prominent contributors. They have been collaborating closely with the following bodies on various projects, to ensure that IMS specifications have a high level of applicability across global learning domains:
  - US Aviation Industry CBT Committee (AICC) [[www.aicc.org/](http://www.aicc.org/)]
  - ARIADNE consortium [[www.ariadne.unil.ch](http://www.ariadne.unil.ch)]
  - Dublin Core [[www.dublincore.org](http://www.dublincore.org)]
  - European Committee for Standardization/Information Society Standardization System (CEN/ISSS) [[www.cenorm.be/iss/](http://www.cenorm.be/iss/)].

### Run-time data passing

- Where virtual learning environments are present learning objects are expected to communicate with them. This communication should be carried out using the SCORM runtime API model. Documentation of the SCORM API data model is available at [[www.adlnet.org/](http://www.adlnet.org/)]. The NLN materials require that a minimum function set is supported equivalent to SCORM RTE1.2 level 1 content conformance.

### Sequencing

- Proposals concerning a specification for sequencing are in development. Sequencing is a function of the virtual learning environment but requires learning objects to be appropriately segmented and to pass scoring information and a pass level where appropriate. Learning objects should be developed to enable sequencing. This means that learning objects contain a 'pass level' in the metadata and allow for score information to be passed back to the VLE.

## Metadata

- The standard for metadata is expected to be based on the IEEE P1484.12 Learning Objects Metadata (LOM) standard. The metadata standards focus on the minimal set of attributes needed to allow learning objects to be managed, located, and evaluated. Relevant attributes of learning objects include type of object, author, owner, terms of distribution, and format.
- Where applicable, learning object metadata should also include pedagogical attributes, such as teaching or interaction style, grade level, mastery level, and prerequisites. It is possible for any given learning object to have more than one set of learning object metadata. Documentation for the IEEE P1484.12 LOM metadata standard is available at [[www.ltsc.ieee.org/wg12/index.html](http://www.ltsc.ieee.org/wg12/index.html)].
- The NLN materials require a minimum data set to be supported, these requirements can be found at [[www.nln.ac.uk/materials/technical/](http://www.nln.ac.uk/materials/technical/)]. This should be combined with a subject area classification for learning materials. The NLN materials are classified according to the LearnDirect classification system and this taxonomy is available at [[www.nln.ac.uk/materials/technical/](http://www.nln.ac.uk/materials/technical/)] but other content regimes such as Curriculum Online require different classification systems.

## Content packaging

- The IMS Content Packaging specification has now been adopted by the e-GIF (e-Government Interoperability Framework) as recommended best practice. The objective of this specification is to define a standardised set of structures that can be used to exchange content. These structures provide the basis for standardised data bindings that allow software developers and implementers to create instructional materials that inter-operate across authoring tools, managed learning systems and run-time environments that have been developed independently by various software developers.
- The following documentation for the IMS Content Packaging Specification Version 1.1 is available at [[www.imsproject.org/content/packaging/index.html](http://www.imsproject.org/content/packaging/index.html)]:
  - Best Practice Guide
  - Information Model
  - XML Binding specification
- It is essential that content packages developed within the project are consistent in their structure and language. To this end we recommend that a single content packaging tool is used across the project. This ensures that any errors in content packaging need to be altered in only one location, increasing the speed of bug fixes.

## Question & test interoperability

- This specification addresses the need to be able to share test items and other assessment tools across different systems. It describes the data structures that are used to provide interoperability between internet-based question and test systems. The key data structures are those of:
  - Assessment - the basic test unit.
  - Section - a container for groups of sections and items which support a common objective.
  - Item - the fundamental self-contained question/response block within which the individual questions are contained.
- The principle aim of the specification is to allow users to import and export their question (termed Items and grouped in Sections) and test (termed Assessments and containing Sections) materials. The following documentation for IMS Question & Test Interoperability Specification Version 1.2 is available at [[www.imsproject.org/question/index.html](http://www.imsproject.org/question/index.html)]:
  - IMS QTI Information Model
  - IMS QTI XML Binding Specification
  - IMS QTI Best Practices and Implementation Guide.
- If separate question banks are to be created then these should be supplied in QTI format.

## Data integration and presentation

XML (Extensible Mark-up Language) and XSL (Extensible Stylesheet Language) must be used for the presentation of data available for reference by other software systems, and must comply with the recommendations of the World Wide Web Consortium (W3C). The use of any product specific XML extensions that are not being considered for open standardisation with the W3C must be avoided.

## Minimum learner machine specification

Listed below is the specification for which all learning material must be designed. Screen resolution should be 800 x 600, and whenever a page is designed to be printed from the learning material package it must print onto standard A4.

Developers must demonstrate that they have taken into account equipment availability in FE Colleges. Further details can be found in Becta's report to the FE ILT Committee of their survey into Information and Learning Technology provision in FE Colleges in England, at: [[www.ferl.becta.org.uk/display.cfm?page=13&resID=1978.htm](http://www.ferl.becta.org.uk/display.cfm?page=13&resID=1978.htm)]. Please note that only 5% of the installed base of machines in the FE Colleges surveyed were Apple Mac computers and that Macs are often associated with particular subject areas such as Art and Design.

### PC

CPU: Pentium 233 MHz  
RAM: 32 Mbytes  
HD with 100 Mbytes of free space  
CD drive: 24x speed  
Sound card (16 bit)  
Speakers or Headphones  
SVGA Graphics card, 16 bit colour  
Keyboard  
Mouse (Microsoft compatible)  
Operating system: Windows 95 or later  
Web-enabled using a Level 4 browser  
Web connectivity via a 56 kbps modem or a network

### Mac/iMac

CPU: Mac 604e processor 200 MHz; iMac G3 processor 233 Mhz  
RAM: 32 Mbytes  
HD with 100 Mbytes of free space  
CD drive: 24x speed  
Speakers or Headphones  
SVGA Graphics card, 16 bit colour  
Keyboard & Mouse  
Operating system: Mac OS 7.6 or later  
Web-enabled using a Level 4 browser  
Web connectivity via a 56kbps modem or a network  
Recommended Web plug-ins (all Mac/PC)  
Macromedia Shockwave Player version 8 [[www.macromedia.com](http://www.macromedia.com)]  
Macromedia Flash Player version 6  
Macromedia Authorware Web Player (Authorware 5.1 only)  
Quicktime 6

## Development and delivery issues

Content should be designed within a broad guideline of a maximum of 25 MBytes per hour of estimated delivery.

## Downloading screen

Whenever possible there should only be a sub-second response time for downloading screens and the learner should never have to wait more than 30 seconds for any file to download. If a screen is going to take more than one second to download, then a splash 'Downloading' screen needs to appear stating 'Please wait. Loading...'. If a developer needs to exceed these limits then they must enter into discussions with the NLN Materials Team.

## File names

All file names should be in lower case only. Each learning object should have a unique file path, so no two learning objects created should have the same filename and path. Spaces should not be used in file or directory names, spaces should be replaced by an underscore \_.

## File size limits

The table below outlines the recommended file size limits. If developers wish to exceed these limits then this must be done in consultation with the NLN Materials Team. Loading times can vary enormously according to different factors, so developers are reminded to be economical with file sizes. Developers should keep as far as possible to the recommended maximum single file limits outlined below.

## Streaming files

Streaming files such as video, audio, animation, must stream at an acceptable rate on 56k modem. All streaming media must have multiple data rates to stream on modems and must not have a delay of more than 8 seconds for buffering, eg Surestream.

Data type (PC and Mac compatible)	Recommended single file size	Max single file size	Desired file format	Customer plug-in requirements
Flat/Static Images	15k	45k	.GIF/.JPG	N/A
Image Maps (client side)	35k	50k	.GIF	N/A
Animation Download	15k	45k	.GIF(GIF89a)or Flash	N/A or Flash
Animation Streamed	120k	150k	SWF	Flash/Shockwave
Video Download	50k	100k	.MOV/.AVI	QuickTime
Video Streamed	120k	N/A	.MOV/	QuickTime
Audio Download	35k	90k	.MOV/.WAV/.MP3	N/A
Audio Streamed	120k	N/A	.MOV/.MP3 (MPEG 1, Layer 3)	Shockwave-Flash/ Quicktime

## Use of Flash and Shockwave

Flash and Shockwave may be used to provide interaction and simulations within a learning object, but may not be the primary delivery format for the learning object. Browser compatibility issues with Javascript and Flash/Shockwave mean that Flash and Shockwave cannot reliably be used to pass SCORM API information. All SCORM API calls must therefore be sent from an HTML/DHTML object and not a Flash/Shockwave object or other proprietary plug-in.

## Usability and accessibility

Standards for usability and accessibility are evolving all the time and with such diverse uses and users of the web, conflicts between the standards will be inevitable. Materials developers should, as far as possible, comply with the following guidelines and standards, in order to produce effective materials which are accessible to all students irrespective of academic or physical abilities.

ADL, through its co-laboratories, are producing a set of guidelines for the development and evaluation of effective web-based learning materials. It cites recognised participants in this arena including many useful references [[www.jointadlcolab.uwsa.edu/lo/index.htm](http://www.jointadlcolab.uwsa.edu/lo/index.htm)].

## General

It is expected that all NLN materials will be designed to make things convenient for learners with no disabilities and make things possible for those with disabilities. The materials should also be usable by learners with learning difficulties. Suppliers should also consider including positive images of learners with disabilities.

All materials must conform to the accessibility guidelines laid out in the NLN Accessibility Requirements document.

## Quality assurance

### Introduction

The NLN Materials Team has put in place rigorous quality controls to ensure the materials are of high quality, meet all guidelines, and are fit for purpose. These controls include close management of the projects, prototype development, technical and accessibility testing, and regular end-user reviews.

### 1 Project management

**Prince2** project management methodology has been adopted by the NLN Materials Team to monitor closely the progress of all NLN materials development projects. A Project Initiation Document (PID) is produced at the start of the project that outlines every aspect of the project including a list of identified risks and their countermeasures. The projects are broken down into stages (approximately 5 in total) and plans are drawn up detailing the activities, resources, milestones and deliverables for each stage. Each project is also overseen by a Project Board, and the full programme of development is monitored by a high-level Programme Board. Each supplier has a quality assurance officer who reports to the Project Board.

An NLN Project Support Officer works with each supplier on a day-to-day basis supporting and monitoring their progress. An NLN Project Manager oversees the progress of all the suppliers through regular meetings and the organisation of quarterly Supplier Forums. Once the selection and competition period is completed the NLN suppliers meet together on a regular basis to share ideas, discuss pertinent issues and look for collaborative solutions, even acting as critical friends.

### 2 Prototype

A **fully functional** prototype is produced by each supplier within the first four months of the project. This will reveal any potential technical problems and 'look and feel' conflicts early on in the development process. The purpose of the functional prototype is to demonstrate how each element will function and how the user will interact with the material. The prototype also demonstrates the proposed interface, functionality and screen layout. The prototype is tested with as many end-users as possible, and if appropriate, their feedback is used to develop a further prototype or even as a prompt to return to the drawing board.

### 3 Technical testing

Rigorous technical testing is undertaken by an external test house at the prototype stage. A test plan has been developed based on the NLN technical specifications, which cover:

- Content
- Functionality
- Cross-compatibility
- Compliance to NLN brand guidelines
- Web compliance for people with disabilities

**Testing for accessibility** is done under contract by the Royal National College, Hereford. Suppliers are encouraged to visit the college at the scoping stage prior to prototype development. Accessibility testing is also done at Alpha and Beta development stages.

Final testing of content and build at Gold stage is the responsibility of the supplier, who must complete detailed technical checklists for submission to the NLN Materials Team.

## 4 Reviews and user trialling

At each stage of the development, commencing with the scoping and design document, reviews and trials are undertaken by the suppliers.

The various types and processes for trialling are planned at project initiation and form part of the Project Initiation Document. A member of the Project Team is assigned responsibility for the trialling and liaises with all the trial sites. A member of the NLN Materials Team attends a selection of trials and also attends the review meeting. A senior subject expert with experience of ILT is appointed Quality Assessor to review the materials on behalf of the NLN.

The instructions that the NLN Materials Team give developers for trialling the learning materials developed for the National Learning Network follow. This level of detail may not always be applicable to the development of other e-learning materials, but it is what the NLN Materials Team recommends to ensure that material is fit for purpose.

### The NLN Model - Instructions for trialling

#### Usability trials

Trialling has a very important role to play in the development of high quality on-line learning materials and should form an integral part of the development process. The purpose of a trial is to ensure that the material will function correctly and is effective for the target users before the majority of the content has been incorporated.

*There are a number of reasons why trialling is so important:*

- it allows the developer to test out the materials on real learners before they are too heavily into the main phase of the development process
- it enables the developer to see the responses/reactions of typical target learners
- it identifies new or different approaches that may need to be incorporated into the materials and also ensures that the correct approach is being taken.

It is important that the materials should be reviewed by both subject specialists/tutors as well as by learners in several colleges, differing in location and size.

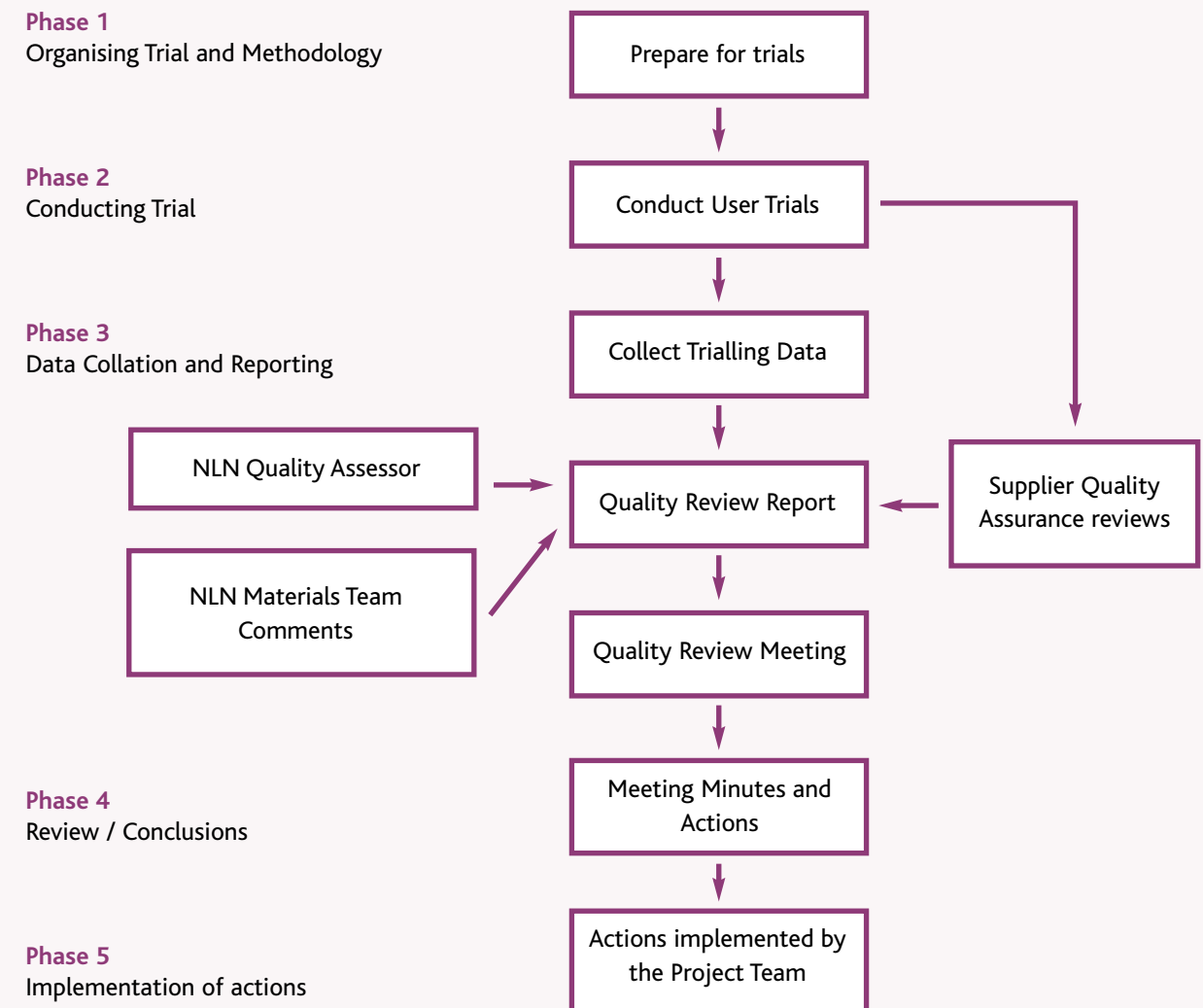
*There are a number of different approaches to trialling that can be used:*

- focus groups
- asking the learners questions before and after using the materials, to gauge how much knowledge they have gained
- vocalisation of thought processes
- allowing learners to work through the materials and complete a checklist/feedback form.

All feedback and observation from learners and tutors should be collated into a quality review report, together with a set of recommended actions to be taken as a result of the trialling.

However, organising trials can be a time-consuming and often difficult process, due to the need to build relationships with other colleges before you can progress. Responsibility for the trialling process should be allocated to a member of the Project Team (not the Project Manager) to ensure that this becomes an integral part of the project. The flow diagram on the following page illustrates the user trialling process.

### User trialling process



## PHASE 1

### Organising trial and methodology

Trials should be college-based and the participants should reflect the end user of the materials, eg level 2 materials should be trialled with level 2 students, and it is hoped that students with disabilities will be encouraged to provide information about any accessibility issues. Tutors should also be involved with trialling as they will be using the materials in the classrooms.

Trials should involve colleges from different geographical areas to allow for regional differences. The materials must also be trialled with groups of students with a variety of disabilities.

It is recommended that at least one Project Team member facilitates each trial. The hosting college must be informed of all the trial requirements, ie it is essential that the college technical team is involved as well as the tutor to ensure that the trial runs smoothly.

The role of the NLN Materials Team member is to ensure that the trialling of the materials is conducted appropriately and fairly.

## Trialling requirements

On site:

- computers with audio running Internet Explorer V4.0 or above, with the most up-to-date Flash and Shockwave plug-in with relevant extensions and Acrobat reader
- one computer per user/per user group
- user briefing documentation
- questionnaire for users (including user profile questions)
- questionnaire for observers.

## PHASE 2

### Trialling of the materials

*The following types of information and responses will be collected during the trials:*

- the motivation of users towards the product, and towards the use of a computer as the means of delivery
- ease of use, for example:
  - where button use is not intuitive
  - where layout is not helpful
  - where navigation is not intuitive
  - where routing or menu structure causes problems
  - any instructions which are unclear
- users' responses to questions and feedback
- users' reactions to, and appreciation of features, such as Help or Glossary
- users' reactions to any new functionality
- assess how easy the material is to understand, record the actions of users, noting:
  - users' understanding of the content
  - where the content itself is not clear to the user
  - users' reaction to the delivery style adopted within the materials
  - where the delivery style interferes with the effective communication of the content
- the nature of the environment and possible and observed effects of this environment on the trial.

### Introductions and setting the scene for the trial

- Introduce yourself and explain the purpose of the trial.
- Explain any equipment involved.
- Explain that user feedback is invaluable in the development of good materials.
- Explain to the user that you cannot help them or guide their progress through the software because you need to know whether or not the instructions are adequate and whether the package is easy to work through.
- Explain that questions are welcome, but make sure you only intervene where necessary.
- Introduce the project - explain the purpose of the software that is being developed, being careful not to demonstrate anything you wish to test.

- Make it clear that there is no pressure on the user to finish the trial if he or she feels uncomfortable about finishing.
- Answer any questions the user wishes to ask before the trial begins.

### Role of the project team observer at the trials

#### Starting the observation

You need to record your observations, attributing any problems to the product rather than to the user. Record your observations and use prepared prompts on areas of particular interest, such as new types of functionality, or for example ask - "do you find the Help facility useful?" or "are the question feedbacks helpful?"

#### Assessing the experience of users

Log the following information about users:

- previous experience with computers
- familiarity with the content.

#### Assessing the motivation of users

Establish and record the motivation of users towards the product, and towards the use of a computer as the means of delivery.

#### Appropriateness of material

To assess how easy the prototype is to understand, record the actions of users, noting:

- users' understanding of the material delivered
- where the material itself is not clear to the user.

#### Appropriateness of delivery style

To assess how effective the delivery style adopted in the prototype, record the actions of users, noting:

- users' reaction to the delivery style adopted by the product
- where the delivery style interferes with the effective communication of material.

#### Assessing the environment in which the usability trial takes place

To assess how the delivery environment will affect the use of the software, record the actions of users, noting:

- the nature of the environment
- possible and observed effects of this environment on the trial.

You will also need to compare and record any differences between the trial environment and the intended delivery environment.

#### Concluding the observation

Answer any questions the user may have. Discuss the product and any actions that the user took. Thank the users for their time and co-operation.

#### Role of users during the trial

- Ask users to complete a short questionnaire outlining their interests, their age and gender, their previous experience of key skills, their previous experience of learning using computers. Give users the option to identify themselves on the questionnaire or leave it anonymous. Introduce them to the trial questionnaire that they will be asked to complete.
- Give an indication of the timescales involved in the user trial to set their expectations, but it is important that they are not given a specific length of time to work on the resource.
- Introduce the resource and say how it can be used.
- Give users an instruction sheet outlining the activities they should carry out during the trial. This should include a sheet on which to note their comments and observations - additional comment sheets should be made available.

- Users should work either one to one with a computer or, where there are many users, ask them to work in small groups of two or three.
- Allocate an observer to one or more users to make notes. The purpose of these notes should primarily be to note areas of the resource where the users have problems. Note how the users are interacting with the resource and identify additional areas for follow-up questions. (Observers should use the same comment sheets as users.)
- An observer should interview users as they complete the resource. Users should be interviewed individually, or as a group if they were working together. The observer should complete one questionnaire per interview.
- The completed questionnaire, comment sheet and interview should be coded so that the profile of the users can be linked with their comments. This is useful when looking at learners' comments in relation to previous experience, gender and age.

#### Role of the tutor

Tutors should participate in the trials in a similar way to students, and should be given a different activity briefing sheet.

When the observer interviews are complete, the tutor should be encouraged to talk to their students to capture their thoughts and any negative feedback that they may be reticent to share with the observer. Interview the tutor at the end of the event using the observer questionnaire.

### PHASE 3

#### Data collation and reporting

- A trialling report should be produced by the Project Team prior to the Quality Review meeting and should include an overview of the trialling procedures employed, observations from the trials, and findings from the questionnaires and other evidence gathering methods employed as well as recommended actions.

### PHASE 4

#### Review/conclusions

- A Quality Review Meeting should be arranged soon after each set of user trials.
- Attendees at this meeting should include: The Project Manager, lead designer (or similar person), any other appropriate people from the supplier project team, and the Quality Assessor and a member of the NLN Materials Team.
- The meeting should include a discussion of the findings of the trial (the trialling report), feedback from the NLN Materials Team and the observations of the Quality Assessor.
- A set of action points to have arisen from the trialling and review process will be agreed by the meeting and subsequently implemented by the Project Team.
- The minutes of the Quality Review Meeting and a copy of the action points agreed at the meeting should be sent to the NLN Materials Team Project Support Officer as soon as possible after the meeting.

### PHASE 5

#### Actions implemented by project team

Software amendments and/or errors identified by the user trial should be corrected immediately by the Project Team.

## Implementation and dissemination

### Introduction

To ensure that the full impact of the NLN ILT materials is felt across all colleges in England, to improve the quality of learning and teaching, and to secure an appropriate return on this large central investment, an extensive implementation support programme has been funded by the LSC and is being undertaken by the NLN Materials Team. To achieve the greatest impact and embed the NLN materials into existing teaching and learning a multi-pronged approach is being taken, namely:

- recruitment of ILT Subject Mentors to work directly with subject tutors in colleges across England
- the development of an online resource 'Using the NLN materials - a Practical Guide'
- central provision of support, dissemination and evaluation
- eight regional residential events for practitioners in the appropriate use of NLN materials
- three national one-day events for ILT and Staff Development managers to increase awareness of the NLN, the materials, and the changing needs within colleges.

### ILT Subject Mentors

Up to 30 national ILT Subject Mentors are being recruited to raise awareness and promote good practice in using electronic learning resources, particularly the NLN materials, within the post-16 sector. The team of ILT Subject Mentors is visiting colleges and working with lecturers, managers and partners to:

- make and retain contact with fellow subject specialists in colleges across a region
- raise awareness of NLN materials and other e-learning resources
- promote good practice in appropriate use of online learning materials
- create and maintain ILT subject communities.

### Using the NLN materials - a Practical Guide

Using the NLN materials - a Practical Guide is an online resource that has been developed to help colleges use the NLN materials effectively and creatively. It includes tutorial information, real-life examples of good practice, advice on using the materials to help solve specific problems, and ideas on how e-learning can be used to help enrich lessons. The guide has been presented in a similar format to the NLN materials so, by working through the series of learning objects that make up the guide, tutors will become familiar with the way that the NLN materials are structured.

ACT e-learning were commissioned to develop the guide in partnership with the NLN ILT Subject Mentors. It is available at [[www.nln.ac.uk/materials/tutors/practical\\_guide.asp](http://www.nln.ac.uk/materials/tutors/practical_guide.asp)].

### Evaluation

An evaluation project is underway to study what is required to embed the NLN materials into the curriculum and will identify strategies and good practice for integration that can be disseminated to the sector. Areas to be covered include infrastructure, technical implementation, technical support, staff development, funding and resources, and management.



## Dissemination

### NLN Materials Website

This site gives users a 'one-stop shop' for information and support on downloading and using the high quality e-learning materials that are now available free to FE colleges through the NLN partnership programme. The separate areas of the site provide distinct support and advice for tutors, developers and technical staff. There is also an outreach section where Regional Support Centre staff and ILT Subject Mentors can exchange views and find information about future developments and to access important resources and information to aid successful and effective use of the materials.

### NLN Materials World

The team produces a quarterly newsletter, which is the key dissemination vehicle of the NLN Materials Team. NLN Materials World showcases the latest materials, events, case studies, good practice, developer activities, examples of the materials in action, NLN Materials Team news, news about recent legislation and guidelines, and information from the LSC. It also includes features from other providers of e-learning to the sector such as Ufi/Learndirect, the BBC and JISC.

### Support

NLN Materials Team Education Officers have undertaken a programme of college visits to support staff since the NLN programme first began in 1999. They have travelled to FE colleges all over the country demonstrating the materials to practitioners and managers, and explaining how they can be integrated into teaching and learning.

### Workshops and events

- The NLN Materials Team held three national one-day events entitled The NLN: Content, Culture and Change for ILT and Staff Development Managers to support the process of change within colleges as they began to make use of e-learning, and the NLN materials in particular.
- The team also held eight residential events for subject tutors, key skills tutors and support staff, learning support staff and ILT Champions entitled Content and Curriculum: the Key to the NLN.
- The team has also run 22 Crafting the Content events in English regions, focusing on the development and use of online learning materials in colleges. A third series is being delivered in June 2003, focusing on the use of NLN Materials in VLEs. A fourth series is also in preparation that will focus on pedagogy and applications of e-learning materials.

The NLN Materials Team works in collaboration with the Regional Support Centres (RSCs) to ensure that as many practitioners as possible are informed of, and involved in, NLN Materials Team activities.

## Appendix

### *Index of acronyms and abbreviations used:*

<b>Becta</b>	British Educational Communications & Technology Agency
<b>CAT</b>	Content Access Tool
<b>FE</b>	Further Education
<b>ICT</b>	Information & Communications Technology
<b>ILT</b>	Information & Learning Technology
<b>JISC</b>	Joint Information Systems Committee
<b>LSC</b>	Learning and Skills Council
<b>LSDA</b>	Learning and Skills Development Agency
<b>MIMAS</b>	Manchester Information & Associated Services
<b>MLE</b>	Managed Learning Environment
<b>NILTA</b>	National Information and Learning Technologies Association
<b>NLN</b>	National Learning Network
<b>RSC</b>	Regional Support Centre
<b>UKERNA</b>	United Kingdom Education and Research Networking Association
<b>VLE</b>	Virtual Learning Environment
<b>QTI</b>	Questions and text interoperability

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