Unit 8: Computer Games Development

Level: **3**

Unit type: **Internal**

Guided learning hours: **60**

Unit in brief

Learners investigate the computer games industry and its impact on technological and social trends. They will design and develop a computer game to meet requirements.

Unit introduction

The computer games industry has been growing year on year and has become a multi-billion pound industry. With the prevalence of computing devices, games consoles and mobile devices, this growth shows no sign of slowing. Many computer games are vast productions involving a range of people such as programmers, graphical artists, animators, level designers, actors and directors. As a games developer, you will analyse the needs of a client and understand the potential and limitations of different gaming solutions.

In this unit, you will investigate the technologies used in the computer gaming industry and the implications they have for users, developers and organisations. You will analyse how user needs and preferences impact on game design and how target technologies affect the design and development of a computer game. Finally, you will design, create and review a computer game to meet requirements and reflect on the skills and understanding applied during the design and development process.

You will apply analytical skills that would be used by any software developer to investigate the available technologies and current trends in order to design and develop appropriate software solutions. The skills you gain through this unit will benefit you as you progress to employment in the computer gaming industry, for example in computer games developer and software developer roles.

Learning aims

In this unit you will:

A Investigate technologies used in computer gaming

B Design a computer game to meet client requirements

C Develop a computer game to meet client requirements.

Summary of unit

Learning aim	Key content areas	Recommended assessment approach
A Investigate technologies used in computer gaming	**A1** Social trends in computer gaming **A2** Technologies used in computer gaming	A report investigating and evaluating social and technological trends in gaming and how they would influence the development of new computer games.
B Design a computer game to meet client requirements	**B1** Computer games design processes and techniques **B2** Design documentation **B3** Reviewing and refining designs	A design specification showing the design and development of a computer game to meet identified client requirements. Project brief, design documentation, development and testing logs, meeting notes and a report that evaluates the effectiveness and appropriateness of the computer game. The evidence should also suggest ways in which solutions could be improved and/or alternative solutions that could be used if the task were to be repeated.
C Develop a computer game to meet client requirements	**C1** Principles of computer games development **C2** Developing computer games **C3** Testing computer games **C4** Reviewing computer games **C5** Quality characteristics **C6** Skills, knowledge and behaviours	

Content

Learning aim A: Investigate technologies used in computer gaming

A1 Social trends in computer gaming

Social trends relevant to computer games, including:

- popular genres
- players, e.g. age range, gender, casual gamers, immersive gamers, themes
- game production, e.g. mainstream publisher, indie, free-to-play
- multiplayer
- artificial intelligence, e.g. search algorithms, mathematical optimisation, logic
- emerging technologies
- security of integrated services and multiplayer environments, e.g. Steam, Google Play™.

A2 Technologies used in computer gaming

Technologies are continually evolving; it is vital to remain up to date with what is current at the time.

- Benefits and limitations of different platform options for the development of computer games:
  - personal computers, e.g. Windows®, Mac®
  - consoles, e.g. PlayStation®, Xbox™, Nintendo®
  - mobile devices, e.g. smartphones, tablets, notebooks
  - web based, e.g. Flash®, HTML5.
- Hardware options and their effect on the development of computer games, including:
  - central processing unit (CPU)
  - graphics processing unit (GPU)
  - memory, e.g. random-access memory (RAM), read-only memory (ROM)
  - output, e.g. display, sound
  - input, e.g. keyboard/mouse, touch, gamepad, joystick, kinetic, voice
  - storage, e.g. hard disk drive, cloud
  - connections, e.g. internet, local area network, mobile network
  - new technologies.
- Software options and their effect on the development of computer games, including:
  - operating system, e.g. Windows, Mac OS, Linux®
  - programming language, e.g. C++, Java®
  - device drivers, e.g. input/output devices
  - graphic options, e.g. DirectX®, OpenGL
  - audio options, e.g. music, ambiance, file format.
- Uses of game engines, their capabilities and how they aid computer game developers, including:
  - rendering engines
  - physics engines
  - collision detection
  - scripting
  - animation.

Learning aim B: Design a computer game to meet client requirements

B1 Computer games design processes and techniques

- Mathematical techniques and processes.
- Graphic processing and editing techniques.
- Platform and delivery.
- Visual styles.
- Assets.
- Game play features, to include:
  o interaction model, e.g. avatar, omnipresence
  o participation, e.g. single player, multiplayer
  o narrative, e.g. story, dialogue
  o game setting, e.g. physical, temporal, environmental, emotional, ethical
  o goals, e.g. what the player needs to achieve in the game
  o challenges, e.g. what the player must overcome
  o rewards, e.g. what the player will receive for completing goals or challenges
  o player actions, e.g. run, jump
  o rules, e.g. valid moves, how high the player can jump
  o feedback, e.g. how the player knows their progress
  o difficulty, e.g. degree of challenge
  o game mechanics, e.g. inventory, scoring, win condition
  o game structure, e.g. storyboard, flowchart, activity diagram
  o quality, e.g. compatibility, performance, gaming experience.

B2 Design documentation

- Requirements of the brief, including audience, purpose and client requirements.
- Legal and ethical considerations applicable to the equivalent legislation in England, Wales and Northern Ireland, e.g. copyright, royalties, digital rights management.
- Game design, to include:
  o type of gameplay
  o data dictionary
  o algorithm design, e.g. pseudo code
  o storyboards, flow charts, activity diagrams
  o visual styles, e.g. world (terrain, architecture, objects), characters, non-playing characters, feedback interface, perspectives (2D, 3D, first-person, third-person, scrolling, aerial and context-sensitive)
  o full motion video
  o assets, e.g. graphical, audio and video
  o gameplay features.
- Choice of programming languages, application program interface (APIs) and computer game development kits.
- Intended platform/media for delivery.
- Timeline, e.g. outlining which different assets are included and when different assets will be combined.
- Production schedule, e.g. timeline of development.
- Hardware, software and other resources required.
- Test plans to check playability, performance and other quality characteristics.
- Constraints, e.g. platform limitations.

B3 Reviewing and refining designs

- Working with clients and others to improve the quality, effectiveness and appropriateness of designs, including:
  - o gathering feedback from client(s) and potential users
  - o communicating with clients, e.g. email, verbal communication
  - o scheduling and documenting meetings
  - o agreeing and adjusting timescales
  - o refining ideas and solutions.
- Updating design schematic documentation based on review and feedback.

Learning aim C: Develop a computer game to meet client requirements

C1 Principles of computer games development

- Design schematics.
- Computational processes applied to computer games development, e.g. use of rendering engines.
- Principles of mathematics applied to computer games development, e.g. vector, physics.
- Prototyping and game engine selection.
- Tools and techniques used to develop computer games.
- Quality characteristics used to test and assess suitability of computer games.
- Technical constraints.

C2 Developing computer games

- Visual style:
  - o omnipresent, e.g. area of vision
  - o avatar, e.g. line of sight.
- Input methods:
  - o keyboard and mouse
  - o gamepad
  - o customisation of control, e.g. user configuration.
- Asset integration, to include:
  - o graphical, e.g. raster, vector
  - o animation and video, e.g. cut scene, story, arc
  - o audio, e.g. syncing sound clips with visual displays
  - o texture mapping, e.g. applying texture to a mesh
- Advanced features, to include:
  - o artificial intelligence, e.g. search algorithms, learning algorithms
  - o 3D rendering, e.g. 3D environment, first-person view
  - o save game state, e.g. options to save, auto-save points
  - o multiple players, e.g. multiple player controls, via network
  - o player progression, e.g. achievements, leader boards.

C3 Testing computer games

- Test computer games including playability, compatibility, stability and acceptance.
- Obtain feedback from others, e.g. effectiveness, presentation, performance, accessibility, portability, robustness, purpose.
- Make improvements and/or refinements to computer games in response to testing and feedback from others.

C4 Reviewing computer games

- Quality of the computer game.
- Suitability for audience and purpose.
- Suitability against the original requirements.
- Legal and ethical constraints.
- Technology constraints.
- Strengths and improvements.
- Platforms and compatibility.

C5 Quality characteristics

- Sources of quality characteristics which can be measured suitably against computer games, including playability, performance and presentation.

C6 Skills, knowledge and behaviours

- Planning and recording, including the setting of relevant targets with timescales, how and when feedback from others will be gathered.
- Reviewing and responding to outcomes including the use of feedback from others, e.g. IT professionals and users who can provide feedback on the quality of the computer games and their suitability against the original requirements.
- Demonstrate behaviour and its impact on outcomes to include professionalism, etiquette, supportive of others, timely and appropriate leadership, accountability and individual responsibility.
- Evaluating outcomes to help inform high-quality justified recommendations and decisions.
- Evaluating targets to obtain insights into own performance.
- Media and communication skills, including:
  - the ability to convey intended meaning, e.g. written (email, design documentation, recording documentation, reports, visual aids for presentation use), verbal communication requirements (one-to-one and group, informal and formal, situations)
  - use of tone and language for verbal and written communications to convey intended meaning and make a positive and constructive impact on audience, e.g. positive and engaging tone, technical/vocational language suitable for intended audience, avoidance of jargon
  - responding constructively to the contributions of others, e.g. supportive, managing contributions so all have the opportunity to contribute, responding to objections, managing expectation, resolving conflict.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate technologies used in computer gaming		**A.D1** Evaluate the impact of current and emerging technologies on the design and development of computer games to meet the requirements of the users and the computer games industry.
A.P1 Explain social and technological trends of computer games. **A.P2** Explain how current and emerging technologies impact computer games' design and development.	**A.M1** Discuss how current and emerging technologies impact on how games are designed and developed to meet the requirements of the users and the larger computer games industry.	
Learning aim B: Design a computer game to meet client requirements		**BC.D2** Evaluate the design and optimised computer game against client requirements. **BC.D3** Demonstrate individual responsibility, creativity and effective self-management in the design, development and review of a computer game.
B.P3 Produce designs for a computer game that meet client requirements. **B.P4** Review the designs with others to identify and inform refinements.	**B.M2** Justify decisions made, showing how the design will fulfil its purpose and client requirements.	
Learning aim C: Develop a computer game to meet client requirements		
C.P5 Produce a computer game to meet client requirements. **C.P6** Test a computer game for functionality, usability, stability and performance. **C.P7** Review the extent to which the computer game meets client requirements.	**C.M3** Optimise a computer game to meet client requirements.	

Essential information for assignments

The recommended structure of assessment is shown in the unit summary along with suitable forms of evidence. *Section 6* gives information on setting assignments and there is further information on our website.

There is a maximum number of two summative assignments for this unit. The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, C.P7, B.M2, C.M3, BC.D2, BC.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to computer software resources that will allow them to use the tools and techniques (given in the unit content) to design and develop computer games, for example game engines such as Unity®, Unreal Development Kit™, or similar.

Essential information for assessment decisions

Learning aim A

Centres may wish to focus on particular areas such as specific consoles, devices, or genres of computer games. Learners must however be given the opportunity to explore alternative areas during their investigation and design.

The evidence must include discussion of social and technological trends in computer gaming and how these trends influence the design and development of computer games.

For distinction standard, learners will provide a clear and balanced evaluation of current and emerging technologies, and a comparison of how they impact on the development of a computer game to meet the requirements of the users and the game industry. Learners will provide clear examples of current and emerging technologies and the requirements of the users and the games industry. Learners must make comparisons between different technologies and how they impact on the games industry and the requirements and expectations of users. The report will demonstrate high-quality written/oral communication through the use of accurate and fluent, technical vocabulary to support a well-structured and considered response that clearly connects chains of reasoning.

For merit standard, learners will show a clear understanding of how available and emerging technologies affect the development of a computer game. The report must provide a balanced discussion as to how user needs and current and emerging technologies impact on the design and development of a computer game. The report will be technically accurate and demonstrate good quality written/oral communication.

For pass standard, learners will provide descriptions of how current and emerging technologies in gaming impact on the users and the games industry. The descriptions must be supported by examples of current and emerging technologies. Learners will explain the technologies available in gaming and how they affect the design and implementation of a game. Learners must support their explanations with examples from existing computer games and how they make use of the technologies available during development. The evidence may have some inaccuracies and the review of the impact may be unbalanced.

Learning aims B and C

Learners must provide evidence of planning and developing a computer game. The computer game must be of sufficient complexity to show use of a range of appropriate software development tools and techniques.

For distinction standard, learners will draw on and show synthesis of knowledge across the learning aims in evaluating how the decisions and processes applied throughout the planning, development and testing stages impacted on the effectiveness of the computer game. Learners will make suitable and reasoned justifications of decisions made in comparison to alternative solutions.

Learners must provide a thorough evaluation of the effectiveness of the content produced against the design and client requirements. In order to reach valid conclusions as to how the chosen processes and techniques provided more appropriate content in comparison to alternatives, the evaluation will be supported by evidence from all stages of the planning, development and review processes. Learners will provide well-considered, justifiable suggestions for improvements to the computer game.

The evaluation must contain a systematic and accurate review of their own skills and performance and the impact that this had on the effectiveness of the solutions. Evaluation of behaviours will consider learners' use of 'soft skills' in relation to the vocational context of a project, such as managing and liaising with other members of the team or clients and time management. Learners will evaluate their own behaviours throughout the project and the impact they have on the outcomes. Learners will take individual responsibility for their own work, for example identifying potential issues and resolving them, reviewing their work and making improvements, keeping their work safe and secure and showing responsible use of quoted materials. Creativity will be shown, for example, through taking innovative approaches to problem solving and through the originality of their solution. Learners will refer to tangible evidence to support their evaluation such as meeting notes, correspondence and time plans.

For merit standard, learners will apply their knowledge through selection and application of appropriate methodologies to plan, design, develop, test and optimise a computer game that effectively meet client requirements. Learners will produce comprehensive designs, including alternative solutions. When developing their game, learners must produce an optimal solution in order to meet client requirements as closely as possible. Learners will also gather and analyse feedback on their game in order to make improvements.

The sourcing, development and testing stages must be well documented with clear justification of decisions and selections made throughout. Learners will record the changes that are made and produce subsequent versions of the game as appropriate. Learners will make clear reference to the client requirements and target platform. They will consider legal and ethical issues as appropriate.

Learners must provide a clear, accurate and robust justification of how the design decisions will ensure the product is appropriate for the use for which it was intended and fully meets client requirements.

Learners will source a wide range of digital content in preparation for processing and editing with appropriate, dedicated editing software. The evidence will demonstrate accurate and appropriate use of visual and audio effects to fully meet the client requirements.

Learners must optimise their computer game by making use of testing and feedback throughout development to improve and refine the game to fully meet client requirements.

Learners will provide a clear and balanced analysis of the success of their outcomes against the design and client requirements, and the quality of the computer game. Learners will refer to how the computer game suits the intended audience, purpose and platform of delivery. Learners must also provide an analysis of how any associated legal and ethical issues were considered and met. They will make accurate and reasoned suggestions as to how the computer game could be improved and will discuss alternative planning, sourcing and processing methods that could be used if the task were to be repeated.

For pass standard, learners will apply understanding through the planning and development of virtualised solutions to meet client requirements. Learners will provide an explanation of the computer game requirements, and related computing requirements, of an identified client and identify the success/acceptance criteria that will ensure the client's requirements are met.

Learners will produce detailed designs for their computer game, including user requirements, visual designs and technical documentation. Learners must consider the appropriateness of different possible techniques and formats and the impact these would have on user experience. Learners must carry out and document a number of tests and reviews of the computer game, including use of test users and appropriate test plans, schedules and test data, to ensure that the solution works and meets the identified criteria. Learners must review their designs with others to identify improvements and refinements. They will provide evidence that different types of testing have been carried out. Learners' games will be functional but there may be some performance issues and/or the implemented solution may not be as efficient or effective as it could be. Learners must show some awareness of the legal and ethical considerations related to producing computer games.

Learners must provide appropriate documentation for the planning, design, development, production and quality assurance of their computer game, explaining the decisions they made during the project to ensure they met the project brief. Learners will produce a solution that meets the requirements of the client, however, some small issues of optimisation may persist.

Learners must provide a review of whether their work meets the client requirements, considering both positive and negative aspects of the outcomes, although their review may be unbalanced and/or superficial. Learners will use relevant feedback, such as client feedback, to make suggestions for the possible alternative solutions that could be implemented.

Links to other units

This unit links to:

- Unit 1: Information Technology Systems
- Unit 4: Programming
- Unit 9: IT Project Management
- Unit 11: Cyber Security and Incident Management
- Unit 12: IT Technical Support and Management
- Unit 17: Digital 2D and 3D Graphics
- Unit 18: Digital Animation and Effects.

Employer involvement

This unit would benefit from employer involvement in the form of:

- guest speakers
- technical workshops involving staff from local organisations/businesses
- contribution of design/ideas to unit assignment/scenario/case study/project materials, including own organisation/business materials as exemplars where appropriate
- feedback from staff from local organisations/businesses on plans/designs/items developed
- opportunities for observation of organisational/business application during work experience
- support from local organisation/business staff as mentors.