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An Introductory Guide to Using K'Nex in the Classroom

Contents

Introduction

This document is intended as a guide for teachers as to how they can incorporate K'Nex into the classroom in a meaningful and engaging way to help meet some of the outcomes of A Curriculum for Excellence.

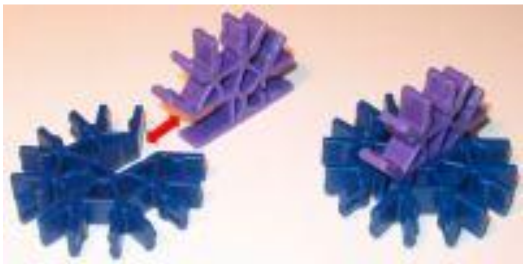
K'Nex can provide a wide variety of ways for teachers to teach technology, maths and literacy skills to pupils whilst also providing variety in the classroom. It can also be an effective way to help pupils to become successful learners, confident individuals, responsible citizens and effective contributors. It is also a particularly good way to encourage co-operative learning and to involve pupils with learning difficulties in a whole class activity.

The activities included in this document are just a starting point and teachers are encouraged to adapt suggested activities to meet the needs of their pupils. Most of these activities have been adapted from the K'Nex User Group website (www.knexusergroup.org.uk) and further ideas can be found there. The activities here are aimed at P4-7, but can easily be modified for younger pupils.

How K’Nex Works

Rods and connectors can join together in 3 ways – side on, end on, through the hole.

To make a connection through the hole in the middle, simply put the rod through the hole. Note that a few special-purpose connectors don’t have a hole in the middle.



Blue and purple connectors have rectangular slots in them, which means you can connect two purple connectors to each other; two blue connectors to each other; or a blue connector to a purple connector. Put one slot inside the other slot, and push until you hear a click. Using blue and purple connectors together is very useful when making a 3-D model which needs corners.

Connectors come in different shapes, with each correlating to an angle. White connectors are 360°, yellow 180°, red 90° and so on.

Don’t worry if you run out of rods. K’Nex rods can be joined together to form longer rods. Two white rods joined with a connector in a straight line is the same size as a yellow rod, for example.

Wheels come in different sizes and are composed of two separable parts: a grey wheel and a tyre. To allow the wheel to spin freely, put a rod through the hole in the wheel, and secure it with a connecter. The grey wheel can also be used alone for pulleys. In order to do this, you can insert the pin of a tan connector into the small hole of the grey wheel.

K’Nex pieces are fairly robust, so don’t be afraid to use a bit of force if pieces are not joining correctly. This is especially true of motors. These are the basic K’nex pieces, but there are lots more available, including motors.

If you are having problems with your model, the chances are that it is because it is not symmetrical. Check to see if you have connector joined in a similar way at each side of the model, and that rod sizes are compatible.

K’Nex is something that you need to experiment with for a while until you ‘get the hang of it’ and it does take a little time to get used to if you’ve not used it before.

Incorporating K'Nex into the Classroom

If pupils are new to using K'Nex, it might be a suggestion to have them build models from instructions initially, so that they understand how it works. Once they are more confident, they might progress onto building a model from a picture. After this, pupils will be ready to progress to the 'challenge' level.

A challenge is where pupils build a model without instructions. It is a focused practical task where pupils work in pairs to meet a set objective, and lasts about an hour. For example, pupils might be asked to build a buggy that can carry a rubber and a shoe down a ramp, without either falling off, but the rubber is not allowed to sit on the shoe. Pupils work together through the following process to design and build their model.

- Agree objectives
- Design product
- Build prototype
- Test prototype
- Improve prototype
- Product completion
- Analysis of process

The whole class will then look at each model to decide which is the best and why.

Though K'Nex can be used as a standalone activity, it can be a valued resource in the classroom because of its versatility. It can be incorporated into virtually any topic. Some examples could include building a skeleton, towers (look-out towers, towers that can withstand earthquakes), models with gears, pulleys and motors, rockets powered by balloons, fairground and play park models,sports equipment, Roman roads etc. Almost anything can be built from KNex.

It also helps speaking, reading, writing and listening skills, as well as being great for creativity. Pupils can give presentations on their models, followed by a question and answer session. The process of designing and building their model could be written out as a report, a series of instructions or put into a database, a poster can be made. The possibilities are endless.

After carrying out a challenge, the activity could be repeated with different members in each team to produce a different learning experience. If photos were taken, a review could be done of what was learnt and what improvements could be made. These could then be used to make a poster or presentation on the activity to show what was achieved.

K’nex Links to Curriculum for Excellence

This is a guide for learning outcomes that could be met using KNex as a cross-curricular resource - it is definitely not exhaustive. For example, a school could choose to include Social Studies outcomes if looking at Scotland’s bridges and the impact upon society, or health and wellbeing outcomes when using KNex for group interaction.

When developing your project consider what aspects of the Curriculum are being developed and how new learning within a particular EO is being promoted and progressed.

Where you choose to plan activities that challenge children to transfer and use learning from elsewhere it is suggested that you identify and list these EOs separately.

Technologies

<table>
<tr><th></th><th>First</th><th>Second</th><th>Third</th></tr>
<tr><td>Technological developments in society</td><td>I can work with others to generate, discuss and develop imaginative ideas to create a product of the future.
TCH 1-01b</td><td>When exploring technologies in the world around me, I can use what I learn to help to design or improve my ideas or products.
TCH 2-01a

I can investigate how an everyday product has changed over time to gain an awareness of the link between scientific and technological developments.
TCH 2-01b</td><td>From my studies of technologies in the world around me, I can begin to understand the relationship between key scientific principles and technological developments.
TCH 3-01a</td></tr>
<tr><td rowspan="2">Craft, design, engineering & graphics contexts for developing technological skills & knowledge</td><td>I explore materials, tools and software to discover what they can do and how I can use them to help solve problems and construct 3D objects which may have moving parts.
TCH 1-12a</td><td colspan="2">By applying my knowledge and skills of science and mathematics, I can engineer 3D objects which demonstrate strengthening, energy transfer and movement.
TCH 2-12a / TCH 3-12a</td></tr>
<tr><td>Through discovery and imagination, I can develop and use problem-solving strategies to construct models.
TCH 1-14a

Having evaluated my work, I can adapt and improve, where appropriate, through trial and error or by using feedback.
TCH 1-14b</td><td>Through discovery and imagination, I can develop and use problem-solving strategies to construct models.
TCH 2-14a

Having evaluated my work, I can adapt and improve, where appropriate, through trial and error or by using feedback.
TCH 2-14b</td><td>By using problem-solving strategies and showing creativity in a design challenge, I can plan, develop, organise and evaluate the production of items which meet needs at home or in the world of work.
TCH 3-14a</td></tr>
</table>

Science

	First	Second	Third
Forces	By investigating forces on toys and other objects, I can predict the effect on the shape or motion of objects. **SCN 1-07a**	By investigating how friction, including air resistance, affects motion, I can suggest ways to improve efficiency in moving objects. **SCN 2-07a**	By contributing to investigations of energy loss due to friction, I can suggest ways of improving the efficiency of moving systems. **SCN 3-07a**
Energy sources and sustainability	I am aware of different types of energy around me and can show their importance to everyday life and my survival. **SCN 1-04a**	By considering examples where energy is conserved, I can identify the energy source, how it is transferred and ways of reducing wasted energy. **SCN 2-04a** I can investigate the use and development of renewable and sustainable energy to gain an awareness of their growing importance in Scotland or beyond. **TCH 2-02b**	I can use my knowledge of the different ways in which heat is transferred between hot and cold objects and the thermal conductivity of materials to improve energy efficiency in buildings or other systems. **SCN 3-04a** By investigating renewable energy sources and taking part in practical activities to harness them, I can discuss their benefits and potential problems. **SCN 3-04b**

Mathematics

	First	Second	Third
Properties of 2D shapes & 3D objects	I have explored simple 3D objects and 2D shapes and can identify, name and describe their features using appropriate vocabulary. **MTH 1-16a**	Having explored a range of 3D objects and 2D shapes, I can use mathematical language to describe their properties, and through investigation can discuss where and why particular shapes are used in the environment. **MTH 2-16a** I can draw 2D shapes and make representations of 3D objects using an appropriate range of methods and efficient use of resources. **MTH 2-16c**	Having investigated a range of methods, I can accurately draw 2D shapes using appropriate mathematical instruments and methods. **MTH 3-16a**

Literacy

	First	Second	Third
Listening & Talking **Tools for listening & talking**	When I engage with others, I know when and how to listen, when to talk, how much to say, when to ask questions and how to respond with respect. **Lit 0-02a/ENG 0-03a**	When I engage with others, I can respond in ways appropriate to my role, show that I value others' contributions and use these to build on thinking. **Lit 2-02a**	When I engage with others, I can make a relevant contribution, encourage others to contribute and acknowledge that they have the right to hold a different opinion. I can respond in ways appropriate to my role and use contributions to reflect on, clarify or adapt thinking. **Lit 4-02a**
Listening & Talking **Finding & using information**	As I listen or watch, I can identify and discuss the purpose, key words and main ideas of the text, and use this information for a specific purpose. **Lit 1-04a**	As I listen or watch, I can identify and discuss the purpose, main ideas and supporting detail contained within the text, and use this information for different purposes. **Lit 2-04a**	As I listen or watch I can: Identify and give an accurate account of the purpose and main concerns of the text, and can make inferences from key statements Use this information for different purposes. **Lit 3-04a**
Listening & Talking **Creating Texts**	When listening and talking with others for different purposes, I can exchange information, experiences, explanations, ideas and opinions, and clarify points by asking questions or by asking others to say more. **LIT 1-09a**	When listening and talking with others for different purposes, I can: • share information, experiences and opinions • explain processes and ideas • identify issues raised and summarise main points or findings **LIT 2-09a**	When listening and talking with others for different purposes, I can: • communicate information, ideas or opinions • explain processes, concepts or ideas • identify issues raised, summarise findings or draw conclusions. **LIT 3-09a**
Writing **Creating Texts**	I can convey information, describe events of processes, share my opinions or persuade my reader in different ways. **Lit 1-28a/Lit 1-29a**	I can convey information, describe events, explain processes or combine ideas in different ways. **Lit 2-28a**	I can convey information, describe events, explain processes or concepts, and combine ideas in different ways. **Lit 3-28a**

Using K'nex to Develop Skills

What skills are developed in the technologies?

Well-designed practical activities in the technologies offer children and young people opportunities to develop:

- curiosity and problem solving skills, a capacity to work with others and take initiative
- planning and organisational skills in a range of contexts
- creativity and innovation, for example though ICT and computer aided design and manufacturing approaches

- skills in using tools, equipment, software and materials
- skills in collaborating, leading and interacting with others
- critical thinking through exploration and discovery within a range of learning contexts
- discussion and debate
- searching and retrieving information to inform thinking within diverse learning contexts
- making connections between specialist skills developed within learning and skills for work
- evaluating products, systems and services
- presentation skills.

What skills are developed in the sciences?

Inquiry and investigative skills

Through experimenting and carrying out practical scientific investigations and other research to solve problems and challenges, children and young people:

- ask questions or hypothesise
- plan and design procedures and experiments
- select appropriate samples, equipment and other resources
- carry out experiments
- use practical analytical techniques
- observe, collect, measure and record evidence, taking account of safety and controlling risk and hazards
- present, analyse and interpret data to draw conclusions
- review and evaluate results to identify limitations and improvements
- present and report on findings.

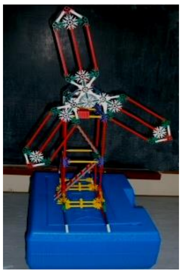
The main approaches to science inquiry are:

- observing and exploring – careful observation of how something behaves, looking for changes over time and exploring 'what happens if...?' and 'how could I...?' questions
- classifying – through identifying key characteristics
- fair testing – through identifying all possible variables and then changing only one while controlling all others
- finding an association – linking two variables to determine relationships.

Scientific analytical thinking skills

Children and young people develop a range of analytical thinking skills in order to make sense of scientific evidence and concepts. This involves them:

- being open to new ideas and linking and applying learning
- thinking creatively and critically
- developing skills of reasoning to provide explanations and evaluations supported by evidence or justifications
- making predictions, generalisations and deductions
- drawing conclusions based on reliable scientific evidence.

Turbine Challenge

Objectives and Topics: How to make tall, stable structures, designing skills, forces, making skills, shape, space, measurements, presentations skills, awareness of renewable energy

Instructions

The year is 2025 and you are the engineer of your town. The environment and renewable energy are very important issues, and you have been asked to create a brand new renewable energy source that will not harm the environment. You decide to build a wind turbine.

Things to Think About

Your turbine will need to have a strong base that will support the weight. There will need to be a way of allowing people to get to the top to check the turbine for repairs and maintenance. Your model should be at least 30cm tall. Test the structure – how strong is it if you press your hand down on it? How could you make it stronger? Don't be afraid to start again if your design isn't working.

Difficulty Level 1: Build a basic model of a turbine
Difficulty Level 2: Build a basic model of a turbine with one moveable propeller
Difficulty Level 3: As level two, but with two moveable propellers. Can you make your turbine taller?

Conclusion

Test the models – this could be done with a fan, hairdryer, by blowing on the turbines, or outside if the weather is suitable!
Have a look at the other models. What worked well and what could be improved? Why? Give a class presentation on your model and write up the experiment.

Possible Lessons, projects and follow-up activities

- Renewable energy
- Past, present and future sources of energy
- Climate change
- Wind
- Effects of turbines in Scotland/Highlands/local area
- How electricity works
- Energy debate
- Scotland's global/national role in renewable energy



Bridge Challenge

Objectives and Topics: How to make structures more stable and withstand greater loads, how structures can fail when loaded and techniques for reinforcing and strengthening them. Structures, designing skills, forces, making skills, shape, space, measurements, presentations skills

Instructions

A big storm has washed away part of the main road near your school. A child in the school is very ill and the ambulance can't get through. We need your help – can you design and build a bridge that can carry the ambulance across the gap in the road?

Things to think about

How can you make your bridge really strong? Try out your ideas on a short bridge – does it break or sag in the middle? If so, how could you strengthen it?
Push down on the centre of the bridge – does it start to fail in any way? How can you prevent this? Don't be afraid to start again after you have tested your bridge – getting the best design is not easy.
When you are happy with your short bridge, extend it to 1 metre long and test it again. Can you improve your design even further?
Finally extend the bridge to 2 metres and test it. If it stands up ok, try adding books to the centre, one at a time (carefully!). If the bridge starts to bend or break – back to the drawing board!

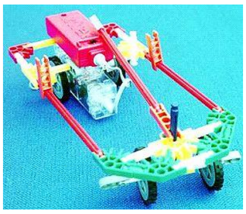
Difficulty Level 1: Make a bridge which can span a 30 centimetre gap.
Difficulty Level 2: Make a bridge which will span a 1 metre gap without supports
Difficulty Level 3: Make a bridge which will span a 2 metre gap without supports which will also support the weight of a box of K'Nex or books in the middle.

Conclusion

Ask the pupils what they have learnt in the process of completing the challenge.
Ask them to compare the different bridges built by the class and assess the strengths and weaknesses of each. Pupils give a class presentation on their model and write up the experiment

<u>Possible Lessons, projects and follow-up activities</u>

- Types of bridges
- Bridges around the local area/UK/World
- Purpose and location of bridges
- Three-dimensional structures
- Symmetry
- Scottish/famous engineers
- Entrepreneurship – build a bridge within a budget. Rods and connectors are allocated a cost, eg red rods = 10p each. Pupils cannot exceed the budget. Who can build the strongest, most cost effective structure?

Mars Rover Challenge

Objectives and Topics: Design a vehicle capable of travelling over rough ground and steering. Structures, designing skills, forces, making skills, shape, space, measurements, mechanisms, Earth and beyond, presentation skills.

Instructions

“Hello, Houston? We have a problem. It’s zero minus one hour and counting. We have developed a malfunction with our Mars rover vehicle. Can you ship in a replacement as soon as possible?”

Things to Think About

What shape will your Mars rover be? How many wheels will it have? How will the wheels be fastened to the body? For level 2 how can you make the motor drive the wheels? Will the rover travel over rough ground like that found on Mars? For level 3 how can you make the rover steer around in a circle?

Difficulty Level 1: Build a simple model of a Mars rover vehicle
Difficulty Level 2: As level 1 with a motor which will cross the landscape of Mars
Difficulty Level 3: As level 2 which will steer round in a circle

Conclusion

Each team presents their rover to the class. What works well? What could be improved? Discuss the equipment that a real Mars rover would have to carry in order to perform different experiments. Pupils write up a report about the activity.

<u>Possible Lessons, projects and follow-up activities</u>

- Mars
- Planets/the solar system
- Space and its exploration
- Vehicles
- The Mars rover
- Geography/different kinds of terrain
- Kinetic energy
- Design your own planet. What do those who live there need to survive? What do they look like etc
- Estimation and measurement – how fast can the rover go? What angle of a ramp is the optimum for speed? Put the results into a spreadsheet.

Crash Helmet Challenge

Objectives and Topics: To encourage children to consider safety issues associated with head protection, how to make structures more stable and withstand greater loads, how structures can fail when loaded and techniques for reinforcing and strengthening them. Structures, designing skills, forces, making skills, shape, space, measurements, presentations skills

Instructions

Whether you are riding a bike, playing American football or working on a building site, your head is in danger! Can you make a crash helmet that will protect it?

Things to Think About

How could you make a hat or helmet that is the right shape for your head? What K'Nex rods and connectors could you use to make it fit snugly? How can you make it as strong as possible? For level 2, test your helmet by putting it on your head and patting it. Did it bend or break? How could you improve the design so it won't break? Don't be afraid to start again if you want to try a new design. For level 3, put your hat on the floor and put your foot on it gently. Does it bend or break? Keep improving your design so eventually you can stand on it.

Difficulty Level 1: Make a simple hat or helmet
Difficulty Level 2: The helmet does not break if you pat the top of your own head quite hard
Difficulty Level 3: As level 2 and the helmet does not break if you stand on it (on the floor!)

Conclusion

Each group presents their end design to the class. What problems did they have making the helmet? How did they solve this? What improvements did they make?
Compare the different approaches the children have used to make strong helmets. Pupils write up a report about the activity.

Possible Lessons, projects and follow-up activities

- Safety clothing and equipment at home, in school, in sport and industry
- Safety in aspects of everyday life
- History – helmets, armour and body protection past, present and future
- Entrepreneurship – rods and connectors are allocated a costs, eg 10p for a red rod, and helmets need to be made within a certain budget. How could you sell these? Make up a company that manufactures these and plan an advertising/marketing campaign.

Seesaw Challenge

The school has decided that they are going to build a new playground. The head teacher wants you to design and build a seesaw.

Things to think about:

- What does a seesaw look like?
- What happens when people sit on a seesaw?
- What happens when a big child sits on one end and a smaller one on the other end?
- How can you make sure that your seesaw will balance?
- How many seats is your seesaw going to have?

Work with your partner to plan, make and test your seesaw.

Good luck!

Literacy

Coding Machine

The Enigma machine was used during World War Two as a coding machine to keep messages secret. You can make a simple coding machine out of K'NEX, as shown opposite.

The top section slides backwards and forwards, to allow you to change the code as often as you want.

Q1. Can you use your coding machine to send secret messages to a friend?

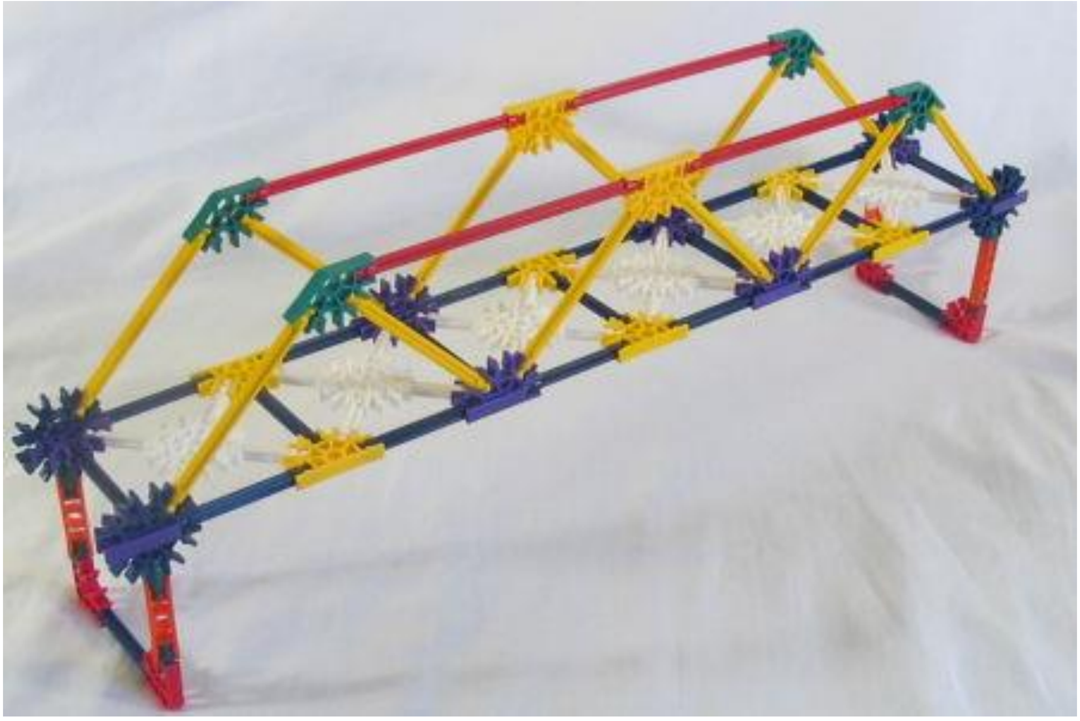
Possible topic follow-ups:

Researching, reading, writing about methods of communication,
World War Two
Innovations in technology
Language focus on specific letters, spelling, phoenetic sound groups etc.

Maths Activities

3D Structures from 2D Images

Copy the model below



What makes the bridge strong?

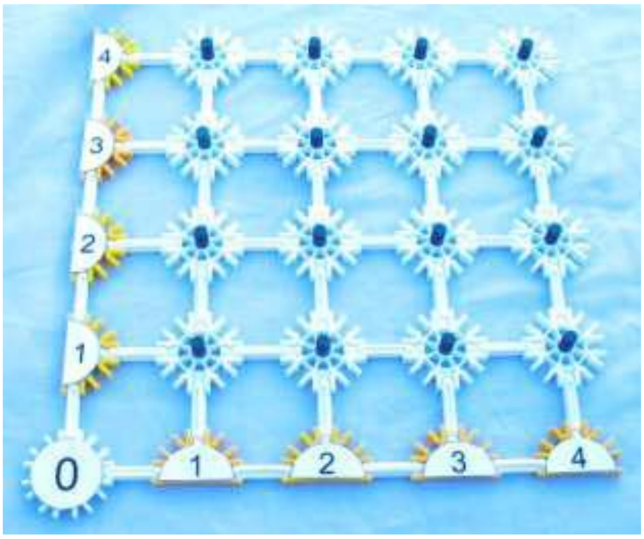
What might the bridge be used for?

Further activities:
Can you build another bridge using just 24 pieces that will support the weight of a small book?

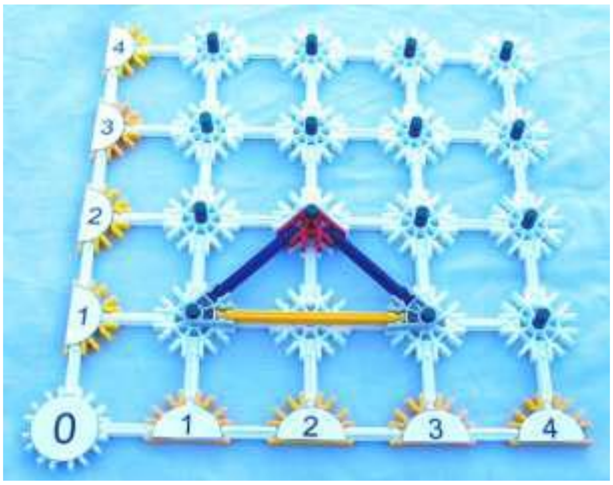
Can you build a bridge within a set budget? Each K'Nex piece has a different value allocated to it. Who can build the cheapest, sturdiest structure? (eg red rods = 10p blue connectors = 5p or rods = £1 each, connectors = 50p each etc. For further suggestions see below)

Co-ordinates

Build the K'NEX grid shown and attach the numerals with Bluetac or similar.



The numerals up the left hand side are known as the"x axis", and number the horizontal lines. The numerals across the bottom are known as the "y axis", and number the vertical lines. At every intersection of a horizontal line and a vertical line there is a white connector. Each white connector has a "coordinate" (x,y) which is the number of the horizontal line, followed by the number of the vertical line. Now build a K'NEX triangle with its corners at (1,1), (2,2) and (1,3), as shown.



Q1. What shape would yet you get if you build a K'NEX model with its corners at (3,1), (3,4), (1,1) and (1,4)

Q2. Make a triangle with two yellow rods and a red rod. Place it on the grid, with the right angled corner on coordinate (1,0). Then write down the coordinate of the other two corners of the triangle.

This activity can be developed by looking at the different angles of the shapes made. KNex Connecters are great for demonstrating angles clearly, eg red connectors are 90° and yellow connectors are 180°.

Measurement

Make the K'NEX racing car shown above.

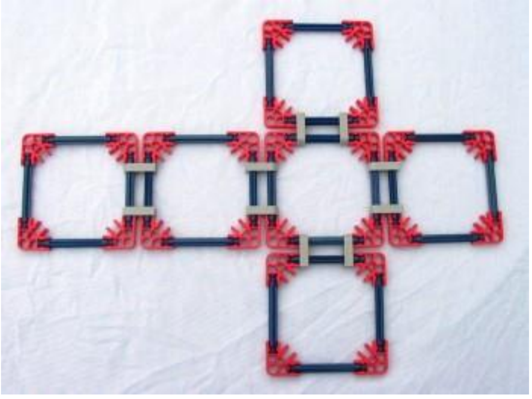
Use a board to build a ramp that is about 1.5m long, and set it at an angle of 30 degrees to the floor, with a clear, bare floor in front of it for the cars to run on. Mark a finishing line across the floor approximately 3m in front of the bottom of the ramp. Measure the exact distance between the top of the ramp and the finishing line.

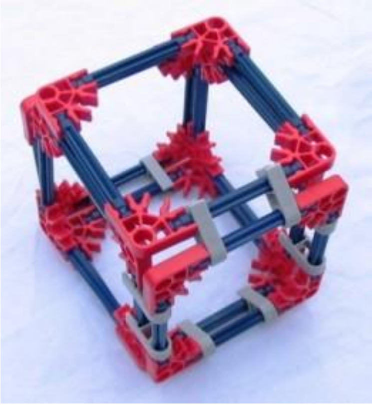
To race a car, place it at the top of the ramp, and then let it go. Use a stop watch to record the start time, and the finish time, when the back of the car crosses the finishing line.

Variations: pupils design their own car in pairs or groups of three. The class then tests which car is the fastest, then analyses what makes a good design.

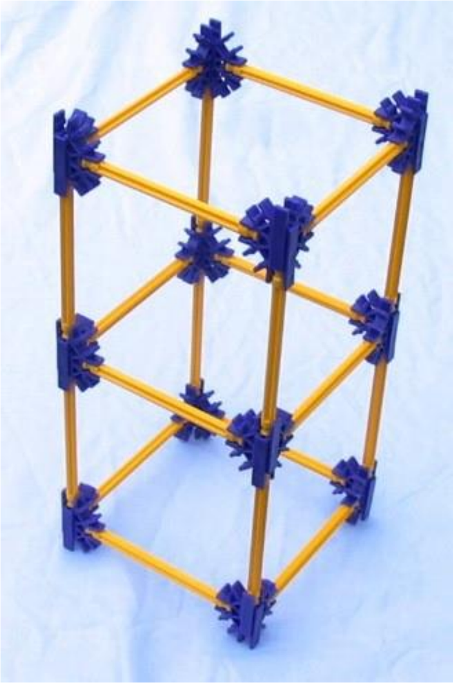
Nets

Simple 3D shapes can be built by folding up a "net", which includes every side of the 3D shape. Make a net for a cube as shown opposite, and fold it up into the cube as shown below.
Can you make a net for a rectangle? What other nets can you make?





Estimating



Build the two-level tower shown opposite:

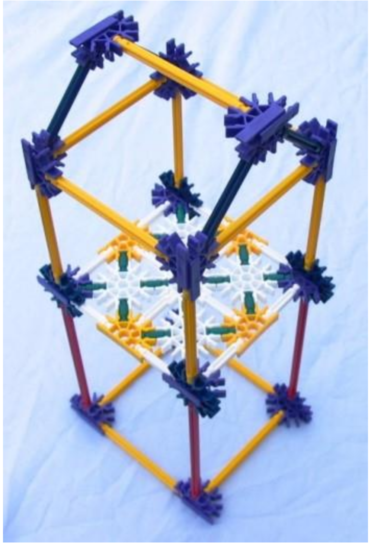
Q1. How many yellow rods and double-purple connectors would you need to add a third level to the tower?

Now build the tower to check whether you were right. The process of thinking how many extra rods and connectors are needed is called "estimating".

Q2. Estimate how many blue rods and white connectors you would need to build a large K'NEX square which contains 9 smaller squares.

Q3. Estimate how many of each rod and connector you would need to build a roundabout. Check your estimates by building the models, and counting the rods and connectors you have used.

Costing



Make the K'NEX bird table shown opposite:

Q1. If each rod costs 5p, and each connector costs 10p, what is the total cost of the bird table?

Q2. Can you design and build a bird table that is only half the cost of the one shown?

Entrepreneurship

You are a business and you have been asked by Sir Alan Sugar to come up with a design for a car. It must be able to carry a shoe and a rubber down a ramp without either falling off. The rubber must not sit in, on or under the shoe.

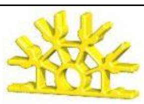
He will give the contract to build it to the team that can come up with the best value design. Using the price guide, can you plan and make the most economical design?

Further suggestions:

- Pupils build their model within a set budget.
- Change the prices of pieces at different points throughout the activity. This could reflect a change in the circumstances of the company/country that makes an item, eg blue connectors are now 50p as they are a finite resource as we are running out of them.
- Pupils can trade with each other. Each group is given a set amount of pieces. One team could have 40 rods and no connectors, whilst another has 40 connectors and no rods etc. Teams have to build a model, eg a tower, trading with each other in order to achieve this.




Example Values of K’Nex Pieces

 Grey rod	50p
 Red rod	50p
 Yellow rod	£1
 Blue rod	£1
 White rod	25p
 Yellow connector	£1
 Blue connector	£1
 Red connector	50p
 Purple connector	£1.50
 White connector	75p

Useful Websites

www.knexusergroup.org This has challenges and fantastic resources. It also tells you exactly how KNex works, has trouble shooting tips and has a very friendly staff more than willing to help with any questions.

www.knex.com The manufacturers website including designs by K'Nexperts, photo galleries and details of all available K'Nex products

http://global.knex.com/uk/club/bonus.php Club K'Nex is a global club that regularly updates model ideas on its site

www.yecscotland.co.uk Young Engineers for Scotland promote science and engineering throughout the country. After school clubs are encouraged, and a £100 start up grant is available for this.

www.balmoralsoftware.com/knex/knex.htm KNex Design Gallery

www.g6cqb.freeserve.co.uk/knex.htm Another K'Nex Gallery

http://home.wanadoo.nl/dark.link/home.htm K'Nex models

www.ai.mit.edu/people/naha/knex/knex.html Don't be put off by some of the complicated accompanying text. Excellent pictures detailing different aspects of K'Nex.

www.facebook.com Features lots of K'Nex fan pages with forums and ideas for using it.

www.youtube.com Shows K'Nex models being built and offers ideas for activities and models

www.ketchum.org A nice site to see photos of a number of different bridges

http://travel.howstuffworks.com/bridge.htm A basic introduction of how bridges work and description of the different designs.

http://travel.howstuffworks.com/pulley.htm A basic description of how pulleys work.

www.stemnet.org.uk Science, Technology, Engineering and Maths Ambassadors who can assist you with STEM subjects. Also offers great resources.

www.stemnorthofscotland.com STEM North of Scotland is the web site to find information on science engagement in the Highlands. This web site will help you to find Science, Technology, Engineering, and Maths activities suitable for various pupil levels linked to the Curriculum of Excellence

www.teachersdomain.org Lots of lesson ideas and resources for teaching about science, technology, engineering and maths. The newspaper chair is a particularly fun activity.

www.proteacher.com A good source of pictures and lesson plans

www.growyourownscientist.co.uk Scotland based K'Nex service provider

Sample Marking Sheet

Pupil Forename	**Pupil Surname**	**Gender**	**Age**	**Pupil Forename**	**Pupil Surname**	**Gender**	**Age**
1)				**2)**			

<table>
<tr><th>Judging Criteria</th><th colspan="2">Buggy Challenge</th><th>Score</th><th>Judge's Comments</th></tr>
<tr><td>Operation, Function and Design

Max. points 50

Poor 1 - 10 Average 11 - 25
Good 26 - 40 Excellent 41 - 50</td><td colspan="2">Does the model perform its intended function competently? Could it be improved? Is their buggy sophisticated? Does it go down the ramp ok? Does the shoe stay on? Does the rubber stay in place? Is it securely attached? How far does it travel? Have the pupils included any novel ideas to assist the model to better carry out its function? Review your overall impression of the model, does it look good?</td><td></td><td></td></tr>
<tr><td>Presentation and Communication

Max. points 25

Poor 1 - 6 Average 7 – 15
Good 16 – 20 Excellent 21 - 25</td><td colspan="2">Did the pupils plan the model before building it?
Do they have drawings they can show? Were they made before during or after they started to build?
How well did the team communicate about their design?
Did they work together as a team?</td><td></td><td></td></tr>
<tr><td>Problem Solving

Max. points 25

Poor 1 - 6 Average 7 – 15
Good 16 – 20 Excellent 21 - 25</td><td colspan="2">Did the pupils encounter any problems during the design and construction stages of the model?
Did they overcome any problems methodically and analytically?
Did they work together to solve any problems?</td><td></td><td></td></tr>
<tr><td>Maximum score available: 100</td><td>Judged by:</td><td>TOTAL</td><td></td><td></td></tr>
</table>