

FIRST® LEGO® League Challenge – Secondary National Curriculum links

Key Stage 3 (Year 7 - 9)

Subject/ Subject strand	Key Stage 2 NC objectives	Example application in FIRST® LEGO® League Challenge
<p>English</p> <p>To promote high standards of language and literacy by equipping pupils with a strong command of the spoken and written word, and to develop their love of literature through widespread reading for enjoyment.</p>		
<p>Spoken language</p>	<p>speak confidently and effectively, including through:</p> <ul style="list-style-type: none"> – using Standard English confidently in a range of formal and informal contexts, including classroom discussion – giving short speeches and presentations, expressing their own ideas and keeping to the point – participating in formal debates and structured discussions, summarising and/or building on what has been said – improvising, rehearsing and performing play scripts and poetry in order to generate language and discuss language use and meaning, using role, intonation, tone, volume, mood, silence, stillness and action to add impact. 	<ul style="list-style-type: none"> – Taking part in team discussions throughout the season – Conducting interviews, gathering information from experts, peers and the wider public as part of the Innovation Project process – Presenting their research findings and Innovation Project solution to different groups, including judges at a tournament.
<p>Grammar and vocabulary</p>	<p>consolidate and build on their knowledge of grammar and vocabulary through:</p> <ul style="list-style-type: none"> – extending and applying the grammatical knowledge set out in English Appendix 2 to the key stage 1 and 2 programmes of study to analyse more challenging texts – drawing on new vocabulary and grammatical constructions from their reading and listening, and using these consciously in their writing and speech to achieve particular effects – knowing and understanding the differences between spoken and written language, including differences associated with formal and informal registers, and between Standard English and other varieties of English – using Standard English confidently in their own writing and speech 	<ul style="list-style-type: none"> – Reading aloud as part of team practise sessions - rules, research, presentations. – Reading and understanding technical vocabulary as part of their Innovation Project research. – Presenting Innovation project and answering questions around their chosen topic and research findings.
<p>Writing</p>	<p>write accurately, fluently, effectively and at length for pleasure and information through:</p> <ul style="list-style-type: none"> – writing for a wide range of purposes and audiences, including: <ul style="list-style-type: none"> • notes and polished scripts for talks and presentations • a range of other narrative and non-narrative texts, including arguments, and personal and formal letters – summarising and organising material, and supporting ideas and arguments with any necessary factual detail – applying their growing knowledge of vocabulary, grammar and text structure to their writing and selecting the appropriate form – drawing on knowledge of literary and rhetorical devices from their reading and listening to enhance the impact of their writing – plan, draft, edit and proof-read through: <ul style="list-style-type: none"> • considering how their writing reflects the audiences and purposes for which it was intended • amending the vocabulary, grammar and structure of their writing to improve its coherence and overall effectiveness • paying attention to accurate grammar, punctuation and spelling; applying the spelling patterns and rules set out in English Appendix 1 to the key stage 1 and 2 programmes of study for English. 	<ul style="list-style-type: none"> – When planning and writing materials for their Innovation Project to ensure it is a clear and well structured presentation of their ideas.

Subject/ Subject strand	Key Stage 2 NC objectives	Example application in FIRST® LEGO® League Challenge
Reading	<p>develop an appreciation and love of reading, and read increasingly challenging material independently through:</p> <ul style="list-style-type: none"> – reading a wide range of fiction and non-fiction, including in particular whole books, short stories, poems and plays with a wide coverage of genres, historical periods, forms and authors. – choosing and reading books independently for challenge, interest and enjoyment. – understand increasingly challenging texts through: <ul style="list-style-type: none"> • learning new vocabulary, relating it explicitly to known vocabulary and • understanding it with the help of context and dictionaries • making inferences and referring to evidence in the text • knowing the purpose, audience for and context of the writing and drawing on this knowledge to support comprehension • checking their understanding to make sure that what they have read makes sense. • read critically through: 	<ul style="list-style-type: none"> – Reading, discussing, debating, summarizing and understanding non-fiction content as part of their Innovation Project research. – Reading from different sources such as books, websites, newspapers, magazines as part of their Innovation Project research.
<p>Mathematics</p> <p>Become fluent in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.</p> <ul style="list-style-type: none"> – reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language – can solve problems by applying their mathematics to a variety of routine and non- routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions. 		
Working Mathematically: (develop fluency)	<ul style="list-style-type: none"> – select and use appropriate calculation strategies to solve increasingly complex problems – use language and properties precisely to analyse numbers, algebraic expressions, 2-D and 3-D shapes, probability and statistics. 	<ul style="list-style-type: none"> – Calculating and adjusting values for variables in code (e.g. motor rotations or sensor readings) while programming a robot.
Working mathematically: (reason mathematically)	<ul style="list-style-type: none"> – extend and formalise their knowledge of ratio and proportion in working with measures and geometry, and in formulating proportional relations algebraically – make and test conjectures about patterns and relationships; look for proofs or counter-examples – explore what can and cannot be inferred in statistical and probabilistic settings, and begin to express their arguments formally. 	<ul style="list-style-type: none"> – Measuring and calculating distances required to achieve specific robot movements. – Handling and interpreting data as part of research in the Innovation Project
Working Mathematically: (solve problems)	<ul style="list-style-type: none"> – develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems – develop their use of formal mathematical knowledge to interpret and solve problems, including in financial mathematics – select appropriate concepts, methods and techniques to apply to unfamiliar and non- routine problems. 	<ul style="list-style-type: none"> – Calculating and adjusting values for variables in code (e.g. motor rotations or sensor readings) while programming a robot. – Handling and interpreting data as part of research in the Innovation Project
Number	<ul style="list-style-type: none"> – use standard units of mass, length, time, money and other measures, including with decimal quantities – round numbers and measures to an appropriate degree of accuracy [for example, to a number of decimal places or significant figures] – use approximation through rounding to estimate answers and calculate possible resulting errors expressed using inequality notation $a < x \leq b$ – use a calculator and other technologies to calculate results accurately and then interpret them appropriately – appreciate the infinite nature of the sets of integers, real and rational numbers. 	<ul style="list-style-type: none"> – Calculating and adjusting values for variables in code (e.g. motor rotations or sensor readings) while programming a robot.
Ratio, proportion and rates of change	<ul style="list-style-type: none"> – change freely between related standard units [for example time, length, area, volume/capacity, mass] – use scale factors, scale diagrams and maps – solve problems involving percentage change, including: percentage increase, decrease and original value problems and simple interest in financial mathematics – use compound units such as speed, unit pricing and density to solve problems. 	<ul style="list-style-type: none"> – Measuring and calculating distances, angles, time, speed required to achieve specific robot movements.

Subject/ Subject strand	Key Stage 2 NC objectives	Example application in <i>FIRST</i> ® <i>LEGO</i> ® League Challenge
Geometry and measures	<ul style="list-style-type: none"> – draw and measure line segments and angles in geometric figures, including interpreting scale drawings – interpret mathematical relationships both algebraically and geometrically. 	<ul style="list-style-type: none"> – Measuring and calculating the angle of turn required to achieve specific robot movements.
Probability	<ul style="list-style-type: none"> – record, describe and analyse the frequency of outcomes of simple probability experiments involving randomness, fairness, equally and unequally likely outcomes, using appropriate language and the 0-1 probability scale 	<ul style="list-style-type: none"> – Using probability from testing and programming to calculate and adjust values for variables in code (e.g. motor rotations or sensor readings) while programming a robot.
Statistics	<ul style="list-style-type: none"> – describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete, continuous and grouped data; and appropriate measures of central tendency (mean, mode, median) and spread (range, consideration of outliers) – construct and interpret appropriate tables, charts, and diagrams, including frequency tables, bar charts, pie charts, and pictograms for categorical data, and vertical line (or bar) charts for ungrouped and grouped numerical data 	<ul style="list-style-type: none"> – Handling and interpreting data as part of research in the Innovation Project
Science <ul style="list-style-type: none"> – develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics – develop understanding of the nature, processes and methods of science through different types of science enquiries that help them to answer scientific questions about the world around them – are equipped with the scientific knowledge required to understand the uses and implications of science, today and for the future. 		
Working scientifically (scientific attitudes)	<ul style="list-style-type: none"> – pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility – understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review 	<ul style="list-style-type: none"> – Designing, building and testing a robot and its attachments including sensors to achieve specific goals.
Working scientifically (experimental skills and investigations)	<ul style="list-style-type: none"> – make predictions using scientific knowledge and understanding – select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate – make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements 	<ul style="list-style-type: none"> – Designing, building, testing and adjusting a robot and its attachments including sensors to achieve specific goals.
Working scientifically (analysis and evaluation)	<ul style="list-style-type: none"> – apply mathematical concepts and calculate results – present observations and data using appropriate methods, including tables and graphs – interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions – present reasoned explanations, including explaining data in relation to predictions and hypotheses – evaluate data, showing awareness of potential sources of random and systematic error – identify further questions arising from their results. 	<ul style="list-style-type: none"> – Presenting their research findings and Innovation Project solution to different groups, including judges at a tournament. – Handling and interpreting data as part of research in the Innovation Project
Working scientifically (measurement)	<ul style="list-style-type: none"> – use and derive simple equations and carry out appropriate calculations – undertake basic data analysis including simple statistical techniques. 	<ul style="list-style-type: none"> – Designing, building and testing a robot and its attachments including sensors to achieve specific goals.
Motion and forces	<ul style="list-style-type: none"> – forces as pushes or pulls, arising from the interaction between two objects – moment as the turning effect of a force – forces: associated with deforming objects; stretching and squashing <ul style="list-style-type: none"> – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water 	<ul style="list-style-type: none"> – Designing, building and testing a robot and its attachments to achieve specific goals.

Subject/ Subject strand	Key Stage 2 NC objectives	Example application in FIRST® LEGO® League Challenge
Computing <ul style="list-style-type: none"> – can understand and apply the fundamental principles and concepts of computer science, including abstraction, logic, algorithms and data representation – can analyse problems in computational terms, and have repeated practical experience of writing computer programs in order to solve such problems – can evaluate and apply information technology, including new or unfamiliar technologies, analytically to solve problems – are responsible, competent, confident and creative users of information and communication technology 		
Computer Science	<ul style="list-style-type: none"> – design, use and evaluate computational abstractions that model the state and behaviour of real-world problems and physical systems – understand several key algorithms that reflect computational thinking [for example, ones for sorting and searching]; use logical reasoning to compare the utility of alternative algorithms for the same problem – use 2 or more programming languages, at least one of which is textual, to solve a variety of computational problems; make appropriate use of data structures [for example, lists, tables or arrays]; design and develop modular programs that use procedures or functions – understand simple Boolean logic [for example, AND, OR and NOT] and some of its uses in circuits and programming; understand how numbers can be represented in binary, and be able to carry out simple operations on binary numbers [for example, binary addition, and conversion between binary and decimal] 	<ul style="list-style-type: none"> – Writing programs for a robot to accomplish the Robot Game missions. – Testing, correcting and improving programs for a robot to accomplish the Robot Game missions. – Working with input and output devices on a robot (e.g. sensors and motors)
Information Communication Technology	<ul style="list-style-type: none"> – undertake creative projects that involve selecting, using, and combining multiple applications, preferably across a range of devices, to achieve challenging goals, including collecting and analysing data and meeting the needs of known users 	<ul style="list-style-type: none"> – Using IT to collect, analyse, evaluate and present data and information in the Innovation Project and Robot Design process
Digital literacy	<ul style="list-style-type: none"> – understand a range of ways to use technology safely, respectfully, responsibly and securely, including protecting their online identity and privacy; recognise inappropriate content, contact and conduct, and know how to report concerns 	<ul style="list-style-type: none"> – Working as part of a team to communicate and share ideas, and develop materials for both Innovation Project and Robot Design process
Design and Technology <ul style="list-style-type: none"> – develop the creative, technical and practical expertise needed to perform everyday tasks confidently and to participate successfully in an increasingly technological world – build and apply a repertoire of knowledge, understanding and skills in order to design and make high-quality prototypes and products for a wide range of users – critique, evaluate and test their ideas and products and the work of others. 		
Design	<ul style="list-style-type: none"> – use research and exploration, such as the study of different cultures, to identify and understand user needs – identify and solve their own design problems and understand how to reformulate problems given to them – develop specifications to inform the design of innovative, functional, appealing products that respond to needs in a variety of situations – use a variety of approaches [for example, biomimicry and user-centred design], to generate creative ideas and avoid stereotypical responses – develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools 	<ul style="list-style-type: none"> – When developing an innovative solution to a problem that the team has identified in the Innovation Project – To adapt the robots physical design in order to solve the robot game missions.

Subject/ Subject strand	Key Stage 2 NC objectives	Example application in <i>FIRST</i> ® <i>LEGO</i> ® League Challenge
Evaluate	<ul style="list-style-type: none"> - analyse the work of past and present professionals and others to develop and broaden their understanding - investigate new and emerging technologies - test, evaluate and refine their ideas and products against a specification, taking into account the views of intended users and other interested groups - understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists 	<ul style="list-style-type: none"> - When developing an innovative solution to a problem that the team has identified in the Innovation Project
Technical knowledge	<ul style="list-style-type: none"> - understand and use the properties of materials and the performance of structural elements to achieve functioning solutions - understand how more advanced mechanical systems used in their products enable changes in movement and force - apply computing and use electronics to embed intelligence in products that respond to inputs [for example, sensors], and control outputs [for example, actuators], using programmable components [for example, microcontrollers]. 	<ul style="list-style-type: none"> - Designing, building and testing a reliable robot and its attachments to achieve specific goals including the use of sensors. - Presenting and explaining their design choices for a robot and its attachments in the Robot Design judging.