UNIT 1: INFORMATION TECHNOLOGY SYSTEMS

Delivery guidance

Approaching the unit

In this externally assessed unit, you can help your learners to explore how computer hardware, digital devices, and relevant software combine to form small- and large-scale systems. You should focus on developing learners' understanding of how Information Technology systems (IT systems) can be used in vocational contexts to solve problems and/or meet the needs of organisations and users. Learners will need to be able to analyse the impact of IT systems, evaluate the effectiveness of systems in a range of contexts and, where appropriate, suggest and plan improvements to current solutions. Learners should be able to make justified recommendations for the solutions they propose.

There are many ways in which IT systems are used to solve problems. You should expose your learners to a wide range of effective, and less effective, uses of IT systems. In addition to the obvious business systems, there are many examples in the real world that can be used to illustrate the power of IT such as 'fly-by-wire' air travel, 'just-in-time' manufacturing, computerised banking and the use of IT in health (such as in hospitals as part of diagnostics, automated treatment and patient monitoring). In each case, these are examples of different technologies that are used together in different ways to solve a range of problems and improve the way people work. Prepare learners to use IT systems effectively and be able to think about the wider implications of their application and use, by giving them opportunities to develop analytical and decision-making skills, that would be of benefit in a managerial or project management role. For example, they should be able to analyse problems related to IT systems and make reasoned suggestions as to how IT systems can be used in a range of settings in comparison to alternatives (where appropriate). The key with IT is to find the best solution to solve a problem, but this does not mean that there is always a 'right' answer.

In the Extended Certificate, this unit is designed to be synoptic in nature and draws on core knowledge from a range of other units within the qualification. While the unit can be delivered as a single unit, learners are likely to perform better when sitting the unit towards the end of the course when they have experienced a range of internally assessed units.

This delivery guide does not cover everything that needs to be delivered to complete 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. In the external assessment, learners may be tested on any of the content in the specification.

Delivering the topics

For topic A, show your learners how digital devices can be used individually or in combination with other devices to form small- and large-scale IT systems. You
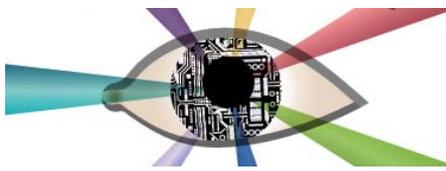
should be aiming to develop your learners' understanding of how the features of different digital devices affect their use in an IT system, as well as the implications of the relationship(s) between devices and relevant peripherals. Make learners aware of the important role that software plays in any system and show them how to analyse the way in which the features and uses of different types of software have an impact on the effectiveness of an IT system overall. Equip learners with up-to-date knowledge of IT systems and give them opportunities to explore emerging technologies and the associated implications for organisations, IT systems and users.

You should also give learners opportunities to explore a range of contexts to which they can apply their knowledge and demonstrate their ability to choose appropriate IT systems to meet a range of needs. You should help them to use their knowledge to make decisions, plan, and evaluate IT systems. Topic B asks learners to explore the ways in which data is transmitted within and by computer systems. Allow learners to explore the technologies that enable devices and systems to communicate and share data with each other, and how the features and characteristics of these technologies affect the system and its effectiveness. You should make learners aware of different connection types, the role of different networks and the issues relating to the use of technologies for transmitting data.

Learners should understand that there is often a range of possible solutions and success in IT is being able to explore and evaluate these to find the best fit. They should understand that there will be occasions where the solution chosen may be a compromise due to the limitations on available technologies, cost or efficiency, compatibility between new and existing systems, and perceived benefits such as improved productivity or security. For topic C, learners should explore how the increased use of internet-based technologies and services affect the way users and organisations use and interact with IT systems. You should allow learners access to different online systems for accessing, sharing and storing data. Ask them to research the way in which using online communities is integrated into many aspects of the IT systems used by individuals and organisations. Help learners to develop a strong understanding of the capabilities and limitations of available services, technologies and procedures, as well as to explore how and why these technologies are used.

Learners should not forget that there could be negatives coming from operating online as well as positives and there will be significant opportunity for discussion on issues such as personal privacy.

In topic D, introduce learners to the threats to IT systems, and the data they store and use. Ensure that learners are able to assess the impact that a threat may have on a given situation if adequate steps are not taken to mitigate it. Ask learners to explore ways in which IT systems can be protected from threats and the implications associated with implementing (or not) the identified protection. Learners should be able to consider threats to small- and large-scale systems as well as the measures and responsibilities, at personal and organisational level, that can protect systems. Introduce learners to the relevant UK and European legislation that governs the use and protection of IT systems and the data they contain.

For topic E, learners should consider how small- and large-scale organisations make use of IT systems and the impact these have on how they fulfil their aims. Ask learners to explore how common, and cutting edge, IT systems are implemented in a range of vocational areas (as listed in topic E1). You should encourage learners to make links between this and earlier topics in order to develop a clearer understanding of how organisational needs are met. For example, when exploring IT systems in retail, a scenario could be used in which
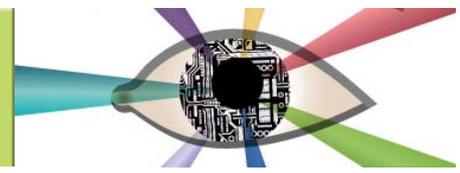
learners first explore the components of a particular system (hardware, software, data transmission etc), and look at how each of the components fills a specific (or set of) function(s). They could then consider how these meet the needs of the organisation. It would be beneficial to compare these with other scenarios to consider how/why they differ.

Make learners aware of the importance of data in personal and professional/organisational systems. Explain to your learners the ways in which data is collected, interrogated and used by a wide range of IT systems. You should give learners opportunities to explore ways in which data is collected and how its accuracy is ensured. Learners should explore how the source and collection of data can have an impact on its usability and the implications for individuals and organisations of using IT systems to collect, store and process data.

For topic F, learners should explore the moral, legal and ethical issues resulting from the use of IT systems. You should demonstrate to learners how the use of IT systems by individuals and organisations affects how people conduct their personal and professional lives, and the subsequent implications. Help your learners to gain a strong grasp of relevant UK legislation relating to the use of IT systems, as well as guidelines and codes of practice produced by relevant professional and public bodies. It is essential that learners know how to remain informed about legal issues, for example the sources of information. Where can they access information that ensures that they remain up to date?

Throughout this unit, give learners a range of opportunities to explore and analyse situations to identify problems, suggest and evaluate solutions, and discuss wider considerations of implementing and using IT systems. The content for all topics should be delivered by means of a combination of tutor presentations, individual and group learning tasks, visits, guest speakers and detailed case studies.

In preparation for assessment, centres should ensure that learners understand what is meant by the command words used, (as detailed in the units) and that during teaching learners undertake classwork to demonstrate understanding of what is required to obtain full marks in response to these command words. For example: how to obtain the full six marks for a question where the command word is 'explain', or a ten mark question where the command word is 'analyse'. Tutors can effectively utilize standard writing rubrics to support this learning such as BLT, (because, leading to, therefore) and PEEL, (point, evidence, explanation, link), for medium and extended answer questions. Centres should make full use of the sample assessment materials (SAMs) and Mark Schemes that are on the Pearson website.

Assessment guidance

Learners will be assessed by means of a written examination paper, which will include short-answer questions, extended tasks and tasks requiring diagrammatical explanations and solutions. This will assess technical and theoretical understanding as well as their problem-solving skills. For full details of assessment, refer to the SAMs and the specification.

In preparation for the examination, learners should respond to vocational scenarios to explore using IT systems to meet specified needs and solve problems. Learners should be able to discuss, analyse, evaluate and design small- and large-scale IT systems. Applying these skills should be supported by the development of exam techniques, such as how to identify the requirements of specific command words and how to structure and present answers.
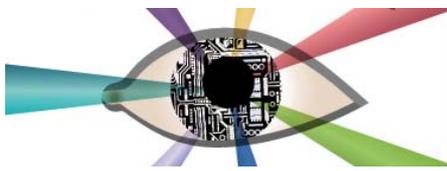
This unit is synoptic in the Extended Certificate. In this qualification you should ensure that learners have undertaken a variety of units and are prepared to apply knowledge and understanding from across these units in the completion of their assessment.
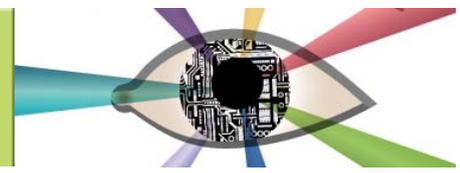
Getting started

This gives you a starting place for one way of delivering the unit.
Activities are suggested in preparation for the external assessment.

## Unit 1: Information Technology Systems

Introduction

IT systems support and enable individuals and organisations to achieve their aims and are present in almost everything people do. Being able to effectively select and use appropriate IT systems is a valuable skill in any area, vocational or personal. In delivering this unit, you should give learners a sound knowledge of a wide range of IT systems that are used to support the aims of individuals, groups or organisations. Learners should be able to apply this knowledge to identify needs and plan solutions as well as analyse and evaluate situations and outcomes relating to using IT systems. These transferable skills will equip learners for further study or employment in a wide range of vocational areas.

Topic A – Digital devices in IT systems

- You could begin by introducing the aim of the unit (ie to become a highly skilled IT user who can analyse situations in order to select appropriate IT systems), and how an understanding of IT systems, including their possibilities and limitations, can be applied to plan solutions and analyse and evaluate outcomes or decisions in many situations.

- Introduce learners to the concept that an IT system can be anything from a single digital device to a global collection of computers and interconnected devices. Explain that even large IT systems are often made up of smaller devices across a range of technologies that can perform both an isolated individual role or be part of a larger IT system.

- It might benefit you to establish a baseline understanding of learner concepts of digital devices. You should start with common devices such as computers and mobile devices before moving to more specialised or less common devices. You may wish to introduce digital devices along with an overview of the tasks that they can perform to give the learners a little context. At the very early stages, this should be just in enough depth to understand the concepts – learners will develop deeper and more complex understanding of 'how' and 'why' as the unit progresses.

- You should ensure that learners understand the concept of 'input – process – output' and that this is the basis of any computer system. Establish the level of learners' understanding of common hardware used by computer systems. You may wish to spend some time ensuring that learners have a sound grasp of subject specific terminology in this area.

- Through a range of group and individual activities, you should give learners opportunities to explore the concept and implications of software in IT systems (topic A3). You should introduce learners to more common uses of software first before progressing to more specialised software. For example, in the modern world there are very few organisations that do not use computers and a range of software to manage their activities.

  However most organisations recognise that technology in the wider context can improve their core activity and organisational efficiency – use examples from:

  o education (such as remote learning, interactive learning, the use of MOOCs)

  o health and social care (faster critical response with higher quality information,
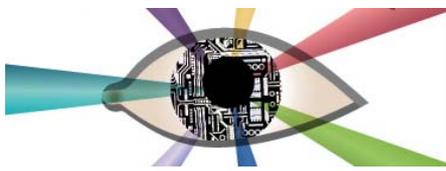
improvements in post-operative care through the interconnectivity of support services)

   o   manufacturing (research and development and the use of IT in design, prototyping through the use of 3D technologies such as 3D printing, and CAD/CAM systems for managing the full manufacturing processes).

● Make learners aware of both established and emerging technologies and how they influence the ways that individuals and organisations use IT systems. How does the Internet of Things (IoT) revolutionise manufacturing? How does Big Data measured in real time contribute to maintenance in manufacturing to improve downtime and reduce costs? You could give further local opportunities for this, and traditional classroom based activities can be supported by visits and guest speakers.

● Give learners practical tasks where they will analyse scenarios and make informed choices regarding selecting IT systems. Learning activities should be supported by realistic scenarios that allow learners to consider a range of factors that influence the choice of parts, or all, of a system. For example – a large company wishes to introduce a CRM (Customer Relationship Management) system that will be used across the business by both technical and non-technical users including office based and field based staff. How would all users interact with the systems – what technologies could be used? What would the concerns be? Are there any technical restrictions that would need to be accommodated? This is a potential scenario that could be used for a whole class discussion with all learners allowed to contribute. Learners should remember that there is no right answer but, as IT practitioners, they must be able to defend their judgement. There are natural links between this and other topics in this unit and, after ensuring that learners have established a strong grounding in the concepts of systems and hardware and software, you should continue to develop and reinforce their understanding of this topic area in conjunction with other topics.

Topic B – Transmitting data

● It may be helpful to introduce this topic to learners by asking them to consider different methods of connecting devices and systems and think about some of the features, limitations and implications of different connection methods.

● Where possible, give learners practical tasks and opportunities to select and use different connection methods to achieve different aims. Allowing learners to compare results from first-hand experience will give them a clearer idea of what can or cannot be achieved.

● Demonstrate to learners how devices and systems can be connected to form different types of network. Learners should develop a strong grasp of how different types of network are used and the factors that influence the choice of network. Make your learners aware of how the component parts affect the function and performance of the network as a whole. The learning for this topic area can be supported by a range of activities including:

   o   visits to local employers to see how networks are used to meet organisational, user and customer needs

   o   individual and group research and discussion tasks supported by guest speakers and case studies of real-world examples such as the local library that has to interconnect with regional and national systems for inter-library loans, or transport systems (such as busses) which have GPS updates that are transmitted to bus stops further down the line to keep customers up to date about the arrival of the next bus etc

   o   practical activities involving setting up and using different types of network.

● Explain to learners that, as well as the impact of the devices and other hardware
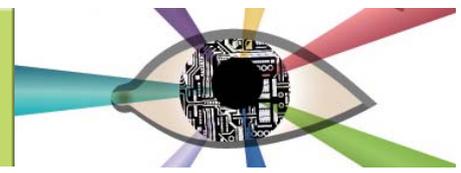
that form the network, there are other factors that need to be considered when transmitting data. Give learners opportunities to explore these other factors, which include the protocols used, security issues and bandwidth. They should understand, for example the implications of compression used to reduce file sizes and speed up transmission

● Ask learners to work through tasks based on a variety of scenarios and to plan solutions and/or make and evaluate decisions relating to transmitting data. Learners should be able to consider a wide range of implications and apply them to realistic and varied examples. Where possible, these tasks should include a scenario that contextualises the learning. Vary the level of scaffolding made available for the devised tasks. Examples could include the photographer sending image files to a printing service, a group of architects in different locations sharing a series of architectural drawings or a graphic designer working on illustrations for a new book.

Topic C – Operating online

● Due to the integrated nature of many modern systems, depending on the scenarios used, there will be areas of this topic that you may have already touched upon during previous topics. It would be beneficial to draw learners' attention to these natural links using suitable visits and case studies.

● Explain to learners the ways in which online systems are used by individuals and organisations. Learners should explore the features of a range of different online systems that are used to store data and perform tasks (such as contributing to an organisation's disaster recovery plan), and investigate the impact and implications of these systems.

● Give learners opportunities to explore the widespread integration of online communities with personal and professional activities, for example learners could investigate Microsoft's purchase of LinkedIn. What was the rationale for this purchase and what benefits were there to Microsoft? Were there any drawbacks? They should understand the features and services that these communities offer individuals and organisations, and the impact and associated implications of their use. Will all LinkedIn customers be happy about their data being available to a large commercial company?

● You should enable learners to develop the ability to analyse impacts and implications beyond superficial levels. Ask them to explore a wide range of factors (as listed in the relevant specification points) and consider how these factors link with, and have an impact on, each other.

Topic D – Protecting data and information

● You should give learners opportunities to explore the potential threats (accidental and malicious) to data and information stored on and used by IT systems. The subject content could be introduced by tutor presentations and individual and group research tasks. Learners' understanding of the characteristics, impact and implications of these threats could be developed using case studies and real-world examples. Examples could include the Northern Ireland Prison Service data breach (May 2016), the Thames Valley Police Officer who was sentenced for breaching data security (June 2016), personal data lost by 132 councils (November 2011) – BBC News site, or the article from the Daily Mail Online which claims that 2000 NHS patient records are lost every day.

● Ask learners to consider ways in which systems can be protected from potential threats. You should ask them to explore the ways in which individuals and organisations can reduce potential risk and mitigate damage to, and loss of, data. Learners should be made aware of the responsibilities of individuals (in personal and professional settings) and of organisations to ensure that data is safe and the relevant codes of practice and legislation that support and enforce this are in place.
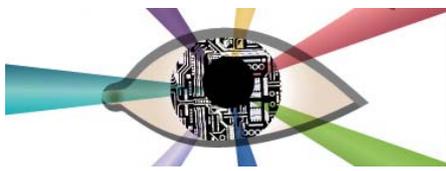
The financial services industry contains many possible case studies.

- You should help learners develop the ability to analyse the impact and implications of these risks beyond superficial levels. Through real-world examples, case studies and discussion, you should allow learners to explore how relevant factors are linked and how considering one thing may have an impact on another. For example, a decision to employ new software or access procedures to manage security could have an impact on employee productivity. Employees may need to be trained, there may be more processes they have to go through to share data, or it may simply take them much longer to start work in the mornings because of additional security steps they need to take. Due to the integrated nature of many modern systems, depending on the scenarios used, there will be areas of this topic that may have already been touched upon during previous lessons.

Topic E – Impact of IT systems

- You should give learners opportunities to explore how online services are used to meet the needs of organisations and individuals in a range of contexts (as listed in topic E1), through a combination of research, case studies, visits and guest speakers. What has happened to the high streets of many large towns with businesses opting to sell online (with reduced costs, staffing, premises etc)? Is this good news for consumers? How does it impact on the local economy?

- When exploring topics E1 and E2, ask learners to draw on their knowledge of previous topics studied in terms of how systems are formed, how they communicate etc. However, learners should have the opportunity to expand this knowledge. For example, when exploring the purpose and features of online and IT systems, you could introduce specialised devices and software or the concept of using common or familiar IT systems to perform specialised tasks.

- Make learners aware of the importance of data, and how it is collected, stored and processed by IT systems. Ask learners to explore the implications of storing, using and processing data for individuals and organisations. Explain how data can be collected and processed, and ways in which the accuracy and reliability of data can be improved. Learners should be able to apply their understanding to real-world scenarios. The learning can be supported by a number of activities such as:
  - research projects exploring and comparing the usefulness, reliability and accuracy of primary and secondary sources
  - data collection exercises which use different collection methods or involve creating data collection systems for others to use, for example using wearable technologies to gather data used in sports performance analysis
  - creating and using numerical models in spreadsheet software, for example using what..if modelling to process a number of scenarios with changing variables (what the impact will be of increased oil prices on profitability in a logistics business)
  - creating and using database software
  - individual and group research and discussion tasks supported by guest speakers (particularly from a market research or marketing company) and case studies of real-world examples.

Topic F – Issues

- This topic covers the legal, moral and ethical issues resulting from the use of IT systems. You should give learners opportunities to explore a range of scenarios covering using IT systems in professional and personal contexts, from which they should consider the implications for individuals, organisations and wider society. For example, the ethical dilemma around job displacement, the ownership of
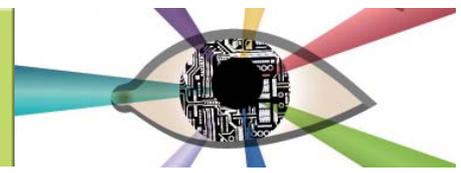
> intellectual property and non-disclosure with regards to an organisation's information and activity, and the control organisations can exercise to monitor employees during working hours through their online activity.
>
> - Ask learners to draw upon their understanding of earlier topics studied in order to promote the development of their knowledge throughout this topic. For example, when considering online services such as social media, the issues such as privacy, freedom of speech and so on, are natural considerations to explore. Learners should be aware that many of the topics in this unit have natural and logical links to others. Exploring these links should be encouraged and this would typify the requirements for higher attainment in this unit.
>
> - Give learners tasks that require them to explore the features and concepts of relevant legislation and codes of practice. They should understand how individuals and organisations implement these and the subsequent implications of following, or not following, the specified rules and guidelines. What are the ramifications of not adhering to codes of practice? Do learners remember what they signed up to at their own centre in terms of what constitutes acceptable use of IT systems? You could walk learners through any centre-related document and ask them to discuss the relevance and appropriateness of the content.

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

Pearson BTEC Level 3 Nationals in IT (NQF):

- *Unit 2: Creating Systems to Manage Information*

- *Unit 3: Using Social Media in Business*

- *Unit 4: Programming*

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 IT. Check the Pearson website (http://qualifications.pearson.com/en/support/published-resources.html) for more information as titles achieve endorsement.

Journals

- www.mdpi.com/journal/computers
  A free, open access journal that publishes peer-reviewed academic papers for all computing sectors.

Websites

- www.legislation.gov.uk
  UK government website containing information about UK legislation and subsequent updates and amendments.
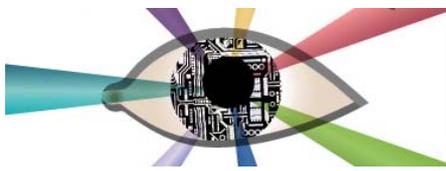
- www.bbc.co.uk/news/technology
  British Broadcasting Corporation – this site has news and information regarding technology and IT.

- www.forbes.com/technology
  Forbes.com LLC™ – this site contains news and information regarding technology and IT.

- www.gchq.gov.uk/Pages/homepage.aspx
  This is a government website dedicated to data security.