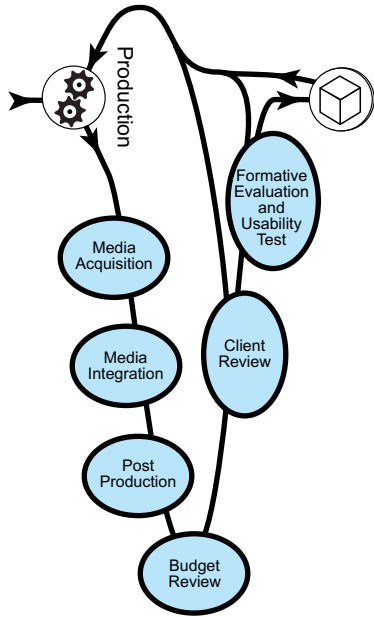


Production





		Initiation	Specifications	Design	Production	Review and Evaluation	Delivery and Implementation
Development	Generic	The overall strategy for product development is determined by the initiation of ideas for MM projects which may come from a variety of sources, the client's expectations and budget.	Detailed specifications are derived from the client's expectations, the user's requirements and the capability of the production unit or organisation.	The design solution identifies the key components, and relationships between, the technical, interface and educational requirements reflecting the primary purpose of communicating effectively with the end user.	Production of quality MM requires the utilisation of developmental environments and media integration strategies linked to the specifications and design solution.	Client review and user evaluation occurs at periodic intervals in the development process, and ensures that the final product meets the needs of the client's.	Delivery and commissioning processes outlined at the planning stage are implemented.
	Online	Providing on-demand access to interactive education/training requires a documented account of not only hardware, software and bandwidth, but also the requirements of the user.	Course design for online delivery focuses on the objectives to be achieved and not on the means of achieving them, necessitating a shift in the instructional design paradigm.		Delivering course material online requires knowledge and understanding of technical issues so that the end user is not impeded by the limitations of the medium.	The review, assessment or evaluation, and modification of online course material will reflect the faster and more cost-effective process.	Once the course is operational, on-going management and maintenance strategies are implemented to ensure currency, correctness and applicability.
Management	Legal	Costs associated with copyright and rights negotiations need to be incorporated into the budget to ensure that legal complications do not jeopardise the project financially.	The diversity of inputs to multimedia means that there are more rights involved and therefore more clearances to obtain for both production and/or delivery of	Endeavour to incorporate a significant proportion of original material in online resources, and that linked materials are attributed to the respective authors.	All copyright restrictions and/or encumbrances should be resolved before production commences.	Arrange any non-disclosures for outside parties involved in evaluation or acceptance testing.	Confirm that all licencing agreements have been finalised and that liability and insurance coverage has been arranged for the delivery of the product.
	Project	Project scope and contract requirements are reviewed. The client is briefed on change control procedures, review and approval procedures, and confirms the	Stated and implied needs of the client are matched with appropriate development methods, tools and skilled resources to supply a quality product.	A global overview of the project is derived once revisions of cost estimates, schedules, team participants and other matters are conducted in accordance with the concept brief and the detailed design	Each skill group, such as graphic artists, animators, programmers, goes about its tasks with appropriate guidance/support from the project manager.	Provide evidence that the project achieved what it was designed to do. Obtain independent evaluation of the expected outcomes from the use of the product.	Provide the handling, storage, packaging, preservation, and delivery mechanism to guarantee the product is shipped as built. Release notes and instructions for installation and setup are provided.
	Risk	The scope of the risk management (business, technical and project risks) to be performed is identified.	Potential risks are identified, analysed and assessed, and mitigation strategies, metrics and corrective actions outlined.	Identified risks are quantified and qualified and corrective strategies are validated.	Mitigation strategies and error trapping techniques are employed to reduce the impact of technical risks and risks associated with interface complexity and creativity.	Confirm that risk management strategies have achieved their purpose in all previous phases and that potential risks are minimised for on-going delivery and implementation.	Strategies to reduce technical risks from version control, documentation development, and pre-testing will be employed.
Support	Change Control	The project deliverables and their associated supporting documents, are identified, presentation standards are defined and change procedures established.	A baseline for the user's requirements for the system is established and defined, and changes to the baseline are agreed through a formal process.	The design solution is traceable to the requirements baseline, and agreed changes are reflected in both.	The integrity and consistency of the developed system is ensured through the enforcement of agreed standards and control of change.	Changes to the user's requirements identified during evaluation of the multimedia system are agreed through a formal process.	The configuration for the developed multimedia product to be implemented and distributed is defined and agreed, and placed under formal controls.
	Quality Assurance	Planning for the project assures key sponsors that the plans, procedures and standards outlined will be followed, and that any issues previously raised have been addressed for quality.	The QA group will confirm that the specification of user requirements has been reviewed for completeness and feasibility, and that any issues previously raised have been addressed.	Confidence is established that the design solution accurately reflects the user's requirements, and that the agreed standards are followed.	The developed system is shown to be derived from the agreed design using defined actions and agreed standards.	The agreed steps for addressing issues raised in evaluation will be shown to have been followed.	The planned tasks for implementing and distributing the final product will be shown to have been followed.
	Validation & Verification	A strategy, including tools, techniques and activities, is defined for determining whether each work product functions correctly and meets the user's requirements for the product.	Criteria for verifying the system specification, and for demonstrating that the requirements have been satisfied, will be defined and applied.	The correctness and appropriateness of the design solution will be demonstrated through a process of design review.	The developed system and its components are shown to be a robust and accurate reflection of the user's requirements.	Evaluation and testing will confirm that the user's requirements have been fully addressed as well as identify and rectify technical and other errors.	Verify that the implementation criteria have been fully addressed and that the product meets the client's and/or end user's requirements in an operational environment.

PRODUCTION

Development	Generic	Production of quality MM requires the utilisation of developmental environments and media integration strategies linked to the specifications and design solution.
	Online	Delivering course material online requires knowledge and understanding of technical issues so that the end user is not impeded by the limitations of the medium.
Management	Legal	All copyright restrictions and/or assignments and encumbrances should be resolved before production commences.
	Project	Each skill group, such as graphic artists, animators, programmers, goes about its tasks with appropriate guidance/support from the project manager.
	Risk	Mitigation strategies and error trapping techniques are employed to reduce the impact of technical risks and risks associated with interface complexity and creativity.
Support	Change Control	The integrity and consistency of the developed system are ensured through the enforcement of agreed standards and control of change.
	Quality Assurance	The developed system is shown to be derived from the agreed design using defined actions and agreed standards.
	Validation & Verification	The developed system and its components are shown to be a robust and accurate reflection of the user's requirements.

Overview of the Phase

Once the detailed Design Document has been reviewed and approved, the media elements; text, audio and video etc, are digitised and synchronised into an integrated multimedia system. Attention to detail, consistency and expertise at this stage are so crucial that they can make or break the product regardless of the authoring / programming language used. Clear and open communication between team members is equally important. Adherence to the specified technical aspects and formats are monitored and reviewed along the way.

The production process consists of a series of parallel tasks which may overlap at various points. If the project is especially large and complex, with hundreds of visuals, sound files, pieces of text and video clips, this process can be quite daunting. Control of change is even more critical than in previous stages as the product goes through a series of iterations. An *alpha* version of the product with sample features, navigation structure and some of the content is provided to the client for feedback and testing or may be delivered as a proof-of-concept. The *beta* version contains all the functionality and content with no (or few) known bugs.

Media acquisition is finalised and all rights and/or licences negotiations are completed.

Key Features

- The media elements are integrated into a working prototype or proof-of-concept which is reviewed and evaluated.
- Feedback reports from the review and evaluation are reviewed with suggested changes costed.
- Control of change in this phase is critical in order to produce a product on time and within budget.
- The Quality Assurance group confirms that the specified and agreed standards for implementation have been followed.
- Archiving of the master data is made on a regular basis.
- The scope of the project is assessed, divided into manageable tasks and achievable milestones are set.
- Style guides are created for text production, video, graphics and other media elements to ensure consistency.
- The content is jointly verified by subject matter experts and nominated members of the production team.
- Checks are made on all content and code to detect viruses, delete unused code and to optimise the data for the delivery medium.

Production

Production of quality MM requires the utilisation of developmental environments and media integration strategies linked to the specifications and design solution.

Description

The detailed specifications of the target audience, metaphor(s) and the interface, and skeleton or detailed storyboards in the Design Document outline the pre-production, production and post-production activities of this phase. Audio scripts, shot lists for still frames, graphics, animations, text scripts and video scripts/storyboards are named according to a specified convention, and assembled into a Production database which records the data so that it can be sorted into sequences that will enable efficient production. Once each multimedia component is created the audio, video and other program elements are integrated, keeping in mind the necessary balance between practical information management on screen and the aesthetics of presenting text and graphics. Confirmation is required to ensure that both the production team and client have a clear understanding of goals, resources and time commitments before production begins.

A list of changes and improvements is compiled and incorporated into the product before the final review process and approval of the product.

Tasks

Document the media elements

Using the flowcharts, or detailed storyboards which may have been created, each member of the team constructs the documentation required to produce their particular element. The video storyboard, for example, lists every required motion video segment as detailed in the Design Document, each segment is assigned a file name which is used to track it all the way through Production and, depending on the complexity of the project, each segment has a video script written for it.

Produce the multimedia elements

Video, sound, illustration images and other media are converted into digital form ensuring that the size, colour, sound levels, resolution etc meets the detailed specifications. Shoot original video footage, create graphics, text and other elements. Consider repurposing existing material where appropriate. Prepare adjunct materials. Undertake any post-production activities such as online editing of the video material.

Integrate multimedia elements

Many multimedia products need to be cross-platform so the authoring/programming tool can be dictated by the client's requirements and not necessarily the available in-house skills. Document the code for debugging and on-going maintenance. Consider developing tools to automate processes which can save time and money, for example changing the attributes of a button with different colours in different locations.

Produce a proof-of-concept

Obtain 'start-up' funds from the client to produce a proof-of-concept which demonstrates some artwork, interactive navigation and performance checks or examines specific technology issues. The focused experience of this proof as the first iteration of the project can provide a realistic estimate of the work and cost required.

Develop a prototype

The prototype, which goes through several iterations before completion, is the working model of the conceptual design and is used for testing and evaluation purposes.

Production

Delivering course material online requires knowledge and understanding of technical issues so that the end user is not impeded by the limitations of the medium.

Description

Integrating elements for the Internet, in particular the WWW, requires many of the same production activities as generic multimedia. However, structuring a large information domain into organised objects which are then linked and tested can challenge developers. In addition, if the course is delivered via the WWW the same HTML document will look quite different in every web browser used to view it. Progressive rendering and interlacing of graphics, 'outlining' of content, reusing graphics, clear navigation pathways, creating a visual style and applying it rigorously across all web pages are all techniques which can bypass some of the delivery limitations.

The dynamic nature of online education/training courses requires tools which not only integrate the multimedia elements but have other features such as the ability to create lessons, exam questions etc. Other management features may enable administrators, via their web browsers, to oversee all aspects of the course from monitoring student activity to updating course information.

Tasks

Plan for final storage size and online performance characteristics

Ensure that the client has sufficient file storage space. Review the bandwidth connection and test every link. Check all content and code for viruses, review data rates and file decompression rates.

Document, produce and integrate all components

Online development has three major activities: Information Partitioning, Information Layout and Navigation Design. The Design Document details the navigation design and how the information/content will be partitioned. The Information Layout is defined in three primary structures: Procedural, where the sequence is critical; Hierarchical, where one piece of information contains many parts (all related by the overriding information structure); and Flat where everything is related to everything else. Integrating the content is one or a mixture of these activities, taking account of interrelationships between the text and visual elements such as graphics.

Determine course management tools

Course management features which support the online education/training product include: monitoring student activity; verifying student's access to modules; built-in surveys which collect information from users, whether browsing or utilising the course; and online discussion groups.

Consider visual feedback limitations

The main difference between web pages and other forms of multimedia is in the ways that buttons and image maps interact with the user. These elements usually lack visual feedback and can confuse the user but this confusion can be overcome by simple and subtle visual clues such as a frame which changes colour.

Generate a prototype

Using basic information about the end users' platform and bandwidth, define a 'site' by specifying the directories for the HTML files or CGI scripts. Add the multimedia elements and link them together and set the page-specific attributes. Review the product.

Production

All copyright restrictions and/or assignments and encumbrances should be resolved before production commences.

Description

To avoid major rework, or possible project termination, the Project Manager should ensure that all copyright restrictions and encumbrances have been resolved and that the client has accepted the resolutions.

Part of the entry criteria before production begins should include an independent review of the status and disposition of potential intellectual property restrictions.

Tasks

Review entry criteria to commence production

The Project Manager should review the entry criteria before production commences. This review should be conducted with the developer's senior management.

Resolve all copyright restrictions and encumbrances

Where copyright restrictions or encumbrances need to be resolved, record the outcomes of those resolutions, including any considerations required by the owners of the copyright.

Review status of copyright issues with client

Copyright clearances and other IP issues are reviewed with the client prior to commencement of production. The Project Manager may use contacts with other stakeholders to help resolve outstanding issues.

Rework estimates and budgets as required

When all copyright clearances and considerations for use of IP are known, rework estimates and budgets for the project. Consider whether actors/voice-over people will be members of a union as this will impact on fees for service.

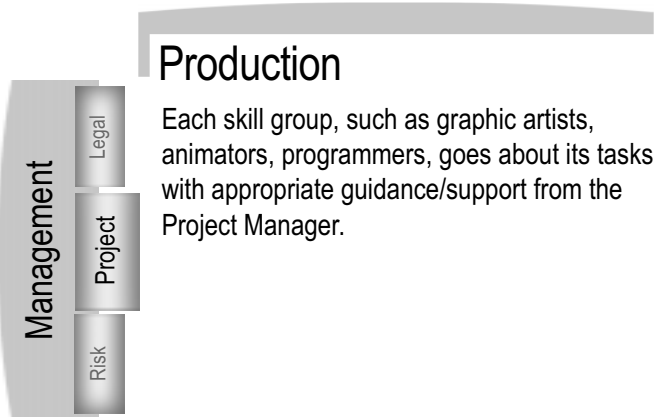
Obtain client approval to commence production

Review revised estimates and budgets for the project with the client and obtain authorisation to commence production.

This may not be required for small projects, or where copyright clearances have minimal impact on the current estimates and budget.

Review agreements with 'talent'

Acquire signed release forms if non-union people are used (authorisation specifies terms for use of the name/voice, sounds, etc) and have it reviewed by legal counsel. Actors Equity and similar unions have proprietary release forms.



Description

The Project Manager implements and executes the project management plan(s). The multimedia product is developed in accordance with the development methodology.

The quality of the multimedia product and project progress is monitored and controlled through the life cycle. This ongoing, iterative task should:

- monitor progress of technical performance, costs, and schedules, and reporting of project status.
- identify, record, analyse and resolve problems and issues as they arise.

Communication with the client is as specified in the contract or the project plans.

Payment requests (invoices) are raised for progress payments according to the contract or billing schedule.

Tasks

Implement Project Plan

Implement, execute and maintain the Project Plan for the period of the project.

Develop project team

Reward and recognition of the team, training and other team building activities are performed.

Develop multimedia product

Develop the multimedia product according to the development methodology, the requirements, and the Acceptance Criteria set.

Monitor progress

The Project Manager monitors the execution of the Project Plan, providing both internal and external reporting of progress as required by organisational procedures, or defined by the contract.

Perform quality assurance and control

Conduct reviews, inspections, and audits to prevent or correct project inconsistencies. These include both product (deliverables) and management performance (cost and schedule).

Resolve problems

Investigate, analyse and resolve problems discovered during the execution of the plan. Resolution of problems may result in changes to the plans. The Project Manager ensures that the impact of any change is determined, controlled and monitored. Problems and their resolution are documented.

Perform corrective action

Fix the product or change the planned set of activities used to achieve the required goals, or both.

Report progress and distribute information

Progress is reported at agreed points to confirm achievement of plans and any corrective actions needed to resolve delays or resolve problems.

Claim progress payments

Arrangements are made for progress claims and invoices to be created as required by the contract or billing plan.

Production

Mitigation strategies and error trapping techniques are employed to reduce the impact of technical risks and risks associated with interface complexity and creativity.

Description

Product quality and production risk measures are used to identify potential problems. The measures include size, complexity, internal and external documentation.

Size - depending on the type of asset (particularly video and animation), large asset files can become difficult to work with and maintain.

Complexity - assets with higher complexity can be more difficult to work with, and may have a higher probability of defects.

Correlation between size and complexity - in multimedia there is a direct relationship between complexity and size. The more detailed and complex a graphic is, for example, the larger the file.

Tasks

Implement Risk Management Plan

Execute the plan and apply the strategies. Production effectiveness measures include resource usage and completion rates.

Resource usage - if significant effort is being used on requirements activities during design (or during production), there is a risk that the project will not be able to meet its schedule objective. Where creative effort is not producing results, intervention may be necessary.

Completion rate - if the completion rate of assets is available from the configuration management system, then the information can be used to project the expected completion date and an estimate of the risk of completing all assets on time can be made.

Monitor changes to risk status

Use risk measures to monitor changes to risk status. Risks that do occur are actual risk events or sources of risks, and the project management team must recognise that one has occurred so that the developed response can be used.

Identify, quantify, and respond to changes

During production, the basic cycle of identify, quantify, and respond to risks is repeated. Technical risks often surface at this point.

Develop workarounds

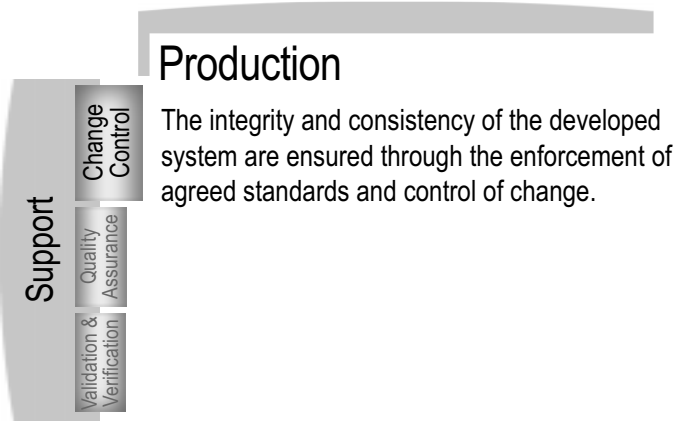
Workarounds are unplanned responses to negative risk events. They are unplanned only in the sense that the response was not defined in advance of the risk event occurrence.

Develop additional risk responses.

When a risk event is not anticipated, or when the effect is greater than expected, the planned response may not be adequate, and the quantification and mitigation strategy will need to be repeated.

Perform corrective actions

When expected progress in risk mitigation is not achieved, perform corrective action. This may involve development and implementation of new strategies or adjusting the existing strategies.



Production

The integrity and consistency of the developed system are ensured through the enforcement of agreed standards and control of change.

Support

Change
Control

Quality
Assurance

Validation &
Verification

Description

The Production phase is concerned with the integration of components into a complete system. Prototypes developed at various stages within production should be demonstrated to be traceable to the current agreed requirements, and standards for the production techniques must be agreed and enforced. Not all components of the system can be prototyped; however, aspects such as the user interface and some of the control systems can be evaluated without the need to integrate the full system. Whatever the strategy for prototyping, change control continues to be a major management concern.

The development and maintenance of a controlled environment for development is a significant issue for this phase. The developer needs to be confident that the development tools are stable and consistent. In a controlled environment, migration to new versions of development tools is disciplined, and persons other than the developer cannot gain access to the products under development.

Tasks

Establish security of the development environment

During the Specifications and Design phases, a decision is taken as to the environment in which the completed system will be implemented. Where it is decided to develop an online multimedia system, this has significant implications for the control of change during the Production and later phases. The question of regulating access to the development environment immediately arises. Also, decisions as to the nature of the development environment have to be resolved; it is not necessary that an online system is developed in an online environment, but if it is not, the mechanism for controlled migration to the production area must be resolved.

Define the production baseline

The complete system defined on completion of the production activities is designated as a baseline, for demonstration to the client as a prototype. Components of the system may pass through different numbers of versions in their evolution.

Document change requests

The evaluation of each prototype may lead to the generation of a number of problem reports, which will be dealt with under V&V. If the process is operating correctly, though, requests for changes to the user requirements should also be generated. Some of these may reflect minor modifications in functionality and content, and may not require formal approval; however, where substantial changes in the direction of the project or the functionality of the product are proposed, there must be an evaluation of the impact of the changes, and formal approval of the change request.

Review and approve requests for change

Where changes are requested, a procedure should be established for the approval process. The procedure should include: evaluating the scope of the proposed change; identifying benefits from the proposed change; assessing the impact of the proposed change on budget and schedule for the project; documenting the costs and benefits for the approval process; and identification of where the authority to approve changes lies.

Production

The developed system is shown to be derived from the agreed design using defined actions and agreed standards.

Description

Quality assurance actions in the Production phase are concerned with the enforcement of standards. In a prototyping environment, as applies in most multimedia developments, it is easy to allow the application of standards to become haphazard, in the interest of providing rapid feedback. QA must ensure that this does not occur; or that if it does, corrective action is taken.

The QA group must confirm that the agreed standards for implementation have been followed. These should cover all of the system components: it is as necessary that graphics are prepared using agreed formats and dimensions, as it is that software code meets agreed coding standards.

In addition, the group confirms that the specified production actions are carried out. These include not only the development of the components, but also their integration and evaluation in the form of workable prototypes. Prototypes must be adequately evaluated, and issues raised in the evaluations followed up and resolved.

Tasks

Identify requirements for audit and review

The nature of reviews and audits in this phase depends to a considerable extent on the type of system being developed. With offline systems, the standards for development must be followed, and the toolset chosen for the development needs to be effective. With online development, additional issues are addressed, primarily dealing with the security of the development environment, and the mechanisms for ensuring integrity in migrating the system to production.

The review and audit requirements are clearly identified and documented at the commencement of the phase, and applied in the scheduled assurance activities. As the product is iterated through a series of prototypes, the requirements should be reviewed to ensure that they remain relevant.

Confirm the security and integrity of the development environment

Unplanned changes in the toolset, upgrades of products without evaluation, and even the

acquisition of new hardware can have significant effects on production. QA reviews should ensure that the integrity of the development environment is maintained throughout the project, with any modifications being performed after adequate evaluation of their impact. In online development, security of the environment is also a major issue, and QA reviews the access arrangements to ensure that security is not compromised.

Confirm adherence to development standards

These standards do not apply to all system components; standards for graphic file formats, video and audio compression, and text format are all important for the eventual success of the project.

Review actions on change requests

The prototyping process generates modifications and refinements of the user's requirements. Where these proposals for change would have significant impact, they should be processed through a formal change control procedure.

Production

The developed system and its components are shown to be a robust and accurate reflection of the user's requirements.

Description

The Production phase involves the development of a series of prototype systems, based upon the agreed and verified designs. The task in this phase is to confirm, by exercising the developed system, that it is properly constructed - robust - and is also a good reflection of the user's requirements.

Problems with the correctness of the system - incorrect implementations of the design - should be corrected in the prototyping production; problems identified in the requirements themselves, or in the way the system has been specified or designed, should be fed back into the next iteration of specifications.

Correct recording of the results of testing and evaluation, and feedback of the results through the process of problem resolution, are an important aspect of the work in this phase.

Tasks

Define criteria for evaluation of production system

The criteria for evaluation of the prototypes developed in the Production phase will vary as the product becomes more mature. On each iteration through the cycle, the criteria is reviewed and revised, to take into account the increasing maturity of the product and the changing expectations of the users evaluating the prototypes. In the early stages of development, criteria is strongly focused on usability of the interface; as the product matures, the ability of the system to meet its learning goals becomes the major feature.

Record results of prototype evaluation

The observations of the users and clients who undertake evaluation of the prototypes are recorded to provide accurate feedback to the developers. The level of recording can cover a wide range; with small systems, and in the early stages of development, records in the form of meeting minutes, with notations of major design

decisions, will be adequate. With mature, larger systems, it may be of value to consider video recording of user interactions with the prototypes, for later evaluation. In some cases, full scale usability laboratory evaluation may be worthwhile.

Record results of unit and system testing

The developer should test the system under development, both at the unit level (that is, the individual elements of the system) and integrated to the system level. The results of both unit and system testing should be recorded, and any anomalies found should be noted and resolved.

Resolve problems and issues raised

Prototype evaluation is only useful if it serves to inform the developer of the user's needs. One way in which this can be ensured is by recording issues and formalising their resolution. This flows on from the recording of the evaluation of the prototypes; the observations made are then analysed and structured into a clearly defined set of issues. These can then be resolved by consultation between developer and client.

Production

Work Products

Test Logs

Test logs should demonstrate that all defined test cases have been performed.

Test Results

Results of testing may be included in the Logs, or may be separately documented. Problems raised will be documented in Problem Reports.

Prototypes/Proof-of-Concept

These provide a number of interested parties with a 'snapshot' of the project at a particular stage of development.

Prototype Evaluation Report

Reports on the evaluation of prototypes by the client and user representatives should be prepared, highlighting the strengths and weaknesses of the prototype.

Invoices

Invoices are submitted according to the billing plan to request payment for work performed.

Project Status Report

Record of the actual status of project against plan. Milestones, costs, resource usage, time, and quality status are compared against the plan. Changes to risk status and strategies are identified.

Corrective Action Log

Identifies the initial problem, issue, or defect, and the owner for the completion of the defined action is recorded. A series of actions to fix the problem are identified, and the open date and target closure date are recorded. A status indicator is used to aid exception reporting.

Opportunity and Threat List

Identifies the opportunities and threats, and records a classification against each. The classification identifies the severity of the item, the impact on the project, and the current status in terms of avoid, mitigate, or accept (with contingency plan).

Review Records

Results of reviews of the product and associated activities at specified periods are recorded.

Risk Measures

Established measures for each risk or risk class are recorded and an indicator to measure changes in the risk status is defined.

Workaround

A documented procedure to temporarily avoid or fix a problem. May have other impacts on performance or operations.

Production

Questions to Confirm this Phase

Has access to the development environment been controlled?

Can all correct versions of all of the components of the current version of the system (prototype) be identified?

Has the current prototype been properly evaluated using agreed criteria?

Has feedback from the prototype evaluation been addressed by raising problem reports and /or change requests?

Have any change requests been addressed through the agreed procedures?

Can it be confirmed that the standards for development have been enforced?

Has the current prototype been adequately tested at unit and system level?

Are the test scripts and test cases used, documented?

Are problems found during prototype evaluation or testing recorded and tracked to resolution?

Have all multimedia elements been coordinated and orchestrated for integration?

Are integration strategies linked to the specifications and design solutions?

Have all copyright issues been resolved?

Are all online components ready to be put on a server and tested?

Does the quality of video and audio satisfactorily add to the overall effectiveness of the learning experience?

Have all components been checked for technical accuracy, spelling, attractiveness, and clarity?

Have all rights, licenses and releases been obtained for materials used in production?

Have the correct versions of all the components been used to build the product?

Is the product ready for release for evaluation?

Have all the problems, feedback comments and outstanding issues been resolved to closure?

NOTES

