



Unit 12: Digital Audio

Delivery guidance

Approaching the unit

This internally assessed unit has been designed to enable learners to explore the principles that underpin the production, manipulation, storage and use of audio in digital format. Learners should apply analytical and creative skills to identify and meet the needs of users through the production and manipulation of audio data. A thorough understanding of computing principles should be supported by creative skills, with particular focus on how these affect digital audio and, ultimately, the aims and success of a project.

This delivery guide does not cover everything that needs to be delivered for completion of this unit but gives examples of delivery methods. You should refer to the specification for full details of all the content that needs to be covered.

Delivering the learning aims

For learning aim A it may be helpful for learners to start with the concept of binary data, and then progress to the difference between binary and analogue signals. Exploring binary representation of sound will naturally overlap with 'sampling', and introducing some of the concepts of sampling (for example, that a binary number will represent one point on an analogue waveform) will provide learners with a natural cognitive link between the two topic areas. When exploring sampling, learners should understand the underlying computing principles of analogue to digital conversion (with reference to the Nyquist-Shannon sampling theorem).

As well as understanding the key theoretical principles, it would be useful for learners to explore how the concepts affect sampling, and other associated topics (A1.3 and A1.4), in a practical way. Learners should have a sound understanding of how different processing and storage methods (including compression and file type) affect the audio data and, in turn, how this has an impact on the use of the audio file and the success of a project.

When delivering the content, you should try to make sure that there is a balance between the underlying theoretical knowledge and the practical application of the associated skills. Learners should explore the use and implications of digital audio in a range of vocational contexts. This will help them to develop analytical and evaluative skills so that they can learn to identify, select and justify sampling and processing methods in relation to the outcomes of a project.

For learning aim B, learners will be required to demonstrate a number of practical project planning and management skills. In preparation for the assignment, you should ensure that learners know how to produce planning documentation that is clear and detailed and that they are familiar with effective methods of communicating with others to seek and record feedback in order to refine ideas. You should ensure that learners are aware of relevant legal and ethical considerations (such as copyright and royalties) and that they know how to follow good practice and can provide appropriate documentation.

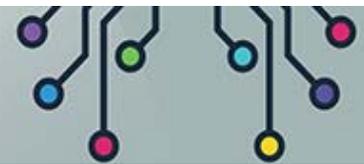
Before they start the assignment, learners will need to have a good understanding of the practical skills required (learning aim C1) and the underlying theoretical principles so that they can provide detailed plans that discuss and justify the sampling, processing and storage considerations and their relevance to the assignment scenario. As with learning aim A, learners should explore the concepts and skills in a range of realistic, vocational contexts.

For learning aim C, learners should develop the necessary practical skills (listed for topic C1) in a range of realistic vocational scenarios in order to implement the designs that they planned in learning aim B. You should ensure that learners have a good understanding of selecting and applying different testing methods, creating and completing test documentation and working with others to review and refine solutions. Learners should be able to select and apply testing methodologies that assess the technical and quality characteristics of the digital audio that they produce and be able to review them against the required outcomes of a project.

Learners need to have opportunities for working with others to identify working parameters, success criteria and to review outcomes. It is important that learners can demonstrate the application of all skills in a realistic project environment. It would be very helpful to have engagement with, and the assistance of, local professionals when delivering the content. Guest speakers can provide valuable insight into how digital audio is used in larger projects or could provide examples and case studies relating to the project management skills required in the computing industry.

Throughout their practical work, learners should be encouraged to keep a diary, in which they can keep a record of their progress, any issues they encountered and how they overcame them. This will be valuable when writing the evaluation and reflecting on their own performance as part of the second assignment.

High-quality, accurate communication skills in written and verbal forms are vital for progression into higher education and in employment. As such, learners should be confident in presenting thoughts and ideas to others, as well as producing well-presented, accurate and appropriate documentation for all stages of a project. Learners must be able to effectively evaluate the success of a project and the factors that contributed to the final outcome, including their own skills, knowledge and behaviours.



Learning aim	Key content areas	Recommended assessment approach
<p>A Examine the principles that underpin digital audio</p>	<p>A1 Digital representation of audio</p> <p>A2 Storing and using audio in digital form</p>	<p>A report on the techniques used to record, store and represent audio in digital format, the relationship between analogue sound and digital data and the implications of using digital formats to store and reproduce sound.</p>
<p>B Design digital audio to meet client requirements</p>	<p>B1 Digital audio planning and design</p> <p>B2 Planning and design documentation</p> <p>B3 Sourcing digital audio assets</p> <p>B4 Reviewing and refining designs</p>	<p>A design specification showing the planning, sourcing and processing of a range of sounds in readiness for an identified digital product.</p> <p>A selection of digital audio files which fulfil the design specification, accompanied by supporting development and testing documentation.</p>
<p>C Develop digital audio to meet client requirements</p>	<p>C1 Digital audio processing methods</p> <p>C2 Testing digital audio</p> <p>C3 Reviewing digital audio</p> <p>C4 Quality characteristics</p> <p>C5 Skills, knowledge and behaviours</p>	<p>A report evaluating the digital audio files against the design specification.</p>

Assessment guidance

It is recommended that this unit should be assessed as two separate assignments. The first assignment should assess learners' understanding of learning aim A and the second assignment should cover learning aims B and C.

The assignment for learning aim A could take the form of an academic paper that explores how the characteristics of digital audio and associated sampling, conversion and processing techniques have an impact on how the sound is represented in digital format. A blog or some form of audio or visual evidence would also be acceptable and would allow learners to develop their creativity, provided the information is communicated in a clear and detailed manner using appropriate language.

Learners will need to explore the effect of using sound in digital format on reproduction of the original sound and how different techniques for processing and storing audio have an impact on the audio files, target product and, where appropriate, the user.

The assignment for learning aims B and C should take the form of a practical project that provides evidence of planning and developing a number of different digital audio files for at least two different uses. The scenario for the assignment should provide enough scope to allow the learners to be able to consider different solutions (such as different sampling and processing methods) and demonstrate a range of testing methodologies to ensure that the outcomes meet the project criteria.

It is important that the context for the assignment is realistic, and that learners have a 'client' for whom they are producing digital audio files. Learners should work closely with the client throughout the project to review outcomes and timescales. The 'client', where possible, should be a real-world client with whom the learner can engage. While the project might be 'simulated', in that it may not be a live project, it is invaluable to engage with local employers to provide a vocational setting. If real-world clients are not available, a tutor or other adult may simulate the role of 'client'. Other learners should not fulfil the role of client, although they may be test users. It is important that the 'client' has a sound knowledge of the project and the related computing requirements.

The scenario should provide learners with the scope to produce a range of sounds for different purposes. Learners are not required to present the final audio files as part of a larger product. To be effective, their testing and evaluation should consider, evaluate and justify choices made in relation to the target product and platform.



Getting started

This gives you a starting place for one way of delivering the unit, based around the suggested assignments and tasks in the specification.

Unit 12: Digital Audio

Introduction

Digital audio is used in all aspects of the computing industry to enhance products as well as to engage and support users. This unit is designed to provide learners with the skills and understanding to source, manipulate and produce audio files for use by computer systems. Learners will apply practical skills and their underpinning knowledge to produce digital audio for a range of purposes. The unit provides learners with project planning, management and analytical skills that can prepare them for a range of apprenticeships or higher education courses, so that they can eventually enter the workplace as professionals in the creative computing field, for example as audio digital signal processing engineers.

Learning aim A – Examine the principles that underpin digital audio

- To begin, you could introduce the overall aim of the unit, providing learners with the 'big picture'. Explain that they will be required to produce two assignments: one that concentrates on learning aim A and one that focuses on learning aims B and C.
- You should provide learners with an initial presentation on the theoretical concepts of digital representation of audio data. It can be useful for learners, when linking concepts, if you start with the idea of binary and refer to the relationship between the binary data and the sampling of analogue sound data.
- Learners should explore the concepts of sampling (with reference to the Nyquist-Shannon sampling theorem) through a combination of input from you, independent research and application of practical skills. Learners should explore how the listed features affect the sound, and associated data, during the process of analogue to digital conversion.
- You should provide learners with opportunities to learn about the characteristics and implications of storing and using digital audio. Learners should explore how, for example, the choice of file format or compression method (as in learning aim A2) affects the audio data and the implications this has for the future use (including the impact on the target product and user).
- Learners need opportunities to develop their analytical and evaluative skills by exploring the effects of using audio in digital form within different contexts. Learners should understand how and why different processes are used, and be able to select different processes to meet identified needs, justifying their choices.

Learning aim B – Design digital audio to meet client requirements

Learners should be competent and possess a range of skills and knowledge before starting the assignment, which should not be used as a vehicle to teach the content.

- You should provide learners with opportunities to develop the practical skills of sourcing, processing and editing digital audio. It is important that learners have a thorough understanding of what can, or cannot, be done as well as having realistic ideas of the resources and timings required, before they start to plan a project.
- For B2, you should teach learners how to use a range of planning documents to identify user requirements, plan the production process (including the tools to use and timescales) and identify and set success criteria/project parameters.

Documentation for this unit will vary and learners will need to know about different styles of document, in varying levels of detail, depending on the situation/project. Learners must be aware that planning documents should be clear and detailed and provide a vehicle for discussion with the client (and other relevant parties) to ensure that the project is efficient and that outcomes are accurate.

- Learners should explore different sources of digital assets (as listed in B3) and the associated legal, ethical and practical considerations. They will need to have the analytical understanding to choose appropriate sources as well as the skills to produce their own assets, as required. Learners should be introduced to the concept of creative ownership/intellectual property and how to acquire permissions to ensure that the law is not broken. In addition, they could discuss some of the high-profile court cases concerning the use of sampling.
- In order to develop strong vocational and employability skills, you must ensure that learners know how to manage projects effectively. This will include organising meetings with a client, recording outcomes from meetings and other forms of feedback, and adjusting plans and timescales for the project, as appropriate.
- You should work with learners to ensure that they develop effective and appropriate communication skills. All project documents and communication with clients should use appropriate style, tone and content.

Learning aim C – Develop digital audio to meet client requirements

Understanding of this learning aim should flow naturally from learning aim B and learners will need to be able to apply this understanding as part of a larger project.

- You should provide learners with opportunities to develop their practical skills of sourcing, processing and editing digital audio. Learners should have a thorough understanding of how to use appropriate hardware and software and how to select and apply the processing methods listed in topic C1 in order to produce audio files that fulfil the requirements identified in the specification.
- Learners should explore the use of digital audio in a range of contexts and consider how the purpose, audience, target file type/size and target platform affect the choice of processing method. Learners should be able to evaluate the requirements of different scenarios and be able to select and justify the use of appropriate tools and techniques.
- Learners should be able to select appropriate testing methodologies so that outcomes can be thoroughly tested and reviewed. They should be able to appropriately and thoroughly plan and document their selected testing processes.
- In order to develop their understanding of the testing and review process, you could provide learners with audio files created by others (and associated project criteria) that they could test and review, identifying areas for development and ways of improving the files.
- You should also help to develop learners' evaluative skills. Learners should be able to use the outcomes of testing and review to evaluate the quality of solutions (and their own performance, as appropriate) against the requirements of a project and client expectations. Learners should be taught the skills to enable them to deliver and receive positive feedback and constructive criticism.
- It is important to work with learners to ensure that they develop effective and appropriate presentation skills. All project documents and communication with clients should use appropriate style, tone and content.
- It will benefit learners if they maintain a diary or take notes as they complete the various practical activities in the lessons relating to this learning aim. They should also note the comments that their peers make when they give feedback.



- Ensure that learners understand how to fulfil the assessment criteria for the pass, merit and distinction grades.

Details of links to other BTEC units and qualifications, and to other relevant units/qualifications

Pearson BTEC Level 3 Nationals in Computing (NQF):

- *Unit 10: Human–Computer Interaction*
- *Unit 11: Digital Graphics and Animation*
- *Unit 13: Digital Video*
- *Unit 14: Computer Games Development*
- *Unit 15: Website Development*
- *Unit 16: Object-oriented Programming*
- *Unit 17: Mobile Apps Development*
- *Unit 24: Software Development*
- *Unit 25: Web Application Development.*

Resources

In addition to the resources listed below, publishers are likely to produce Pearson-endorsed textbooks that support this unit of the BTEC Nationals in Computing. Check the Pearson website (<http://qualifications.pearson.com/en/support/published-resources.html>) for more information as titles achieve endorsement.

Websites

- <http://www.jiscdigitalmedia.ac.uk/guide/an-introduction-to-digital-audio>
Jisc Digital Media. This site gives an introduction to the concepts of digital audio.
- <http://www.indiana.edu/~emusic/etext/toc.shtml>
Indiana University (Prof. J Hass). This is an academic website with information about computer music.
- <http://music.columbia.edu/cmcm/MusicAndComputers>
Burk/Polansky/Repetto/Roberts/Rockmore. This is an academic website with information about computerised music, including digital representation of sound and sampling.

