



## E-Learning Project Management and Documentation Guidelines

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# 1 Introduction

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This document outlines documentation and project management considerations for Defence organisations that are considering e-learning development, whether this is outsourced or developed in house. This document is complementary to DTSM5 and other DCTS issued documents that consider e-learning.

The document is split into several sections:

- The e-learning development lifecycle is outlined from two perspectives
- The e-learning development lifecycle within DSAT is considered, this includes coverage on issues connected with maintaining the integrity of the DSAT process when developing e-learning.
- The decision criteria for choosing e-learning are outlined
- The key critical e-learning documentation required for project management is summarised

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## 2 The e-learning development lifecycle

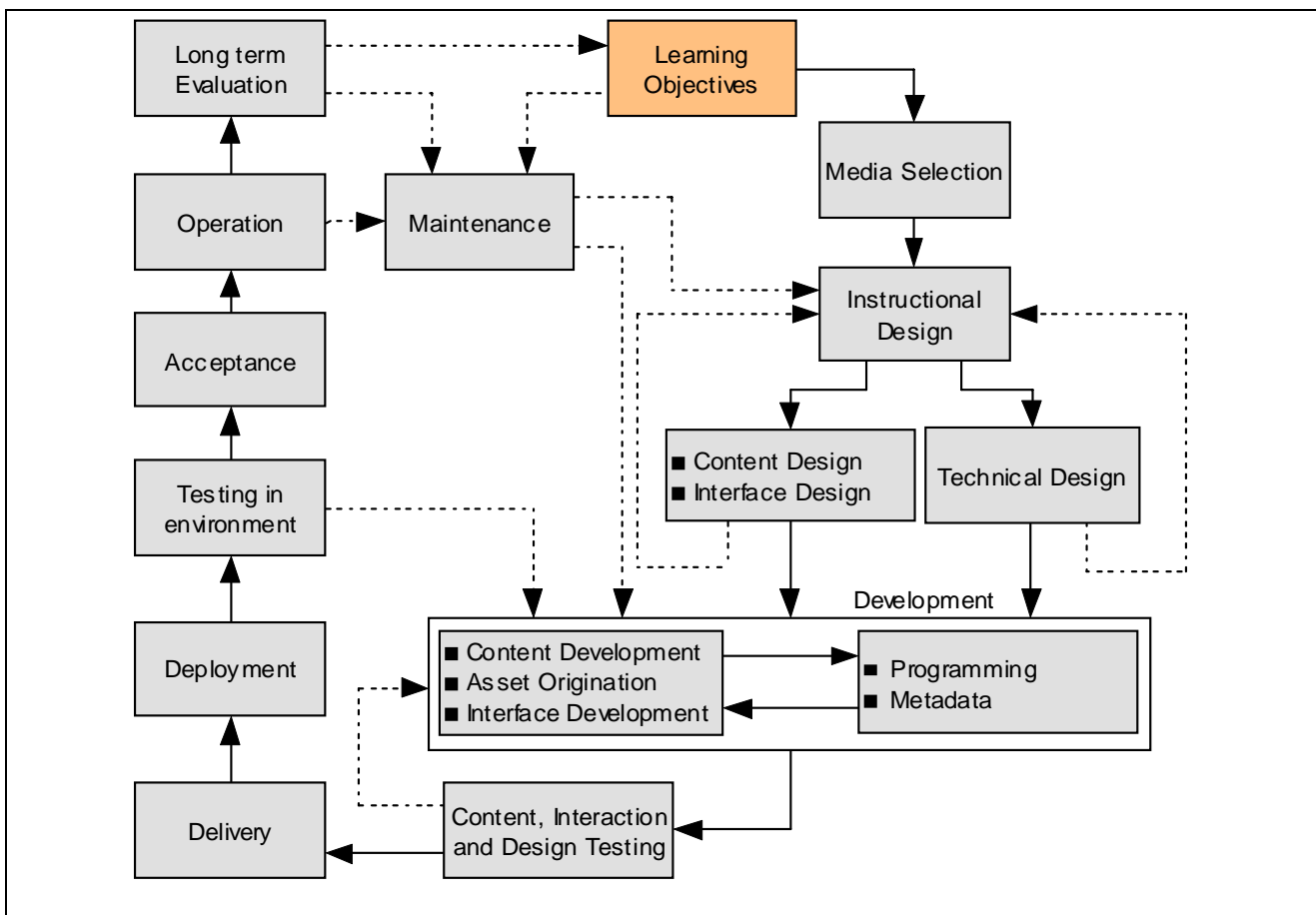
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An e-learning development lifecycle is described from three perspectives:

1. The specific e-learning development lifecycle is described with principal entities outlined (project stages, benchmarks, roles and responsibilities and deliverables). This lifecycle is well suited for characterising the design and development of e-learning projects from an instructional design perspective. This view of e-learning design and development assumes the completion of a DSAT Training Options Analysis as its starting point.
2. A broad project management lifecycle is defined – this lifecycle is useful in that it characterises the broad situation of programme/project development and sheds light on what overarching documents are necessary to ensure wider alignments. The broad approach is suitable for very large developments, or where e-learning is being delivered as part of a larger system.
3. The linkages (inputs and outputs) to the wider DSAT QS training system are given, so that training system quality safeguards are maintained and the e-learning design and development is conducted in alignment with the wider Defence Systems Approach to Training Quality System.

### 2.1 Instructional design perspective

Figure 1 defines e-learning from a detailed developmental perspective – i.e. the design and development process of the actual solution itself, rather than addressing the wider program and organisational issues which are described later from a program management perspective. All development projects are different in their aims, structure and scale, so consequently not all of these stages listed below would be involved in every project.



**Figure 1 - Key activities within an e-learning project**

The key activities described above occur over a number of project stages which are described below. Instructional design for instance, informs content design and interface design. This is not to say that instructional design is conducted in a single step, rather as an activity it spans a number of project steps and a number of project deliverables. Project deliverables are often a synthesis of a number of discrete but connected and interdependent activities – for example an Outline Design document will contain sections that cover instructional design, graphic design, technical design and project management methodologies.

### 2.1.1 Key Stages

The development of an e-learning project usually is conducted between a set of milestones that are generally characterised by formal sign-off and acceptance of documents or other deliverables.

Many of the activities described above are handled by a ‘two-pass’ approach within the project - the Outline Design covers the generalities and principles of design and approach whereas the Detailed Design describes the e-learning solution in detail, on a screen-by-screen basis. The term ‘storyboard’ is also occasionally used to describe a detailed design

document. Detailed design documents are generally issued on a per-module or per-session basis, this leads to multiple detailed design documents. Concomitant with this is a staggered development of e-learning modules within a project. As an example one module might be under full development, while another module detailed design is being written.

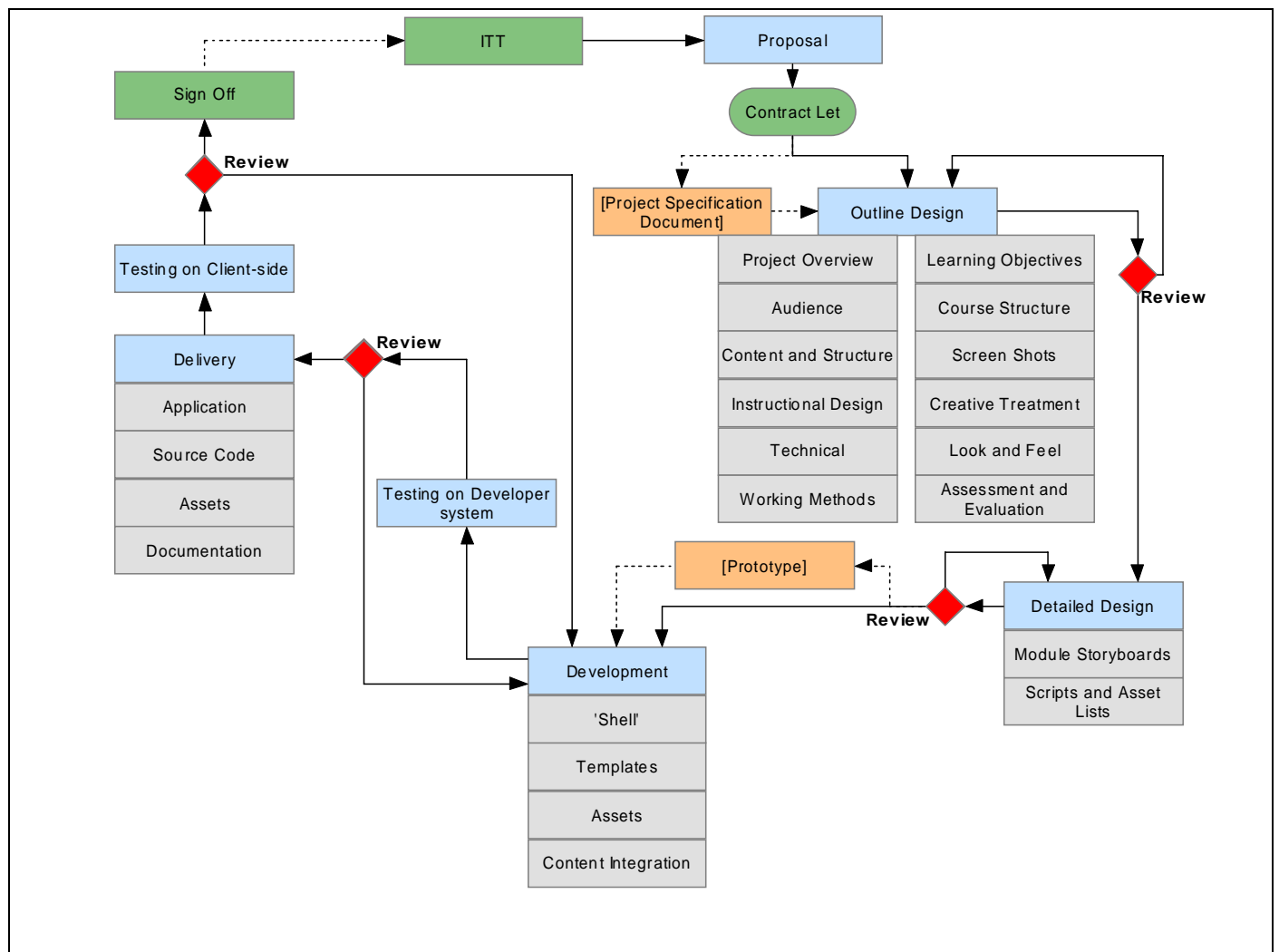
The sequence of deliverables generally follows the following format:

- Proposal / Response to ITT
- [Project Specification Document] – this is optional method for separating components of the initial design stages out from the outline design. Useful for larger projects where project methodologies and working methods need to be described in greater detail – also used in projects which require a higher degree of initial analysis.
- Outline Design (generally includes layout, treatment, screen shots)
- Detailed Design (includes scripts and asset lists)
- [Prototype] – this is an optional stage, on any project larger than about 6-8 hours (delivered materials), a prototype is recommended. This stage is very useful in testing development processes and ways of working – especially in projects that require a high degree of collaborative effort.
- Development and Testing on developer's system
- Delivery and Testing on client's system
- Sign-off

Other documents used during the project include meeting minutes and updates for the project control document where outstanding project issues are outlined.

A typical production sequence for deliverables is shown in Figure 2. The key stages, roles of participants at each stage and deliverables produced during each stage are shown in Table 1, along with explanatory notes.





**Figure 2 - Key deliverables during e-learning development**

**Table 1 - Key Stages, Roles and Deliverables of an e-learning design and development project**

<b>Key Stages (Role)</b>	<b>Deliverable</b>	<b>Notes</b>
<b>All</b> (Project manager)	Proposal Outline Design Detailed Design Final Application	Project management is discussed after the table.
<b>Training Objectives</b> (Instructional Designer)	Outline Design (may be separate document for large projects)	This is generally defined by the sponsor, but may be generated by a vendor as part of a TNA process. Good practice generally includes client defined TOs and EOs in an outline design.
<b>Media Selection</b> (Sponsor) (Instructional Designer)	Outline Design	This decision may be sponsor or vendor side (more normally sponsor side). Generally defined in an ITT. Good practice generally documents the issues connected with media selection decisions in the outline design.
<b>Instructional Design</b> (Instructional Designer)	Outline Design Detailed Design	Instructional design is a stage that spans a number of deliverables. The generalities and defined within the outline design, the specifics of implementation in the detailed design.
<b>Content Design</b> (Instructional Designer) (Writer/Scriptwriter)	Outline Design Detailed Design Scripts Asset Lists	Content design is a stage that spans a number of deliverables. Voice over scripts and asset lists act to define what specific content needs to be produced.
<b>Interface Design</b> (Graphic Designer) [with input from Instructional Designer and Programmer]	Outline Design	Layout and Treatment and Screenshots are normally included in the Outline Design.
<b>Technical Design</b> (Technical Lead) (Programmer) [with input from Instructional Designer]	Outline Design [Technical Design]	Depending on the complexity of the solution technical design may form part of Outline Design or be contained within its own document.
<b>Content Development</b> (Graphic Designer) (Developer) (Programmer)	Actual assets [Prototype] Final product	Content development covers the actual creation of modules, lessons and screens within the e-learning application. It also includes the integration of assets within the development environment.

Key Stages (Role)	Deliverable	Notes
<b>Asset Origination</b> (Graphic Designer) (Illustrator) (Soundengineer) (Cameraman) (Photographer)	Actual assets Final product	Asset origination involves drawing diagrams, sourcing or shooting photographs, shooting video and recording voice-overs.
<b>Interface Development</b> (Graphic Design) (Programmer)	[Prototype] Final product	Interface Development covers actual development effort to translate screen shots into functional entities within the development environment, this may cross over into programming.
<b>Programming</b> (Programmer) (Developer)	Templates Shell development [Prototype] Final product	Pure programming is concerned with the creation of functional constructs that are populated by other developers. Such constructs may include the 'Shell' a generic term applied to a containment construct that stores the application depending on implementation this may be implemented as a "frameset", or may be integrated within the development environment (such as in CMS/LCMS functionality).
<b>Metadata</b> (Writer) (Developer) (Programmer)	Outline Design Detailed Design (Prototype) Final product	Creation of element and classification metadata.
<b>Content Interaction and Design Testing</b> (Testers)	Change request document	Customer feedback is captured in change request forms which are submitted to the vendor.
<b>Delivery</b>	Delivery plan	Delivery and acceptance planning for moving the application to the customer system. May involve using a VPN tunnel or "drop box".
<b>Deployment</b> (Programmer)	Final product Packing Specification Delivery manifest Project Archive	Generally specified by the customer or their hosting facility.
<b>Testing in the environment</b> (Testers)	Change request document	Customer feedback is captured in change request forms which are submitted to the vendor.

Key Stages (Role)	Deliverable	Notes
<b>Acceptance</b> (Sponsor)	Sign-off document	
<b>Operation</b> (Training Manager)	Assessment Scores Management Data Operation Logs	Output produced from the course could be viewed as a deliverable of the operation phase of an e-learning project. Reactionnaires and Student Action plans could be viewed as management data or as part of long-term evaluation.
<b>Maintenance</b> (Training Manager)	Maintenance Plan Maintenance/Updates	
<b>Long Term Evaluation</b> (Training Manager)	Evaluation Documentation	As specified in DTSM 4 (requirements of evaluation) and DTSM 1 (training documentation).

Larger projects will require a higher degree of specialism than the standard outline team described here.

## 2.1.2 Design and Development

On small/medium size projects one project manager is sufficient; when projects become larger a project manager is generally supported by a production assistant or junior project manager. When projects become large (c.8 hours +) or are very complex, additional subsidiary project managers are used.

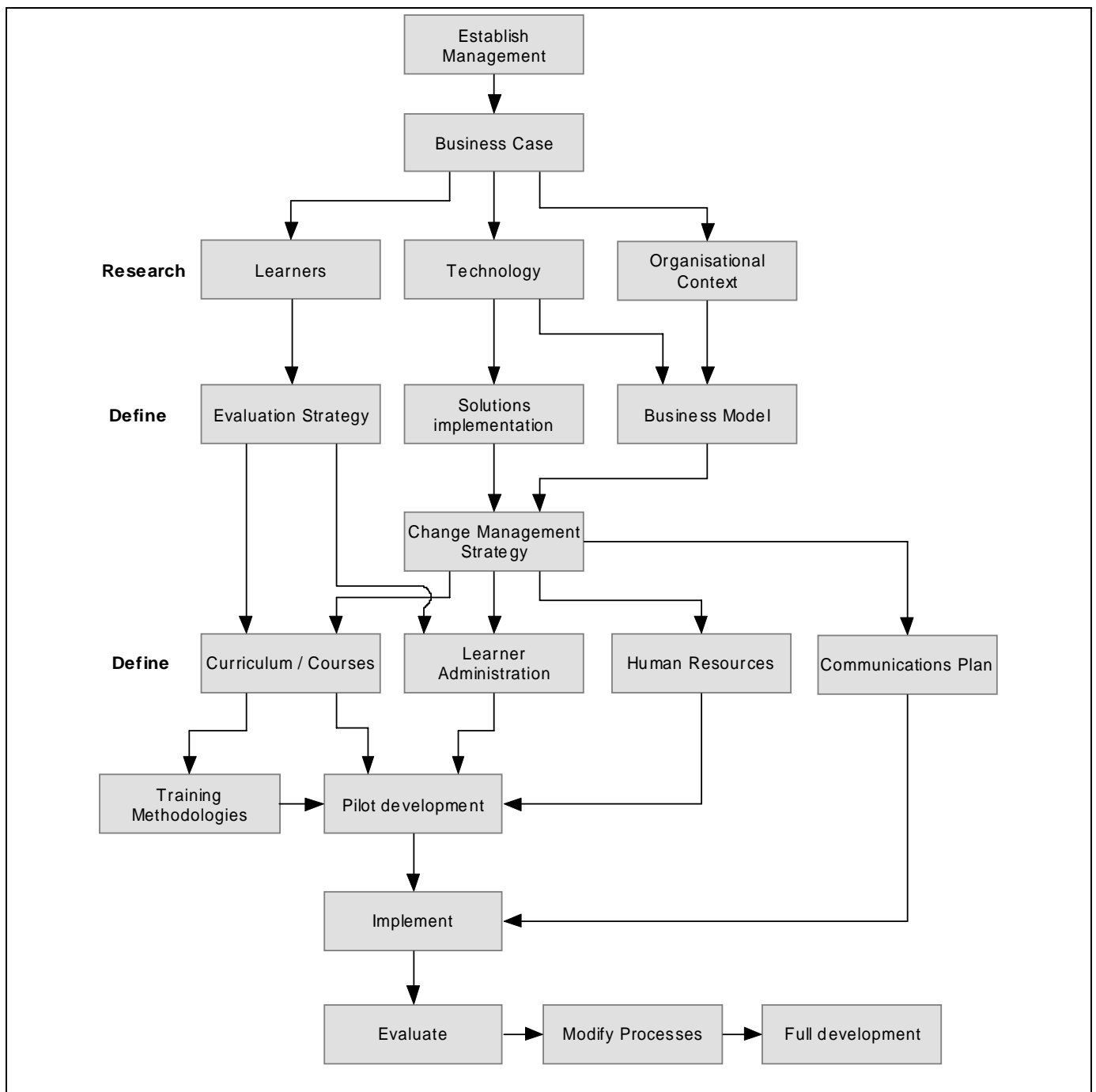
The term 'Producer' is used to apply to project managers who are more directly involved with the shape of solution, rather than the essentials of project planning, control, execution and reporting. In projects with a project manager and a producer, the producer will generally be closely involved with client-side instructional designers, subject matter experts, and the vendor development team. In this situation the project manager will be closely associated with the client-side project management and sponsor.

On very large projects one will have a project manager, instructional design lead, design manager and technical manager. In this situation either the senior instructional designer or graphic designer may hold a producer role (more normally the instructional designer).

## 2.2 Programme management perspective

The overall approach outlined below is based on a broad program management approach, which by its nature must cover a set of factors that are outside the scope of the more detailed development methodology given earlier (these factors include the procurement of hardware, change management and human resources).





**Figure 3 - Broad change management view of e-learning**

Some brief supporting notes for the stages mentioned on previous page:

- **Establish management** – Define project structure, roles and responsibilities.
- **Business Case** – Define and document business case for e-learning including costs and benefits, distribute to stakeholders within the organisation.

- **Learners** – Research learners, and identify key learner characteristics especially barriers to adoption.
- **Technology** – Identify available hardware and software, role of learning standards, define need for enterprise software.
- **Organisational Context** – Identify enablers and barriers for acceptance of e-learning within the organisation. Prepare a plan to promote acceptance of e-learning.
- **Evaluation Strategy** – Develop an Evaluation Strategy that is in alignment with DSAT QS.
- **Solutions implementation** – Develop an implementation plan for the technology that has been selected.
- **Business Model** – Define whether development is outsourced or handled internally (or both), centralised or federated, independent or collaborative.
- **Change Management Strategy** – Develop a change management agenda that views e-learning from a business transformation perspective.
- **Curriculum/Courses** – Identify the components of the curriculum that need to be converted, prioritise the programs that bring the organisation most benefit (curriculum gap prioritisation).
- **Learner Administration** – Define the learner administration requirements for the e-learning, in alignment with the evaluation strategy.
- **Human Resources** – Define the skills and roles needed within the organisation to support the project development throughout the lifecycle. Make decisions on training, recruitment and external support.
- **Communications Plan** – Develop a communications plan for the project and to communicate the change management strategy to the organisation.
- **Training methodologies** – Select and develop appropriate training methodologies in alignment with DSAT QS and the DTSMs.
- **Pilot Development** – Conduct a pilot e-learning design and development project to test the systems put in place and working practices.
- **Implement** – Implement the solution in a realistic setting for pilot users.
- **Evaluate** – Evaluate the e-learning from a Context, Input, Process and Product (CIPP) perspective.
- **Modify Process** – Alter processes and systems as indicated by the results of the evaluation.

- **Full Development** – Conduct full development.

## 2.3 E-learning within DSAT

There are three major sections when considering how e-learning as a specific instructional medium fits within DSAT:

- Firstly, the inputs which lead to e-learning being selected as a candidate instructional medium,
- Secondly, the management of the development process with appropriate quality assurance,
- Thirdly, assessment and evaluation of the training output and the efficacy of the solution.

Prior to the decision to select e-learning as an instructional medium, the following processes will have been followed:

- Scoping Exercise with Scoping Report
- Needs Analysis with operational/Workplace performance Objectives
- Training Design and Development Stage 1 - Determination of Training Objectives

When a decision to use e-learning is made in the Training Options Analysis phase, the findings from these previous studies should be summarised and made available to the developer.

DSAT QS 12.1.1 states that the acquisition of all training solutions should contain the following:

- a) “A statement of requirement, which includes the TOs, shall be clearly defined.
- b) Acceptance criteria shall be clearly defined.
- c) Requirements for the qualification of personnel shall be clearly defined.
- d) Requirements for the management and support of the training solution shall be clearly defined.”

### 2.3.1 Outsourcing

DSAT QS 5.1.4 mandates that:



“Where an organization chooses to outsource any process that affects the determination and/or achievement of the TOs, the organization shall ensure control over such processes. The control mechanisms to be applied to such outsourced processes shall be identified within the MTS.”

This statement makes it the sponsor’s responsibility to ensure control over outsourcing efforts, and to ensure that quality systems are maintained. The overwhelming majority of UK e-learning development companies are highly professional, and have well defined project management and quality procedures. Sponsors may wish to obtain, or be briefed in the quality procedures or ‘ways of working’ that a development company may exercise to satisfy themselves that this is the case. Alternatively this can be covered in an Invitation to Tender (ITT) or Request for Quotation (RFQ) process.

## 2.3.2 Documentation

DSAT QS makes several statements on training documentation, DSAT 7.1 & 7.2 states that:

“7.1 All individual training activities shall be managed and controlled through the use of training documentation.

7.2 Training documentation shall be maintained as a quality record to provide an audit trail from the identification of the training need through to the evaluation of the trained output.”

DSAT QS 5.2.2.1 mandates that:

“Records shall be established and maintained to provide evidence of conformity to requirements and of the effective operation of the MTS. Records shall remain legible, readily identifiable and retrievable. A documented procedure shall be established to define the controls needed for the identification, storage, protection, retrieval, retention time and disposal of records.”

This statement makes it the responsibility of the sponsor to ensure that documentation produced as part of an e-learning project is suitable for ensuring maintenance of the solution. This document puts forward one potential structure and format for e-learning documentation, to help ensure this is satisfied.

## 2.3.3 Assessment

Assessment is not mandatory under DSAT however DSAT QS 10.1(e) states that:

“Where assessment has been identified as a requirement, trainees are assessed for achievement of the TOs in accordance with the assessment strategy and assessment specification. If training is not to be assessed then a statement to that effect, including the reason(s) for not assessing, shall be made.”

If an indication of instructional retention is required, assessment is recommended; especially as it helps assess the quality of the instruction itself.

### **2.3.4 Post-Course Evaluation**

DSAT QS 10.1(f) mandates that:

“An after-action review of the training delivery (e.g. through post-course discussion and/or questionnaire) is carried out and documented. Any resulting recommendations relating to the conduct of training and training content shall be considered to ensure the continuing efficiency and effectiveness of the training activity.”

Given that most e-learning will be delivered through the Defence Learning Portal it is the responsibility of the training sponsor to ensure that appropriate provision for evaluation is being made.

### **2.3.5 The DSAT Process**

The development lifecycle shown in Figure 4 covers the instructional design specifics of handling an e-learning development project integrated with DSAT QS. The yellow areas of the diagram indicate the points within the DSAT process that a decision is made to initiate the e-learning design and development route. The blue areas of the diagram indicate part of the DSAT process that are covered in the design, development and delivery of an e-learning solution (described in the previous diagram).

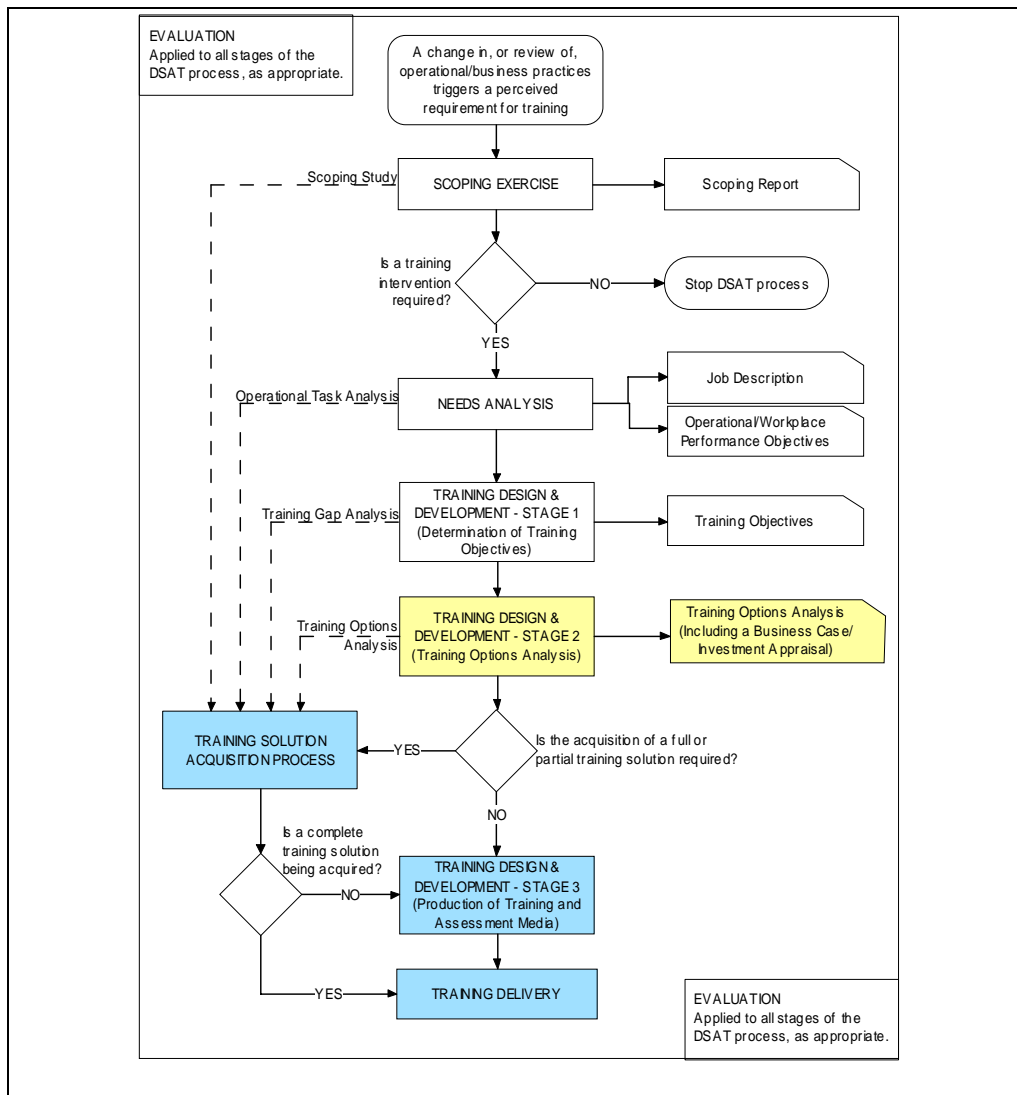


Figure 4 - The DSAT process

### 2.3.6 E-learning as part of a larger procurement project

With very large projects e-learning may be considered as a primary component of the provision of an overall training solution (with classrooms, buildings, hardware, enterprise software, etc). Instructional materials may be included as part of a large solution procurement project, that may include provision for instructional management, communications, mass storage, dual-use delivery systems and electronic documentation. In this situation some sort of scoping study as part of procurement might form the point of entry. In a strategic situation the broad view e-learning lifecycle outlined in Section 2.2 is recommended.

### 2.3.7 Other e-learning solutions

The normal starting point of an e-learning project is as part of a Training Options Analysis process with a defined course or a set of discrete courses is being considered. DTSM3 (Training Needs Analysis) also allows for Training Options Analysis to occur as part of TNA phase 2.

### 2.3.8 Integration of e-learning with DSAT

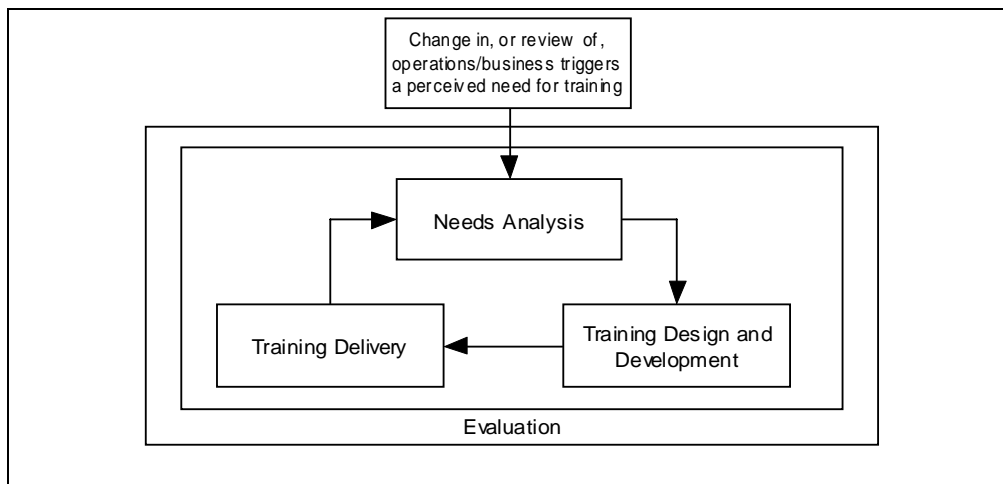
Key considerations for ensuring the validity of an e-learning solution within the DSAT system are to ensure that:

- A valid decision to use e-learning is made (both from instructional and cost effectiveness perspectives) – this involves conducting the DSAT Training Options Analysis process.
- Training evaluation benchmarks that enable evaluation of an e-learning solution are defined. These benchmarks should be defined and documented during needs assessment and form Stage 2 of the DSAT QS Training Evaluation process. Without defined benchmarks there can be no formal evaluation process within DSAT (beyond informal Stage 3 training reaction data capture).
- The solution is developed with suitable project quality controls; this includes using a defined design and development process (including documentation) and conducting quality assurance. All of these steps help with maintainability of an e-learning solution.
- Advice and direction is given to vendors conducting e-learning design and development that captures and collates the specific considerations within DSAT QS and the DTSM series of documents. This assures that the e-learning produced is done so in full accordance with the mandatory aspects of DSAT QS and the ‘best practice’ guidelines’ within the DTSMs.
- The solution is technically interoperable with the DLP, conforms to defined technical criteria, and is instructionally sound (supports a defined instructional strategy as well as providing access to reference information).
- An appropriate Evaluation strategy is defined in alignment with the needs of the sponsor and DSAT QS and DTSM4. This may include Stage 3, Stage 4 and Stage 5 follow-ups using the functionalities offered by the DLP.
- The operability of the solution from a training management and administration perspective – including appropriate personnel are trained and suitable management information is identified (particularly course completion and assessment data).

- Personnel involved in sponsoring e-learning are trained in the implementation of the guidelines above are understand their responsibilities as SMEs and Instructional Designers when working with external developers.

### 2.3.9 Quality systems approach for maintaining the integrity of DSAT

The maintenance of the integrity of the training system is dependant on the evaluation of the systems as illustrated in Figure 5.



**Figure 5 - Overview of DSAT**

This can be broken into:

1. **Evaluation of the evaluation systems** - equivalent to DTSM 4, Stage 1 evaluation. Issues covered in DSAT QS Section 11. The prototype HFI DTC 'evaluation toolkit' allows a training organisation to check its current status against DSAT QS in a simple question-lead format, this information is also captured in paper form within "Instructional Design Guidelines for E-Learning".
2. **Evaluation of needs analysis** – Stage 2 evaluation. Issues covered in DSAT QS Section 8. It is suggested that evaluation benchmarks are established for e-learning projects to allow later evaluation (if required).
3. **Evaluation of training design and development** (which includes the TOA phase) – currently this section is covered in general terms in DSAT QS Section 9.6 (Training Design and Development Review) and Section 12 (Acquisition of Training Solutions), it is not covered in DTSM 4. Outsourcing training development and relying on external organisations to produce instructional content does expose UK Defence to some risk – which can be mitigated by defining the development process in general terms and outlining the quality criteria by which a solution will be judged. Recommendations and requirements to external e-learning vendors will go some way to minimise this risk.

4. **Evaluation of training delivery** - Issues covered in DSAT QS Section 10, and covered by Stages 3-6 of DTSM 4. There exists a great opportunity with the DLP to dramatically lower the cost of training management and cost of evaluation of training through email or web based student reactionnaires (Stage 3 evaluation), and on the job application (Stage 5 evaluation). Sample reactionnaires and job application questionnaires have been researched and are included within the HFI DTC e-learning instructional design guidelines. Reactionnaires may also be useful to identify cultural barriers or issues within Defence that may act to impede the successful operation of an e-learning solution.

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## 3 E-learning Media Selection

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Where e-learning is being considered for a course, or set of courses the Training Options Analysis phase is the normal point of entry within the DSAT QS process.

The inputs to this decision are the outputs from the previous instructional design phases, these may include

- Scoping report
- Output from the TNA
- Job descriptions
- Performance objectives
- Training objectives

DSAT QS Section 9.4 outlines the considerations for Methods and Media Selection, and DTSM 1 outlines the process in detail.

### 9.4 Methods and media selection

The selection of methods and media shall take account of:

- a. the TOs and key learning points (KLPs) to be achieved;
- b. the characteristics, locations and numbers of trainees;
- c. the availability of suitably qualified instructors;
- d. the availability of training resources;
- e. the applicability of emerging technologies;
- f. the training effectiveness of the methods and media;
- g. the cost.

The key factors for making a decision to move to e-learning are summarised below:

1. **Cost effectiveness** – is e-learning a cost effective medium for delivering instruction?
2. **Learning context and practical considerations** – is e-learning possible given the context of the delivery situation and other practical considerations?
3. **Learning task considerations** – is the learning task suitable for e-learning?

4. **Grouping strategy considerations** – is the learning task capable of being handled through individualised instruction?
5. **Learner characteristics** – do the learners have the necessary skills, attitudes and motivation to conduct e-learning?
6. **Media attributes** – does e-learning support the necessary media attributes and interactions required for the instruction?
7. **Instructional management considerations** – is e-learning supportable within the wider organisational/cultural context?

These key factors are considerations for selecting any instructional media for a given learning task, more detail on the decision criteria for assessing the suitability of a learning task is provided in the “Instructional Design Guidelines for E-learning”.



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## 4 E-learning Sponsor Documentation

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Documents issued to e-learning vendors have historically contained information structured in a variety of methods, one of which is shown below:

### 4.1 Guidance for Sponsors in Issuing Invitations to Tender

Typical content for an Invitation to Tender (ITT) might include:

- Introduction
  - Overview
  - Authority
  - Contractor/Tender
  - Meeting the Requirements
  - Project Timetable
  - MOD resources
  - Existing MOD Partnering Arrangements
  - Acceptance Procedure
  - MOD Contacts
  - Response
- Existing Training
  - Course/ Lesson Information
    - Introduction, Background and Aims
    - Security
    - Student Description and Training Support Infrastructure
    - Current Teaching Strategy (including TOs/EOs and ISPECs)
    - Assessment Requirements
    - Existing Materials
  - Target Operating Environment
- Submission of Proposals
  - General Requirements
    - Company Information
    - Project Management Information
    - Sub-contract information
    - Software Development Tools
    - Instructional Design
    - IPR – Vesting in the Authority
    - Further Information
    - Statement on Additional Criteria
  - Statement of Requirement
    - Mandatory Requirements
    - ...
    - Desirable Requirements
    - (...)

## 4.2 Guidance for e-learning Design and Deveoplment

Vendors when undertaking development will benefit from a document which outlines the UK Defences requirements in the areas below:

- Project Management and Documentation (with links to DTSM 1)
  - Stages of a project
  - Milestones
  - Documentation
  - Project roles and responsibilities
  - QA and Acceptance criteria
- Instructional Design Guidelines for E-learning (with links to DTSM 1,3,4,5)
  - Instructional design guidance and best practice
  - Assessment Standards
  - Evaluation benchmarks for the solution
- Technical (with links to DTSM 5)
  - Authoring Tools
  - Bandwidth
  - Software/Plug-ins
  - Hardware
  - Peripherals
  - Reversionary modes of operation
- Specifications and Standards (with links to DTSM 5)
  - SCORM version
  - LMS details
  - DCOM / Granularity
  - Metadata Application Profiles
  - Guidance on keywording
  - Defence Taxonomy requirements
  - DLP Upload procedures.

## 5 Project Documentation

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This section is written both for staff considering in-house or external development.

### 5.1 The need for documentation

Documentation does not have the reputation of being a riveting subject, however it is essential to produce documentation if one does not want finished e-learning to be poor quality, late or impossible to maintain. Documentation is also a mandated part of the process defined under DSAT and in DTSM1.

Key reasons to document are:

- 1) It forms the basis for the design plans, against which the final product is verified. If one wants to run a project professionally from either side of the fence, documentation is a 'must have, must do'.
- 2) It enables one to gauge project progress and constitutes landmarks against which commercial companies may invoice.
- 3) It gives the client the opportunity to view the proposed content and structure of the application, and makes them commit and agree with the approach before the application has been built. This minimises the changes by making the client 'invest' in a plan of action and involving them in the design and development process. Without documentation, chaos can ensue as content, treatment, functionality and look and feel can be arbitrarily changed. This is not a problem in itself, however it wastes time and money and lowers morale.
- 4) It makes change management much easier and makes maintenance and alteration non-dependant on key-personalities (who will almost certainly leave, move or be posted).
- 5) It improves the quality of work, increases efficiency and reduces team stress.
- 6) In the case of late discovered bugs (bugs detected in operation) it enables technical trouble shooters to figure out what is supposed to be happening. Without documentation, this process has the characteristics of bomb-disposal crossed with archaeology and forensics.

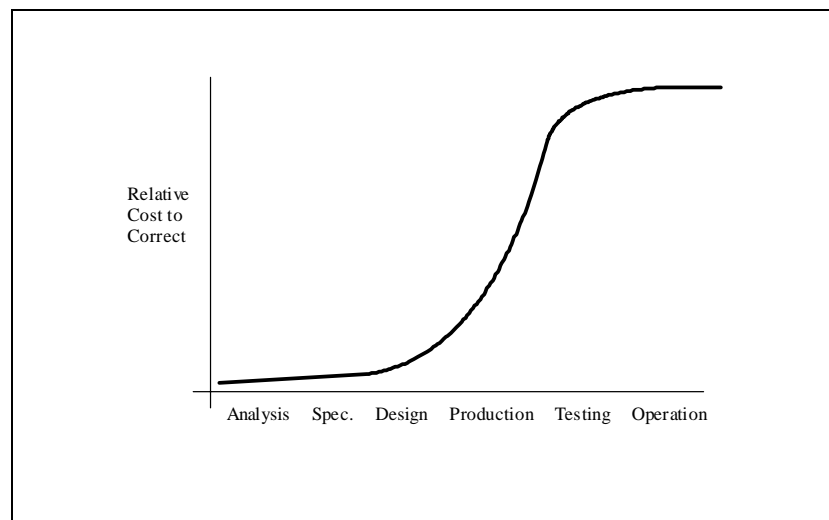
Vendors will (hopefully) use a variety of design documentation and it is not the intention of this document to recommend a prescribed methodology. This said, with increasing amounts of external e-learning development taking place, training maintenance will have an increasing significance to the organisation – especially given the fact that the original members of staff involved on both sides of a project may have moved on, when a need for training maintenance has been identified. It is at this point where one realises whether design documentation is providing what is required by the organisation to make changes to instructional materials in an efficient manner.

Sponsors need to ensure that vendors develop proper documentation as a way of ensuring quality and protecting both sides of the contract. Projects developed without documentation have the capacity to spectacularly fail – a fact personally experienced by the author when called in to troubleshoot failing projects.

The larger a project gets (with attendant larger timescales, teams and budgets), the greater the need to follow the development process as a formal procedure. It is a sad fact that larger projects often have a greater capacity to fail (spectacularly) than smaller projects. The ideal development procedure is broken up into a number of distinct phases with appropriate documentation and interim client signoff at the end of each stage. Client deliverables such as sample screens, storyboards, templates etc. minimise the chance and scale of potential rework being required.

That said, any design documentation is only a descriptor or blueprint for a final application (and thus open to interpretation and misunderstanding); clear communication with the client is also essential. This person should be in a position of authority (this means sign-off authority on the project) and should also be able to guarantee access to the provider of the information, be they a training subject matter expert or technical specialist.

Most projects fail in the design phase, which leads to expensive corrections later, which in turn result in budget / deadline overrun and a loss of quality. The classic cost to correct graph is reproduced in Figure 6 for reference.



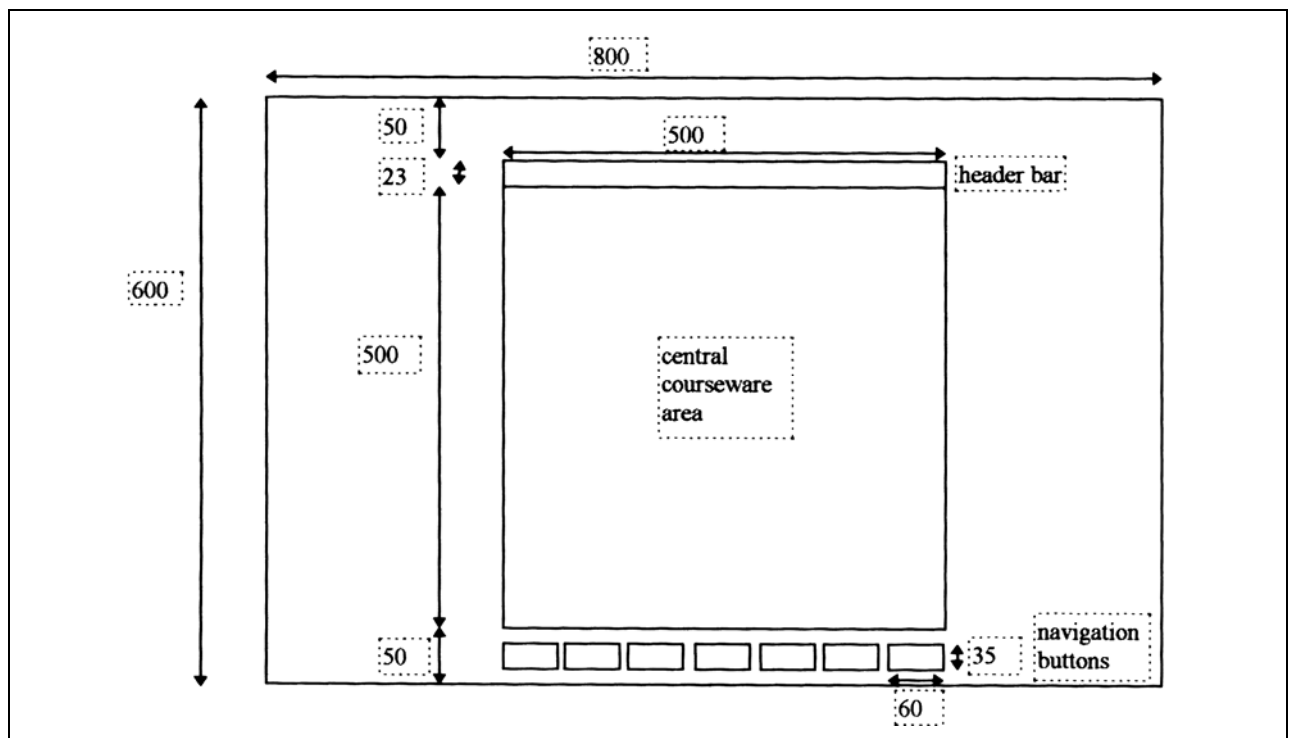
**Figure 6 - The cost of error correction**

## 5.2 Outline Design

Following the contract award to the winning vendor, the first deliverable is the Outline Design document. This document will generally cover:

- **Project Overview** – a brief outline of the project including aims and background.

- **Audience** – this should contain a description of the target audience: age, background, job role, education, prior knowledge, computer aptitude and an exploration of motivational factors.
- **Content and Structure** – summarises the course subject matter and breakdown. To include dependencies within the instructional materials (such as prerequisites).
- **Instructional Design** – outline of the vendor approach to instructional design. Note: vendors should be issued with DSAT QS, applicable DTSMs or JSPs and other appropriate Service or Organisation documents/manuals/guides (e.g. Army SAT Pam8, Army e-learning guidelines). This should include details as to session breakdown, phases of instruction, degree of interaction, breakdown of types of screen etc.
- **Technical Information/Design** – to include a restatement of target hardware (processor, RAM), Display (type, screen resolution, colour depth), browser (type, version), bandwidth, plug-ins (type and version), specific firewall issues (e.g. Data source mapping across domains, use of ActiveX etc.), media servers supported, use of audio.
- **Working Methods** – outline as to how the vendor will approach release of deliverables, project control documents, reporting, use of review sites, turn-round times on documentation review, risk register etc.
- **Learning Objectives** – clear statement of TOs and EOs taken from ISpecs. Articulated in performance, conditions and standards.
- **Course Structure** – probably derived from lesson plans.
- **Look and Feel and Screen shots** - minimum of 4 screen shots to show: main menu, sample content presentation screen, interactive screen and assessment question. These should also be viewed as images on a computer to confirm colours, readability etc. To include descriptions of how things will work and be presented. Other information to be included is details as to layout - which defines the positions of buttons, the placement of titles, text and graphics. It is always a good idea to design a number of set layouts to incorporate different screen types. The layout can only be designed once the overall navigation has been thought through – without knowing the content and how the user is going to navigate through it, one doesn't know how many buttons will be needed and what navigation features will be required. An illustration of such screen shots is given in Figure 7.



**Figure 7 - Sample courseware layout screen**

- **Creative Treatment** – an outline of the creative treatment, the ‘idea’ behind treatment of the subject, and how the student will be engaged (and have their interest maintained).
- **Assessment and Evaluation** – this section may be included within instructional design includes the evaluation and assessment strategy to include details as to how the measurable aims of the project will be seen to be satisfied. This should include a reference to DTSM4 and specific DLP reporting considerations.

## 5.3 Detailed Design

The detailed design document contains a description of the instructional materials that will be constructed, this description is generally down to the page or screen level of detail. Screens are aggregated together into groups organised around a single enabling objective, or set of closely related enabling objectives. The exact organisation of screens and the number of hierarchical levels may differ from course to course, and will to a large extent be determined by the length of course, the length of a standard lesson (also referred to as a session) and the breakdown of the content. Other considerations include specificity of content within a course to a particular audience type, or opportunities for learning object reuse.

The naming conventions used for the various hierarchical levels that are used to organise the learning materials do not themselves matter although the acronym CULT (Course-Unit-Lesson-Topic) is sometimes used. It is the concept of hierarchy that helps define the

navigation and structure of the application, through menus, paging structures, and other navigation devices.

The detailed design should contain all the information required to develop the application, including a list of required media assets. Descriptions of diagrams are generally considered sufficient as these generally reference external materials such as Electronic Technical Publications, paper reference materials or instructor notes or slides.

A detailed design will include:

- Storyboards at a lesson level (a lesson in this definition is taken to be a collection of about 15 – 30 screens). Storyboards may also be described as detailed design documents, and may take a number of formats.
- A voice-over script for each module
- An asset list for the project which describes the images, animations and videos for each project.

### 5.3.1 Story Boards

Storyboards are also sometimes referred to as detailed design documents – although strictly one also needs a voice over script and description of the assets to be included for the document to be self-contained. The exact structuring and formats of the documents generated will vary from vendor to vendor and may vary between types of application, but the overall features will remain the same.

A storyboard should be a clear, concise, design document. As such it should stand on its own; one should not have to rely on external documents (except possibly in the case of diagrams) or have to consult the storyboard author to clarify content. A recommended format for storyboards is presented later.

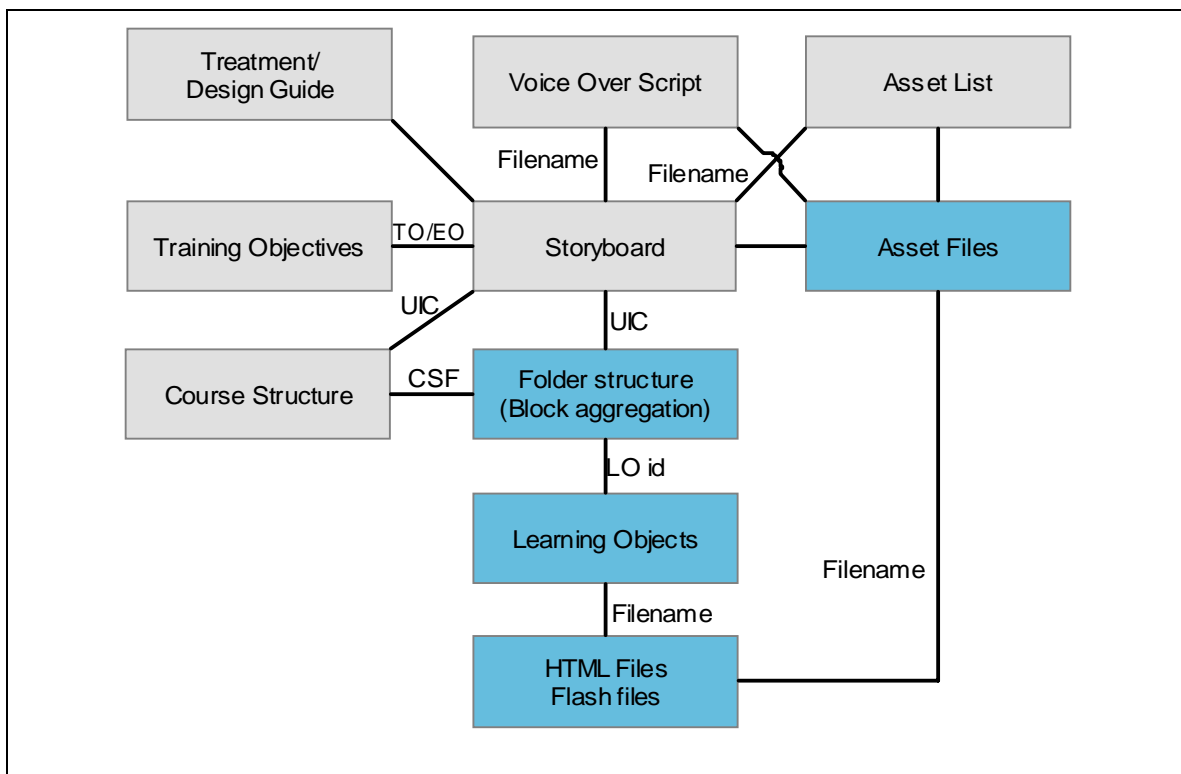
A good storyboard will:

- Enable the application to be produced at a more rapid rate - if the storyboard is precise the authors/ designers/ programmers have more confidence that what they are doing is correct.
- Encourage the staff producing storyboards to think in multimedia terms - the tabular nature of the storyboard encourages the linkage between different media types, and clarifies the timing and interrelation of events. There is a tendency for writers familiar with linear media such as print or video, to sometimes not exploit the full interactive potential of e-learning, the tabular format of the document encourages the writer to think in terms of what is on a particular screen and what images and interactivity is present along with the content.
- Tie the assets (media files), code, training objectives and the application together accurately and tightly - Unique Identification Codes (UIC) and asset numbering will link these components together (see Linking Project Elements later).

- Enable changes and modifications to be more rapidly made - sections can be precisely identified and addressed in a technical context, by referring to the storyboard.
- Reduce asset duplication - assigning asset numbers in the storyboard, gives rise to the asset list at the back of the storyboard. Assets are then produced and stored on the network. Potential duplications become identified by consulting the asset list and redundancy eliminated. This is especially important on large projects where there can be a tendency to re-invent the wheel.
- Provide a more robust framework for archiving - modifications to programs can be made easily due to the tight correspondence between the application and documentation.
- Increase the accuracy of the finished application and minimise errors. This will also speed up review time and number of review cycles needed.
- Provide an essential document for training maintenance (as mandated in DSAT QS and recommended in DTSM1).

In essence cutting storyboarding time is a false economy, because of lengthened production and testing times. Problems faced by internal storyboard writers are: time pressures, technical inaccuracies in support documentation, and the generally short review period for storyboards. All storyboards must be signed off before authoring starts, because cost to correct errors in the authoring phase is probably 3-5x the cost to correct errors in the storyboarding phase.





**Figure 8 - Interdependence of documentation elements**

Figure 8 shows the correspondence between the project elements and documentation. Items in grey are contained in documentation, items in blue are physical files and file aggregations.

The idea is that all components of a project are tied together – training objectives, screens and asset files.

As an example, consider the situation where a piece of e-learning courseware must be maintained to keep it current. A particular panel on a piece of equipment is changed and a new procedure introduced. With an asset list one performs a quick search for the panel name and obtains all the filenames that involve that particular panel. One then searches the storyboard and locates all screens that involve those files, this then identifies all the places within the courseware where the content must be modified. From the screen UICs the developer quickly locates all the files that need to be updated and makes the necessary changes.

UICs, asset filenames and training objectives identifiers are the essential glue that binds the various components together, in a Learning Content Management System (LCMS) many of these functions are supported automatically – however it is always advantageous to have separate hard and soft copies (not in the system) as they are portable, accessible and provide a backup in case of system failure.

### 5.3.2 A sample format for storyboards

The storyboard is the key design document for the production of interactive applications. An incomplete, inaccurate or ambiguous storyboard will greatly slow down development, as content and design issues have to be clarified between designer/developer and storyboard writer before work can continue. Storyboards define when events happen, and how content blocks are linked together; as well as providing content references and suggested design notes. A sample section of a storyboard is provided below.

Section :		UIC	TO/EO	
Title:			Screen Type:	
Body Text/ Voice over reference			Graphic Description:	
Instruction Text:			Interactive Areas / Triggers:	
Feedback Text:			Notes/Keywords	

This format also encourages storyboarders to consider what is on the screen, and how the screens will relate together - encouraging them to think more as multimedia content designers than document writers. The grid layout also shows at a glance if a section has images, text or voice-over missing, and enables the script to be modularised and cross-referenced precisely.

The sections of the storyboard are as follows:

#### **UIC (Unique Identification Code)**

This numeric identifier enables a small part of the application to be precisely and unambiguously referenced. For example; Unit 3, Lesson 2, Topic 4, Screen 11 would be coded UIC: 3.2.4.11. If the application was built in HTML the file corresponding to that screen would be 3\_2\_4\_11.html (or something similar). Naming corresponds to the naming of the HTML,XML or Flash file that represents that particular screen. In other authoring tools the UIC may correspond to the naming of map icons (Authorware) or Markers (Flash/Director). The UIC is the link between code and storyboard, enabling both to be interrelated.

The UIC can be displayed on screen as a variable during application testing, to enable reviewers and testers to pinpoint problems with a numerical reference (the version of the file is also normally appended to aid configuration management). This also enables the author to jump directly to the specified problem in the code and compare with the corresponding place in the storyboard.

### **Section**

This is the name for that particular section (this might be a Lesson or Topic depending).

### **Title**

The Title column indicates which text is to be displayed as a title / sub-title. This should provide the user with information as to what is being shown on screen. It is preferable to have unique titles though with unique UICs this is not essential.

### **Body Text/Voice Over reference**

This cell stores the main text that occupies the screen, which is generally conveying information to the student, or asking a question. The voice-over file reference is given in this column - e.g. 3\_2\_4\_11a.mp3.

Sound files tend not to be reused as much as images - because of this one generally uses the screen UIC as the identifier, however there may be multiple sound files for a screen so the suffix a,b,c etc is usually appended onto the end. The file reference ties into the voice-over script at the end of the storyboard.

### **Instruction Text**

Is the text that gives directions or instructions to the user (such as “*Select the options that are correct by clicking on them, then press <accept>*”).

### **Feedback Text**

This is text that is generated based on user actions. Examples might include rollover text on a diagram or feedback from a formative question.

### **TO/EO (Training Objective or Enabling Objective)**

This section references the Training Objective or Enabling Objective that is being covered in this screen.

### **Screen Type**

This contains a description of the type of screen being represented. Examples include; multiple choice question, drag and drop, staged build of text and graphics or interactive animation. The actual types of screens to be used are normally determined at the beginning of the project. There is a compromise between having too few screen types (a highly templated method); where content is artificially constrained to a few preset types of presentation, or an infinite variety of screens, which leads to expensive development.

### **Graphic Description**

This contains a description of graphics or images accompanying the text.

e.g. Image of sub-module with connectors highlighted (04\_32.jpg)

### **Interactive Areas/Triggers**

This contains a description of the areas of the screen that are interactive or contain triggers for other events, in a question screen this area would contain the text for the various options that the user could select.

### **Notes / Keywords**

Any specific notes to the developer, or client can be inserted here. e.g. “all following text boxes have a close button.” This section can also be used for keywords that the developer can attach to particular sections to enable them to be searchable.

## **5.3.3 Voice-Over scripts**

The voice-over script cross references the asset number of the sound file with the voice-over script:

<b>Sound file</b>	<b>Contents</b>
3_2_4_11a.mp3	By the end of this section you will be able to:
3_2_4_11b.mp3	Describe the operation of the system during the engagement phase
3_2_4_11c.mp3	Describe the operation of the CTA during the guide/gather phase

This saves time of having to extract the sound files from the script, and pasting them into a new document.

## **5.3.4 Other Issues**

Attention should be paid to general issues such as use of capitalisation, abbreviations and units.

Standards for data highways, representation of oil pressures, mechanical linkages, electrical symbols should be defined here - where multiple storyboarders are present they should agree a format for the representation of commonly occurring structures.

Abbreviations, units and other conventions should also be defined here.

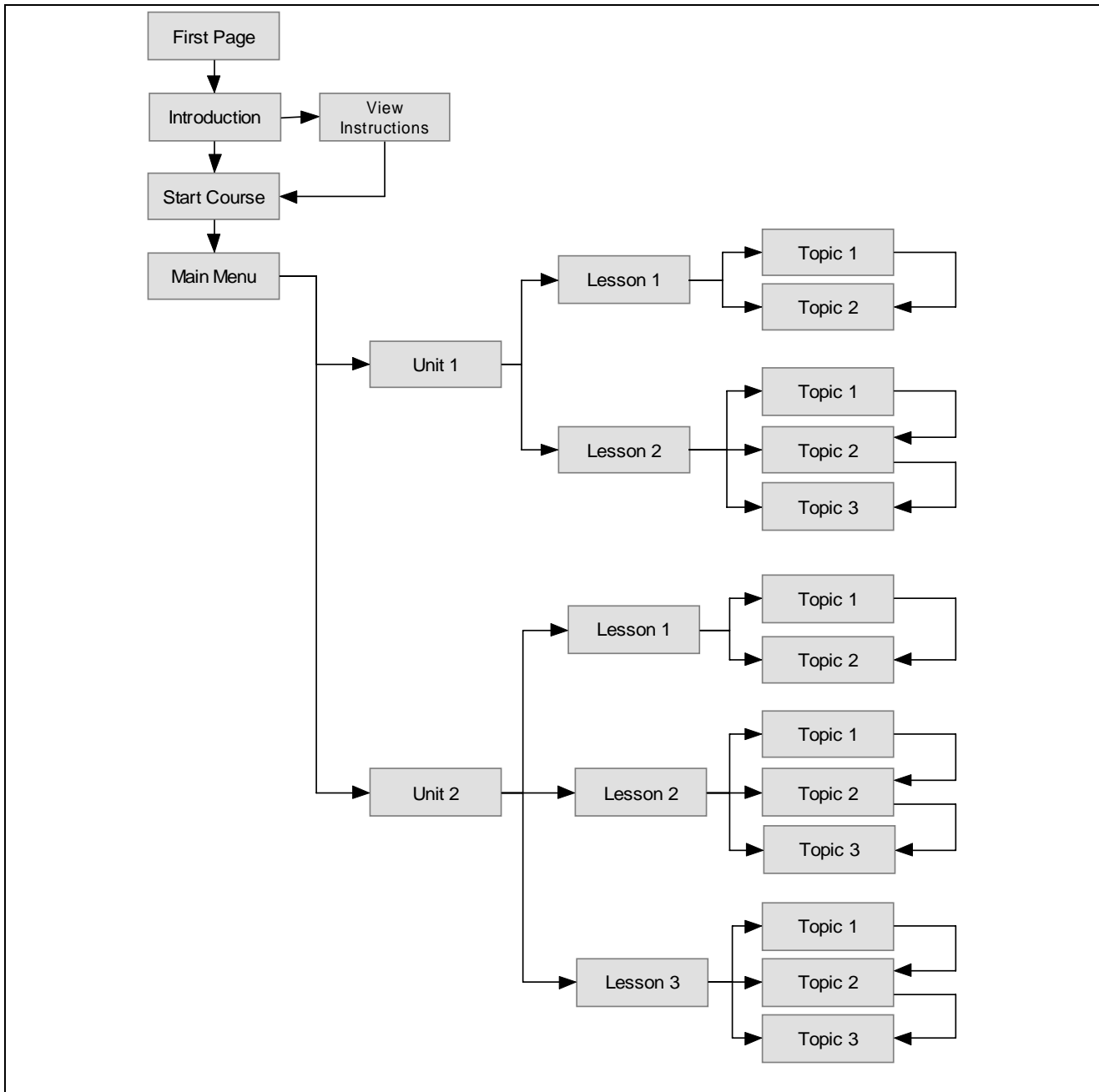
For example:

- s, not S or secs. for seconds

- $\mu\text{m}$ , not micrometer
- Sub-system, not sub-system or Sub-System
- signal names in lead caps, Titles in initial caps etc.

## 5.4 Flowcharts and State Models

The storyboard defines what happens on a small scale within the program (i.e. within the section pages). The larger scale structure is defined by a flowchart, which indicates links between the menus, sections, pages, and other program specific features that may exist such as the course map. A flowchart should always be produced for the application, to define the overall navigation. An example is shown in Figure 9.



**Figure 9 - Sample Flowchart**

Functionality to define the operation of buttons that are perpetually available may also be captured here if required, depending on the complexity of the navigation.

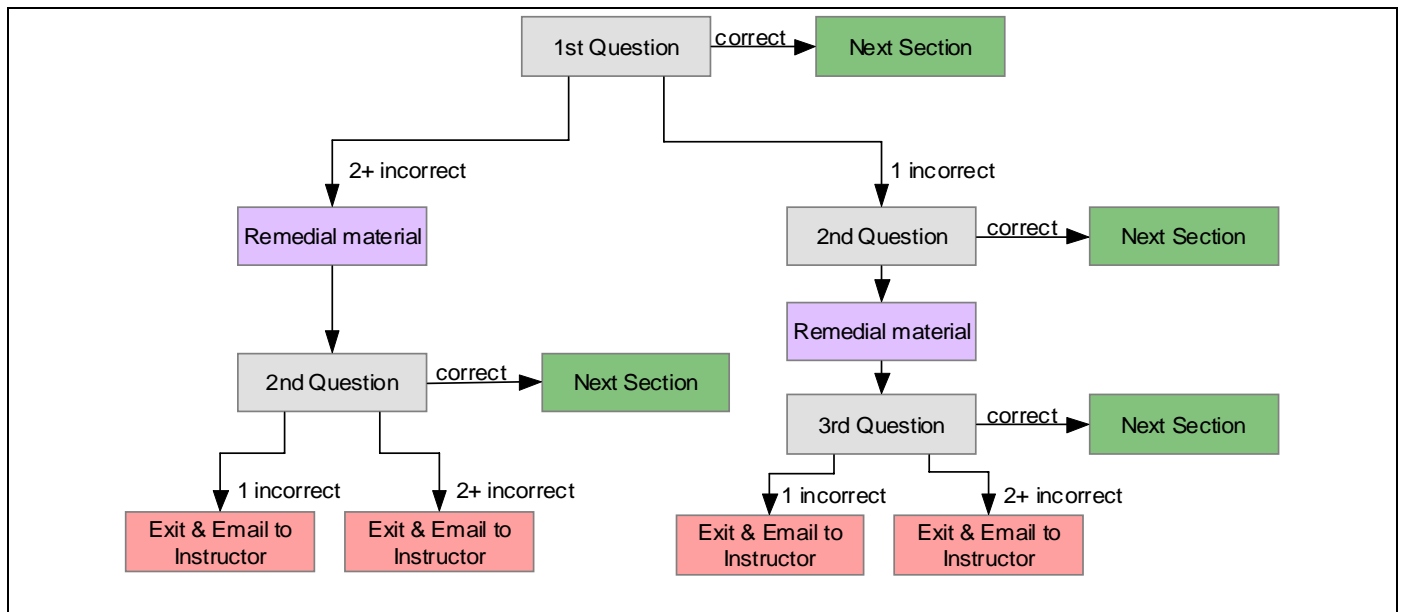
A state model defines which buttons may be available depending on the users context. Examples of context include the type of user, their completion state and position within the structure of the course. The state model defines which buttons are active to which category of user in which section. The state model complements the flowchart in that the

flowchart defines the architecture and possible links, whereas the state model defines the actual possible behaviour.

A sample state model for a course is given below, the 1 indicates that the button is available, 0 that is it unavailable (for example the 'Next' [section] button is only available when the user has successfully completed the section exam, or if the user is an instructor):

Controls	User State								
	In lesson (not done)	Lesson done	End lesson	In question	In remedial	In menu	Question correct	Instructor	In pause
<b>Back</b>	1	1	1	0	0	0	1	1	0
<b>Pause</b>	1	1	1	0	1	0	0	1	1
<b>Exit</b>	1	1	1	0	1	1	1	1	0
<b>Menu</b>	1	1	1	0	0	0	1	1	0
<b>Map</b>	1	1	1	0	0	1	0	1	0
<b>Help</b>	1	1	1	1	1	1	1	1	0
<b>Next</b>	0	1	1	0	0	0	1	1	0
<b>Question</b>	0	0	0	0	0	0	1	1	0

Not all pieces of courseware will require this level of functionality, but this is required when advanced navigation or context sensitive content presentation is required. Within SCORM 2004 the Sequencing and Navigation Book defines advanced branching behaviour that is possible, such as remedial loops and presenting content according to user type. Sample Instructional Design constructs can be found in the Carnegie Mellon University publication – Instructional Design for SCORM. Figure 10 shows a sample sequencing and navigation decision tree for student remediation.



**Figure 10 - Sample sequencing and navigation decision tree for student remediation**

## 5.5 Planning

This section contains a basic checklist, and a summary of the overall methodology to aid development.

### 5.5.1 Generalised Task Planning Checklist

- Design Instructional Framework
- Hold creative ideas session
- Determine delivery platform
- Determine authoring platform
- Assess available content
- Design Navigation Map / Flowchart
- Create storyboards
- Design interface
- Design information containers
- Research / Gather Content
- Assemble team
- Build Prototype



- User Test
- Revise design
- Create graphics / animations
- Produce / Digitise Audio / Video
- Photography
- Author
- Test
- Fix Bugs
- Beta
- Retest
- Final master
- Sign off and delivery

### **5.5.2 E-learning design and development Methodology (idealised)**

- Kick off Meeting

#### **Analysis**

- Audience Analysis
- Environmental Analysis
- Content Analysis
- System Analysis

#### **Instructional Design**

- Instructional Design
- Instructional Goals
- Learning Objectives
- Content Decisions
- Cognitive Model
- Paper Prototype
- Learning Activities

#### **Interactive Design**

- Functional Requirements
- Metaphor & Paradigm(s)

- Interface Design
- Treatment
- Navigation Maps
- Skeleton screens
- Working Prototype

#### **Development**

- Storyboards & Flowcharts
- Scripts

#### **Production**

- A/V Production
- Asset Production
- Integration & Authoring

#### **Implementation**

- Alpha / Beta Test
- Produce final version
- Distribute/Upload
- Test in user environment
- Fix
- Final Delivery

## **5.6 Working with External Developers**

What sponsors and vendors require from each other:

Vendors need sponsors to:

- Allocate sufficient SME resource to supporting vendor development efforts
- Arrange access to equipment, environment or students
- Read and review vendor documents within agreed timescales
- Sign-off deliverables that have been reviewed and approved

Sponsors need vendors to:

- Keep to agreed delivery deadlines to meet the Ready for Training Date
- Provide adequate project management effort, including reporting
- Not overburden SME instructors who may have very limited time to devote to the project
- Understand that review of technical documentation is not a primary job role of sponsor staff and that a degree of training and support may be required to enable sponsor staff to interpret design documentation. To this end functional prototype screens are very useful to demonstrate functionality.
- Perform appropriate configuration management to ensure that the correct versions of deliverables are delivered.

**- End of Document -**

