Next Generation Higher National Unit Specification

Artificial Intelligence (SCQF level 8)

Unit code: J6CA 48

SCQF level: 8 (16 SCQF credit points)

Valid from: session 2023–24

Prototype unit specification for use in pilot delivery only (version 1.0) June 2023

This unit specification provides detailed information about the unit to ensure consistent and transparent assessment year on year.

This unit specification is for teachers and lecturers and contains all the mandatory information required to deliver and assess the unit.

This edition: June 2023 (version 1.0)

Unit purpose

This non-specialist unit introduces learners to the principles and applications of artificial intelligence (AI). It offers a sound foundation for more technical units relating to machine learning and data science, and is useful for learners with an interest in STEM. No previous knowledge of AI is assumed. Learners need a good conceptual knowledge of computing and they could demonstrate this by completing the Computer Science unit at SCQF level 7 or 8.

The unit covers a wide range of conceptual knowledge relating to AI, including its historical development, types of AI, the applications of AI, and the principles behind machine learning and deep learning. It also explores the ethical and social implications of AI. Learners use machine-learning software to carry out an analysis using an appropriate model.

Completing this unit gives learners a good grounding in AI and in the use of machine learning to solve problems. They can progress to more specialist units in the fields of data science and machine learning.

Unit outcomes

Learners who complete this unit can:

1 describe the development of artificial intelligence
2 describe applications of artificial intelligence
3 explain types of artificial intelligence
4 explain machine learning and deep learning
5 apply machine learning to a problem

Evidence requirements

Learners must provide both knowledge and product evidence.

Knowledge evidence is required for all knowledge statements, which learners can produce over an extended period of time, in lightly controlled conditions. The amount of evidence can be the minimum required to infer competence. Sampling is allowed when testing is used. Testing must be carried out in timed and controlled conditions.

Product evidence takes the form of a completed analysis of a large dataset. You can give the dataset to learners. Their analysis must involve machine learning. Learners must provide the following products:

- completed analysis
- training dataset(s)
- testing dataset(s)
- justification of the machine-learning model deployed

Analysis may be carried out using a highly automated analysis tool. The software must provide a selection of machine-learning models.

Authentication is required when the evidence is produced in lightly controlled conditions.

The standard of evidence should be consistent with the SCQF level of this unit.

You should use appropriate level descriptors when making judgements about the evidence.

Knowledge and skills

The following table shows the knowledge and skills covered by the unit outcomes:

Knowledge	Skills
Learners should understand: ♦ the definition of AI, machine learning and deep learning ♦ the historical development of AI, including milestones ♦ rule-based and learning-based approaches ♦ the benefits and risks of AI ♦ algorithmic and data bias ♦ the social and ethical implications of AI ♦ applications of AI, including natural language processing, perception and vision, motion and robotics ♦ the limitations of AI ♦ weak (narrow) and strong (general) AI ♦ intelligent agents ♦ machine-learning models ♦ artificial neural networks ♦ knowledge representation, including decision trees and truth tables ♦ probabilistic algorithms ♦ completeness and optimisation ♦ artificial neural networks ♦ tree and graph search in AI ♦ time complexity ♦ space complexity ♦ the machine-learning process, including training and test data ♦ supervised, unsupervised and reinforcement learning ♦ the relationship between machine learning and deep learning	Learners can: ♦ use software for machine learning ♦ select machine-learning models ♦ create training data and test data ♦ apply a machine-learning model to a problem

Knowledge	**Skills**
Learners should understand: ♦ classification, regression and clustering problems ♦ deterministic models ♦ model validation ♦ machine-learning tools	

Meta-skills

Throughout the unit, learners develop meta-skills to enhance their employability in the data science sector.

Self-management

This meta-skill includes:

- focusing
- integrity
- adapting
- initiative

To complete the unit, learners must select appropriate machine-learning algorithms, and focus on the specific configurations necessary to solve a given data problem. You should encourage them to research alternative providers' solutions to problems to gain a more rounded awareness of what is available, while adhering to the cost implications of those alternatives.

Social intelligence

This meta-skill includes:

- communicating
- collaborating

AI offers natural opportunities for teamworking. For example, different learners could develop separate parts of an AI algorithmic infrastructure and connect their configurations together to produce a solution, especially in deep learning.

Innovation

This meta-skill includes:

- sense-making
- critical thinking

This unit prompts learners to detect themes and patterns in information gathered about data resources, such as business assets, medical solutions and games. Learners need to put these into the required data purpose context allowing shallow, deep and clustering analysis. The unit could also provide solutions for business market prediction using regression.

Learners should become aware of the power AI offers, both in machine and deep learning. They develop the ability to evaluate solutions, for example based on datasets over traditional data modelling solutions. They become more aware of which one is best in different circumstances, for example supervised versus unsupervised. Failing in test approaches to machine learning is important, and learners carry out critical reflection and analysis to understand why they failed.

This unit prompts learners to deconstruct scenario information and come to logical conclusions about potential fail points within the purpose of the data problem. It requires them to provide judgement and advice on key areas in need of improvement using trial and error.

Literacies

Throughout this unit, learners have opportunities to develop their literacy skills.

Numeracy

Learners must understand the costing calculations of using some machine-learning providers, such as Amazon Web Services (AWS). Although the main numeracy skills they employ are in using the metrics typically associated with classification and regression. You should introduce learners to mathematical applications, like Bayes Theorem.

Communication

You can give learners the opportunity to work together in teams and create a unified solution from their individual efforts. Other communication would be through the written presentation of the results.

Digital

This unit contributes towards digital skills, such as when they use various platforms like Google Colab or AWS Machine Learning.

Delivery of unit

We suggest the following distribution of time:

Outcome 1 — Describe the development of artificial intelligence
(15 hours)

Outcome 2 — Describe applications of artificial intelligence
(10 hours)

Outcome 3 — Explain types of artificial intelligence
(10 hours)

Outcome 4 — Explain machine learning and deep learning
(15 hours)

Outcome 5 — Apply machine learning to a problem
(30 hours)

Additional guidance

The guidance in this section is not mandatory.

Content and context for this unit

You can tailor the content to specific learner contexts. As a minimum, we strongly recommend that you cover an overview of the following areas on the importance of AI, however, you do not need to assess all of them:

- ethical and socially responsible AI
- contemporary and historical theoretical evolutions
- historical and emerging technologies for machine learning
- games and search
- cleaning and preparing data
- optimisation
- evolutionary and genetic algorithms
- supervised versus unsupervised approaches
- image and text classification
- artificial neural networks and new evolutions, such as convolutional neural networks (CNN)

You can vary the depth of content depending on the course cohort or specialism being studied. For example, in an aviation school, AI can be used to optimise design or, in a medical application, it can solve a rules-based problem for diagnostics.

In all contexts, you should emphasise the benefit of using a recognised methodology to calculate the values associated with machine learning. It is important that learners appreciate the value of AI in terms of the benefits to society and its practical applications.

You can assess learners in a variety of ways. A traditional approach might involve essay writing and a practical assignment. The essay would relate to outcomes 1, 2, 3 and 4. The essay does not need to include all the required knowledge, but the sampling frame should be large and include the majority of knowledge statements. The practical assignment requires learners to select and apply a machine-learning model to a data problem.

An alternative approach to assessment would require learners to maintain a portfolio of work. If this approach is taken, they would have to evidence all the defined knowledge and skills. Learners would produce the portfolio over the life of the unit, adding their best work as and when they produce it. This could be done under lightly controlled conditions, but authentication would be required.

Equality and inclusion

This unit is designed to be as fair and as accessible as possible with no unnecessary barriers to learning or assessment.

You should take into account the needs of individual learners when planning learning experiences, selecting assessment methods or considering alternative evidence.

Guidance on assessment arrangements for disabled learners and/or those with additional support needs is available on the assessment arrangements web page.

Information for learners

Artificial Intelligence (SCQF level 8)

This section explains:

- what the unit is about
- what you should know or be able to do before you start
- what you need to do during the unit
- opportunities for further learning and employment

Unit information

In this unit, you learn the concepts, principles and practice of AI. It is those with an interest in this area, who have little or no previous knowledge, but who wish to learn about AI beyond the basics. It is particularly suitable if you are studying a Higher National Diploma (HND) in Data Science. However, it may also be appropriate for other qualifications at SCQF level 8.

You cover the principles of historical and contemporary AI, its ethical implications, and how to produce a solution to a data problem with an emphasis on analysing data. In addition, you learn the fundamentals of preparing data and producing valid models that can be applied in the real world.

Although there is a theoretical part, the unit is mostly practical in nature and focuses on machine learning. The emphasis is on teaching you how to use services that provide solutions to real-world problems in data science. When you complete this unit, you understand how AI can solve data science problems ethically.

Assessment can be a combination of essay writing and a practical assignment.

The unit also provides many opportunities for you to enhance your meta-skills, such as self-management, social intelligence, analytical and innovative skills.

On completion of this unit, you can progress to more specialist units in the fields of data science and machine learning.

Administrative information

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Superclass: CB

History of changes

Version	Description of change	Date

Note: please check SQA's website to ensure you are using the most up-to-date version of this document.