BCS Level 1 Robotics Award

Qualification Guide

This qualification is regulated by one or more of the following: Ofqual, Qualifications Wales, CCEA Regulation or SQA.

QAN: 603/7793/8

June 2021 v1.0

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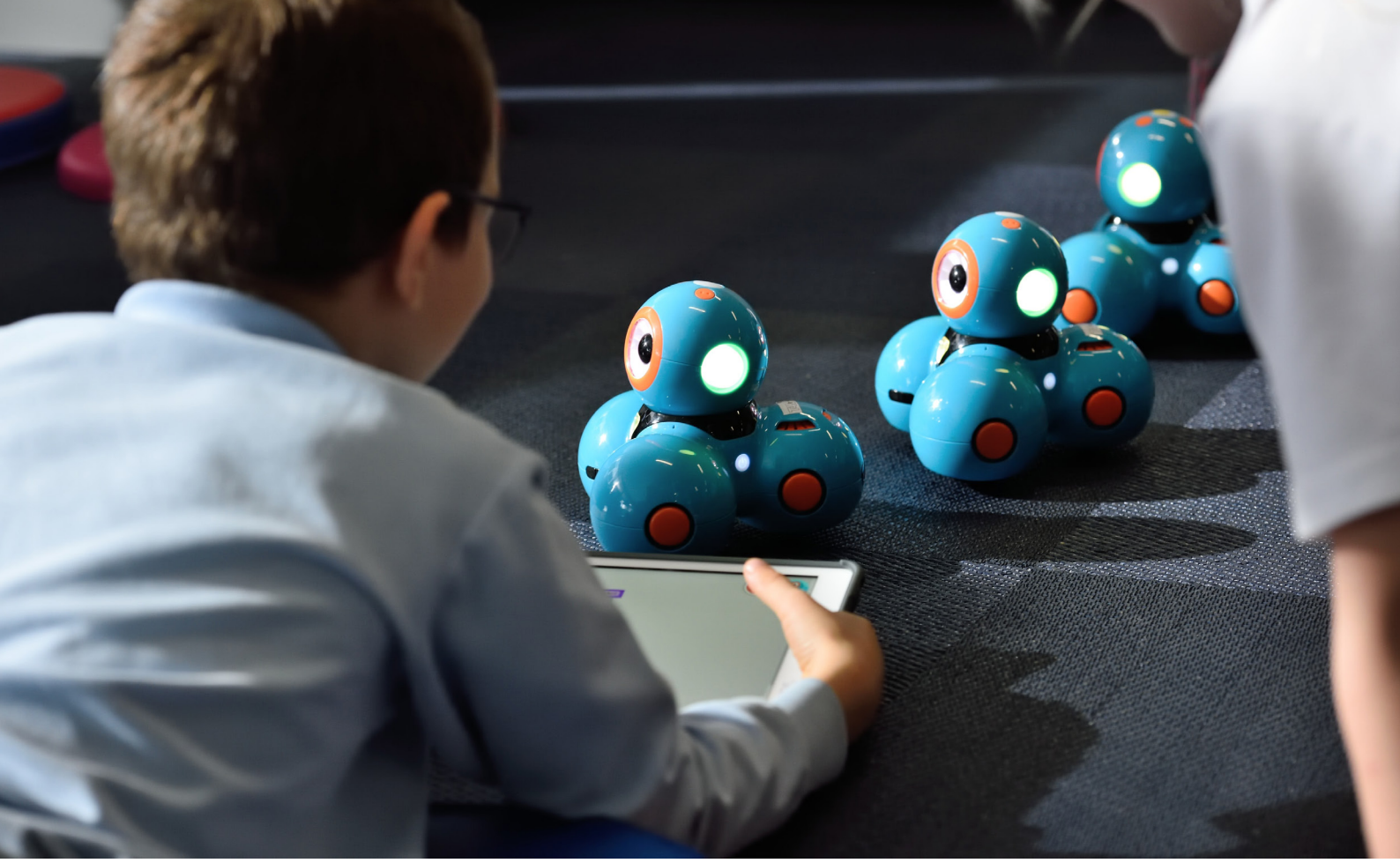


Introduction

They have long been a staple of science fiction on the silver screen, but now robots are stepping into the real world – and they have enormous potential for the workplace. Some traditional roles are incorporating Robotics into their existing ways of working, while brand-new career paths are being forged around pioneering technological capabilities, pushing the boundaries of what we can achieve. As such, it's vital that today's young people can learn to understand, build and use these emerging technological concepts, so that they can take their place in the workplace of the future.

However, they won't be starting from scratch. Many young learners are already developing vital digital and technological skills – maybe without even realising it. Gaming, for example, provides opportunities to build resilience, learning through trial and error, and develop sought-after soft skills. Building on this everyday experience of technology, the new Level 1 Robotics qualification from BCS and ICDL aims to develop young learners' understanding of what robots can do, how they are made, and how they can be programmed and controlled. As well as a solid foundation in robotics, the qualification also emphasises the importance of teamwork, promoting communication and collaboration with other learners, and provides them with transferrable skills to help them stand out on the job market.

We believe that exploring robotics inspires a lifelong love of learning, creativity and logic, all of which are vital for our learners of today to succeed in the ever-changing workplace of tomorrow.

BCS, The Chartered Institute for IT

As the Chartered Institute for IT we are the digital specialists and the only awarding body focussed on computing and IT. Our commitment under our royal charter is to ensure everyone within society, has access to the basic skills required to live and work in a digital age.

Qualification Suitability and Overview

The Level 1 Robotics qualification has been designed to fill a significant gap in the market. It is currently the only Level 1 robotics qualification on the market, representing a unique opportunity for upper Key Stage 2 to lower Key Stage 3 learners to build on their existing skills and experience.

Examples of learners who may benefit from this qualification would include those who are interested in further qualifications in computing or robotics (e.g. GCSE Computer Science), or those who are aspiring to a future career in the digital or technology sectors.

At the end of this qualification, learners will be able to:

- Understand key concepts relating to robots and robotics systems
- Identify examples of robots, as well as the main parts of a robot and their function, including microcontrollers, actuators, sensors, and power sources
- Understand the elements of a simple control system, and test a control system
- Understand basic programming concepts, and create and execute a programme in a visual programming language
- Set up a robot, implement robotic motion, and control a robot in an environment

In order to complete this Level 1 qualification, learners will have to complete all five mandatory modules. An overview of these can be found below, while further details are included under Module Criteria.

MANDATORY UNITS	LEVEL
Robotic Concepts Learners will explore types of robots, their uses and the ethical considerations for their use.	1
Robotic parts Learners will explore the key components that enable a robot to function.	1
Simple control system Learners will explore how to setup a control system and how to test a robot.	1
Visual programming Learners will explore how to create and run a program as part of programming a robot.	1
Working with robots Learners will explore how to work with others to safely operate and navigate a robot within an environment.	1

LEVEL 1 ROBOTICS	
QAN	603/7793/8
Entry Requirements	N/A
Guided Learning Hours (GLH)	37 hours
Total Qualification Time (TQT)	51 hours
Assessment Method	There are two parts to the assessment: • Skills demonstration • 45-minute test with 28 questions
Outcome	Pass/fail – learners must pass all three elements of the skills demonstration in order to progress to the test. The pass mark for the test is 75% (21/28 marks).

Although there are no formal entry requirements for this qualification, it would be beneficial for learners to have a basic understanding of IT, such as that acquired in IT lessons at school, and an interest in robotics. The L1 Robotics qualification also links well to Physics topics which learners may previously have studied, or may go on to study later in Key Stage 3 or at Key Stage 4.

Offering Level 1 Robotics at your school

To be able to offer this qualification, an organisation must be a BCS Approved Centre.

Details of what is required to be a centre can be found on our website.

Learner Progression

After completing Level 1 Robotics, we hope that all of our learners will feel equipped and inspired to go on to study further digital or IT qualifications in the future.

BCS Robotics Level 1 would be an excellent 'stretch-and-challenge' activity for learners with a keen interest in or aptitude for technology, or those looking to study Computer Science at GCSE or A level.

Learners who are particularly interested in continuing to explore the world of robotics might like to aim towards the BCS Foundation Award in Smart Products, Robotics and Automation, designed for individuals interested in furthering their understanding of artificial intelligence (AI).

Businesses in the technology sector have also spoken about the need to improve young people's basic IT skills. Learners wanting to work on this core area may be interested in our Essential Digital Skills Qualifications (EDSQ), which are fully-funded for learners in England aged 16-19. BCS also offers the European Computer Driving Licence (ECDL) Level 1 Award and Level 2 Certificate, which is recognised by employers around the world as the benchmark in digital and IT user skills.

Module Criteria

ROBOTIC CONCEPTS	
Skill set:	**Assessment Criteria : The learner can...**
Robots and Automated Systems	Define robots and robotic systems.
	Identify teleoperated, semi-autonomous and autonomous robots.
	Identify fixed and mobile robots.
The Use of Robots	Identify common uses of robots in different environments like: home, school, manufacturing, healthcare.
	Identify advanced uses of robots like: driverless cars, robot-assisted surgery.
	Identify ethical issues in the use of robots like: harming humans.

ROBOTIC PARTS	
Skill set:	**Assessment Criteria : The learner can...**
Basic Parts and Components	Identify the basic parts of a robot, like: actuator, microcontroller, sensor, power source.
	Understand that robots can be teleoperated, semi-autonomous, autonomous.
Microcontroller	Recognise that the microcontroller collects information from input devices like sensors, executes a program, controls output devices like LED lights, sound device.
	Identify common microcontroller ports like: power, USB, wireless, input, output.
Actuator System	Identify main parts of the actuator system like: switch, motor.
	Explain how the actuator transforms electrical power into mechanical power, enabling the robot to function.
Sensor	Describe how a sensor detects changes in its environment like: light intensity, distance, angle.
	Recognise the function of different types of sensors like: light, sound, gyroscope.

ROBOTIC PARTS (CONTINUED)	
Skill set:	**Assessment Criteria : The learner can...**
Locomotion, Power	Identify the parts of a robot that support motion like: arm, wheels.
	Identify power sources like: batteries, solar power.

SIMPLE CONTROL SYSTEM	
Skill set:	**Assessment Criteria : The learner can...**
Control System Overview	Identify the elements of a control system and the basic types of control: open loop, closed loop.
	Recognise connections to a microcontroller like: button, power, motor, USB input, wireless technology, sensors, output devices.
	Identify connections to the microcontroller represented in a block diagram.
	Set up a simple control system using elements like: power, motor, sensors.
Test a Simple Control System	Run pre-defined programs to provide output values like: light intensity, sound, distance, angle.
	Recognise that there is a response time between inputs and outputs.
	Identify ethical issues in the use of robots like: harming humans.

VISUAL PROGRAMMING	
Skill set:	**Assessment Criteria : The learner can...**
Programming Basics	Define the terms program, programming language.
	Recognise blocks as a basic element in a visual programming language. Recognise common block categories like: Events, Control.
	Recognise typical activities in the creation of a program like: analyse a task, design a solution, write a program, test and improve the program.
	Identify the basic elements of a program like: sequence, decision, loop.
	Describe how a flowchart can be used to present the steps in a solution.

VISUAL PROGRAMMING (CONTINUED)	
Skill set:	**Assessment Criteria : The learner can...**
Constant, Variable	Distinguish between the terms variable and constant used in a program.
	Create new variables and assign suitable input in a program.
Events, Controls	Use an Events block in a program like: when.
	Use a Control block in a program like: wait, wait until.
	Apply a loop or continuous action using controls in a program like: forever, repeat.
	Apply conditions using controls in a program like: if, then, else.
	Apply logic operators in a program like: and, not, or.
Program Creation and Execution	Outline a plan to describe and solve a problem like: control an output, complete a series of actions.
	Draw a flowchart to present the steps in a solution.
	Build a program in a visual programming language to solve a problem like: control an output, complete a series of actions.
	Recognise that there may be more than one way of writing a program to solve the same problem.
	Run a program. Identify and fix errors in a program.

WORKING WITH ROBOTS	
Skill set:	**Assessment Criteria : The learner can...**
Setup	Describe and implement safety guidelines like: safe handling of electrical items and tools, awareness of safety of self and others.
	Assemble a robot using available tools.
Implementing Robotic Motion	Implement simple robotic motion like: stop, move forward or backward, turn.
	Describe the relationships between power, distance, speed, time in robotic motion.
	Apply concepts of power, distance, speed, time to control motions like: move forward, backward. Recognise that momentum and friction can affect robotic motion.

WORKING WITH ROBOTS (CONTINUED)	
Skill set:	**Assessment Criteria : The learner can...**
Implementing Robotic Motion	Describe the relationship between power, rotational speed, angle of rotation in robotic motion.
Implementing Robotic Controls	Use a robot to collect sensor data like: distance, sound, angle, light.
	Build, test and refine a program to control the robot using an input sensor like: light, sound, gyroscope.
	Recognise the importance of testing in order to eliminate errors.
	Recognise that some causes of errors are random like: dust, unknown variables.
Control in an Environment	Navigate a robot in an environment to complete tasks using functionality like: following or avoiding a line; following or avoiding an object, a barrier; moving up, down a slope.
	Navigate a robot in an environment to complete a scenario using an appropriate combination of motions and functionalities.
	Recognise the importance of teamwork when collaborating on a robot and understand skills like: planning, communication, allocation of tasks.

Resources

There are a range of useful resources available to help you and your learners make the most of the Level 1 Robotics qualification. These are available from Skillsbox and the Atlas Cloud platform.

AVAILABLE RESOURCES

Diagnostic test

To enable learners to practise and determine if they are ready to progress to the second part of the assessment, the test. Accessed via the Skillsbox online platform. There are 43 questions, in multiple-choice, drag-and-drop, and hotspot formats.

Learner material handbook

Accessed as an e-book via the Skillsbox platform. Learners will receive credit to buy e-book once their school has purchased the course.

Teacher handbook

Accessed as an e-book via the Skillsbox platform. This includes an overview of robotics, planning considerations, lesson plans including learning outcomes, resources needed, activity description, useful links.

Assessment

There are two parts to the assessment:

- 30-minute in-class skills demonstration test. The Learner can complete this individually or as part of a group of three
- 45-minute online test in a registered test centre, e.g. the learners' school

Skills demonstration test

The skills demonstration test takes place during the learning process, while learners are participating in the programme. Its basic activities are pre-determined, and cover areas such as setting up simple control systems and implementing a simple robotic motion. Learners will self-evaluate their skills in each area, and the teacher or an independent assessor will then verify that each learner has demonstrated the required skills.

Typically, these skills will be demonstrated as part of group work (a group of up to three learners), so the teacher or assessor must be satisfied that the learner has actively participated in the activity. During the assessment, the teacher or assessor will complete the ICDL Robotics Skills Demonstration document. The school or centre will then manually enter the results onto the Approved Centre Forum (ACF) by accessing the ACF and going to 'Ordering and Administration', then to 'Enter manual test results' and filling out the details on the page. The ICDL Robotics Skills Demonstration document does not need to be uploaded but should be retained for audit purposes.

The result of the Skills Demonstration assessment is either Pass or Fail. To pass, the Learner must demonstrate all listed skills on the Skills demonstration record in a 30-minute session. Learners must pass all elements of the skills demonstration test in order to progress to the test.

Online test

The online test assesses the competences outlined in the ICDL Robotics syllabus. Learners must be registered to the Robotics module in order to take a test.

The online test is invigilated and takes place in a registered test centre, which in many cases may be the school. The test is delivered through Skillsbox, an automated test system.

There are a variety of question types used in the test to test the learner's mastery of the knowledge and skills outlined in the curriculum. The question type and format are primarily determined by the type of knowledge or skill being measured. Question types may include multiple choice, match-ups, fill-in-the-blanks, or practical in-application tasks.

The test takes 45 minutes and the pass mark is 75% (21/28 marks). Learners must pass both the skills demonstration test and the test in order to complete the qualification.

While BCS would not normally want to make changes to either grade thresholds or grading algorithms there is potential for them to change in order to maintain standards.

Reasonable Adjustments

Centres will receive guidance on reasonable adjustments in accordance with Equalities Law including, but not exclusively, ensuring there is an environment which will allow access by a disabled learner or to make alternative arrangements such as a different venue or different equipment suitable for the learner.

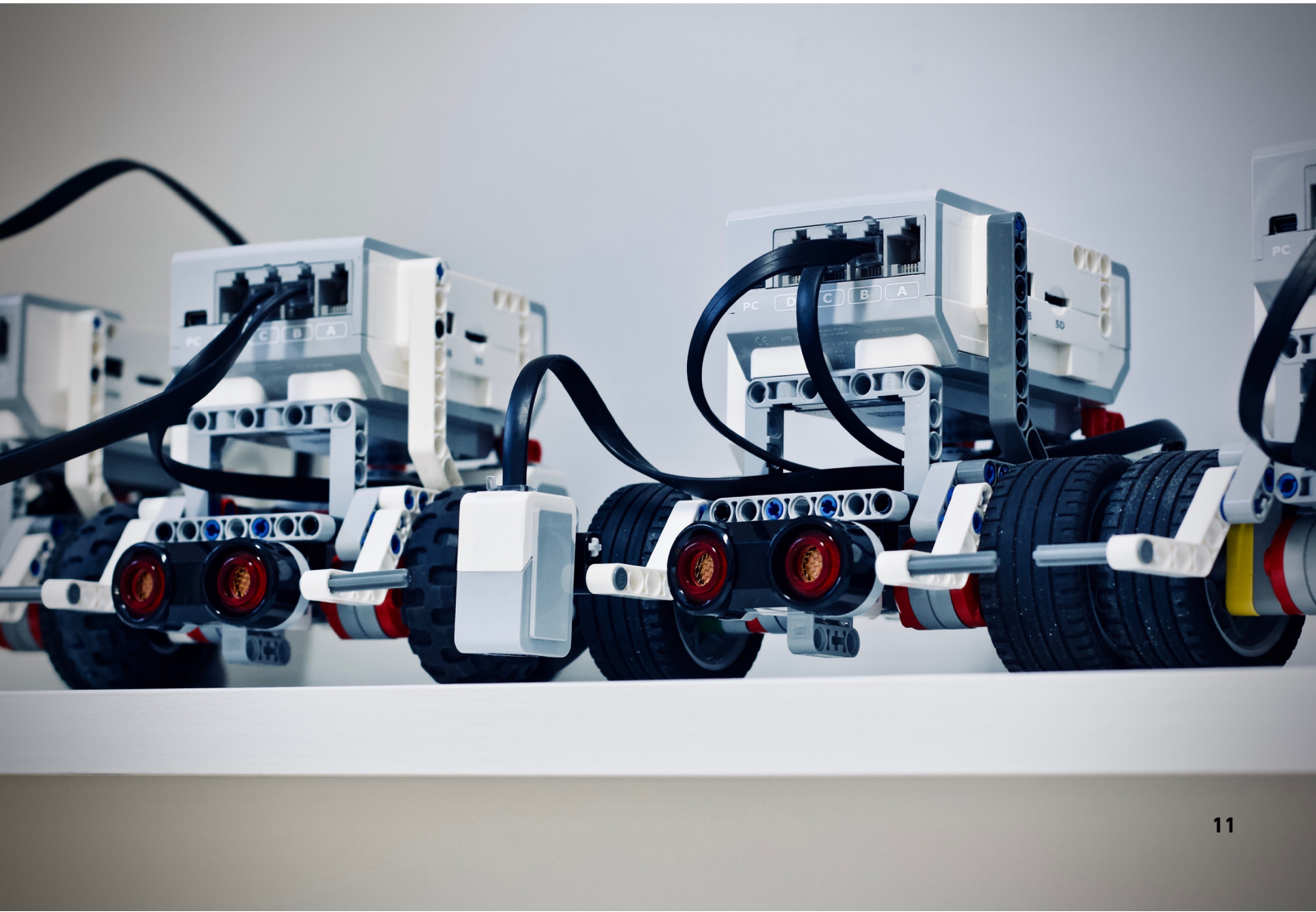
Outcomes and Reassessment

'The first part of the assessment, the skills demonstration, is completed offline and the school or centre will need to manually enter the results onto the Approved Centre Forum (ACF). When a learner completes the second part of the assessment, the online test, using the Skillsbox platform, the results are submitted directly to BCS.

Resits are available for this qualification.

Appeals

If situations arise that call into the question the validity of an awarding decision, for example, via an appeal or an enquiry in accordance with our Appeals Policy, or an error has been made and a learner has incorrectly been awarded, or not awarded, a qualification achievement issue will be brought to the attention of the Service Delivery Manager - Qualifications. Our Appeals Policy is available from the Approved Centre Forum.



Skillsbox

Accessing the online assessments

The test may be completed via the Skillsbox online platform on an on-demand basis. Centres will have access to add and manage users and tests.

You can access Skillsbox by logging in here.

General System Requirements

SYSTEM CHECK	REQUIREMENTS	ADDITIONAL INFORMATION
Operating System	Windows 7/8/10	Only Microsoft Windows is supported for in-application testing
Browser	Internet Explorer 11 Firefox Google Chrome	A plugin is required for in-application testing
Plugin Installation	PSI in-application Plugin is required for tests	All Supported Browsers: Ensure the plugin is fully installed and detected. Additional Chrome Requirements: Ensure the extension has been installed Additional Firefox Requirements: Ensure the Firefox extension and the plugin are installed
.NET Framework	.NET 3.X Framework is required	.NET 3.X framework is required for applications to run**
Microsoft Office	Microsoft Office applications must be installed.	In-application testing will not work with browser versions of Office365
Access to Work Files (Z:/)	Skillsbox Atlas Cloud uses a drive mapping script to create Z:/ on the machine to store test files.	The mapped drive must be visible to candidates if there is already a Z:/ drive on the network the script will work backwards to find the next available letter to map the drive to.
Registry Access	User must have read/write access to HKEY_CURRENT_USER	This is default in Windows. Please note that the online Robotics assessment will work on Chromebooks as the assessment does not feature any questions that use the in-application engine.

Frequently Asked Questions

Q) How long does this qualification take to complete?

A) This qualification has 37 guided learning hours, and a total qualification time of 51 hours.

Q) What learning materials or courseware are available?

A) Learners will be able to access a diagnostic test via the Skillsbox online platform, to practise and determine if they are ready to progress to the second part of the assessment, the test. There are also two handbooks available: one for learners and one for teachers. The learner material handbook will be accessible as an e-book on Atlas Cloud platform and learners will receive credit to buy the e-book once their school has purchased the course. The teacher handbook includes an overview of robotics, planning considerations, lesson plans including learning outcomes, resources needed, activity description, and useful links.

Q) Can this qualification be delivered remotely?

A) As this qualification is designed to be taken by learners approximately 10-11 years old, delivered by teachers in a school setting, and requires specialist equipment, the course will not be able to be delivered remotely.

Q) What is GLH and TQT?

A) Guided Learning Hours (GLH) indicates the approximate time (in hours) that the learner will be supervised during any teaching, learning or assessment activities.

Total Qualification Time (TQT) is a predication of the total time a learner with no prior knowledge might need to complete the course. TQT is made up of two elements: GLH, and all other hours (an estimate of the number of hours a learner will reasonably spend on any unsupervised learning or assessment activities including homework, research, exam preparation and formal assessment) so that they can successfully achieve the qualification.

Q) What practice tests are available?

A) A diagnostic test is available through the Skillsbox platform.

Glossary

We recognise that Level 1 Robotics is not just new for learners – it may be a new topic area for teachers, schools and centres too. With this in mind, we have included a glossary of some key terms used both within this Qualification Guide and in ICDL's Robotics Teacher Handbook.

Arduino	An open-source electronics platform. Its boards can be programmed using mBlock5 software. (See also: Arduino board, mBlock5).
Arduino board	A microcontroller board which can read inputs, such as light on a sensor or a finger on a button, and turn it into an output, such as activating a motor, or turning on an LED. (See also: Microcontroller)
Block diagram	A graphical representation which provides a functional view of a system. It is used to represent processes, functions, and relationships with other blocks.
Control (open-loop and closed-loop)	A differential equation which determines a system's behaviour. Control systems are classified into two types – open-loop and closed-loop. The main difference between open-loop and closed loop control systems is that the output of open-loop systems does not depend on the control action, whereas the output of closed-loop systems does depend on the system's control action. Open-loop systems are sometimes known as non-feedback systems, while closed-loop systems are referred to as feedback systems.
Encoder motor	A simple motor which offers precise control and can be read using a microcontroller such as Arduino.
Gyroscope	A motion sensor which detects and measures angular motion of an object.
Logic operator	A symbol or word used to connect two or more expressions, which determines what action is to be performed or considered. It performs Boolean logic on input data to provide a 'true' or 'false' result.
Makeblock	A global STEAM education provider and creator of the robotic kit used in this module, the MBot Robot ranger.
mBlock5	Block-based and text-based programming software, based on Scratch 3.0. It allows users to create games and animations, and to programme Makeblock robots, Arduino boards and micro:bit. (See also: Makeblock, Arduino board, micro:bit)
micro:bit	A pocket-sized computer designed to help children and young people learn through coding activities and problem-solving projects.
Microcontroller	A compact integrated circuit which is embedded inside a device in order to control its features or actions. They are dedicated to one task and run one specific program. They take input from the device they are controlling and send signals to different components within the device.
Ultrasonic sensor	An electronic device which measures the distance of a target object by emitting ultrasonic soundwaves, converting the reflected sound into an electrical signal.
Variable	A value stored in computer memory for later use, or for use in calculations.
Visual programming language	A programming language which lets users create programmes by manipulating program elements graphically, rather than by specifying them in text.

CONTACT

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