

Unit 4 Models: rules and investigations

About the unit

In this unit pupils learn how simple models are built by first investigating rules, then by seeing how rules can govern the behaviour of simple models.

The unit concentrates on setting up a model of the operation of a successful tuck shop. Pupils identify the objectives for the retailer, outcomes from a consumer perspective, the constraints under which the tuck shop has to operate and the likely effects on the retailers' objectives.

Pupils discuss the ways in which the model could be presented in a spreadsheet, identifying the inputs, the rules (formulae) and the outputs. Pupils then work in groups to construct this model, revising cells, formulae and cell references. They test the effectiveness of the model by using sample data representing a number of scenarios.

This unit is expected to take approximately 5 hours.

Where the unit fits in

This unit is the first on building models using spreadsheets and assumes that pupils will be familiar with cell references, content types and simple formulae, although time is made available to revise this knowledge. It links with unit 5D 'Introduction to spreadsheets' and unit 6B 'Spreadsheet modelling' in the key stage 2 scheme of work.

Expectations

At the end of this unit

most pupils will: understand and be able to describe the rules that govern the operation of models such as a school tuck shop; construct and manipulate a spreadsheet model using formulae; explore patterns and relationships; predict consequences of decisions

some pupils will not have made so much progress and will: understand that rules govern the behaviour of models; test the behaviour of simple spreadsheet models; solve problems

some pupils will have progressed further and will: refine and extend a spreadsheet model, varying the rules, based on the results of test runs

Language for learning

Through the activities in this unit pupils will be able to understand, use and spell correctly vocabulary relating to spreadsheets, *eg rules/formulae, models, test data, absolute/relative references.*

Resources

Resources include spreadsheet software.

Pupils should learn:

Pupils:

Activity 1

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| <ul style="list-style-type: none"> • to revise calculation and graphing techniques in a spreadsheet • the basic structure of spreadsheet formulae | <ul style="list-style-type: none"> • Revise pupils' knowledge of spreadsheet techniques, including entry of data and formulae, graphing and modelling techniques. Use a prepared spreadsheet with column 1 being the items in a recipe for oatcakes, column 2 being the amount required to make enough oatcakes for four people and column 3 the cost of the item. Ask the pupils to investigate what happens when they change the values of any variable. Tasks for pupils could include demonstrating formulae building and replication to produce total costs for enough cakes for 8, 12 or more people. They could use an absolute cell to calculate costs and amounts for any variable, <i>eg if the price of oats goes up or feedback from customers is that oatcakes are too sweet, too small.</i> | <ul style="list-style-type: none"> • carry out calculations and graphing techniques • create correct formulae | <ul style="list-style-type: none"> • Graphing techniques could be revised using a different spreadsheet containing values of, <i>eg</i> x, $x+2$, x^2 |
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Activity 2

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| <ul style="list-style-type: none"> • that systems can be described by rules • to describe rules for a system in a standard and structured manner • to plan the layout of a spreadsheet model | <ul style="list-style-type: none"> • Discuss with pupils how the school tuck shop works, <i>eg types and level of stock, amount of sales, costs and prices, what consumers look for in such a service, and what factors might have to be considered when running a tuck shop.</i> • Pool ideas on the purpose and nature of a successful school tuck shop and identify the constraints under which the shop would operate. • Clarify the purpose behind identifying objectives (or end products), inputs and outputs for a system. • With the pupils, identify and describe the rules governing the operation of a tuck shop. Present an outline of a model representing the changing inputs, differing constraints/variables that affect the outputs, <i>eg a rush on an item could create disappointment, a rise in price could affect sales.</i> Finally, explain that one use of the model will be to predict trends and outcomes. | <ul style="list-style-type: none"> • describe the rules governing systems • present the rules describing a system in a structured manner before constructing a computer-based model | <ul style="list-style-type: none"> • This activity is conducted away from computers. • Teachers could provide a prompt sheet for stimulating discussion about the nature and purposes of a school tuck shop, identifying inputs and outputs. Possible tension needs to be identified between purposes of a tuck shop from the pupils' perspective and from the school's perspective. • Constraints include space, frequency of delivery, choice factors, health factors. • Explain the reasons for choice of test data for the model. • Homework could involve designing a model on paper, based on rules in a system. |
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Learning objectives

Pupils should learn:

Possible teaching activities**Learning outcomes**

Pupils:

Points to note**Activity 3**

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| <ul style="list-style-type: none"> • to enter formulae representing the rules governing the model into a spreadsheet • to run spreadsheet software, saving and loading data files • to enter test data into a spreadsheet model | <ul style="list-style-type: none"> • Ask pupils to start building a model of the tuck shop, translating the rules into formulae – all pupils will model the same agreed tuck shop, <i>eg limited products, agreed time for model</i>. Pupils should save versions of their model in order to describe its evolution when evaluating its success. | <ul style="list-style-type: none"> • run spreadsheet software • save and reload data files • enter formulae using cell references • build a spreadsheet model saving each iteration • translate rules into formulae • use formatting features of software to clarify the screen view of the model | <ul style="list-style-type: none"> • Use crib-sheets and/or demonstrations to revise basic operation of the hardware and the operating system environment. • Use letter/number cell referencing. • Teach the point technique for entering cell references into formulae and any built-in tool bar buttons or menu items to save time on entering, and to make the process easier for those with poor keyboard skills. • Homework could involve considering a variety of test scenarios. • Extension activity: more able pupils should increase the complexity of formulae and be able to graph separated columns. |
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Activity 4

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| <ul style="list-style-type: none"> • to record inputs and outputs from testing a model • to use test data to evaluate the success of a model | <ul style="list-style-type: none"> • Ask pupils to continue building a model of the tuck shop, translating the rules into formulae. • Ask the pupils to test the model with sample data to investigate a variety of scenarios, <i>eg a heatwave resulting in the need for a larger stock of cold drinks</i>. • Ask the pupils to produce a report on the tuck shop at the end of the agreed time, using software that allows them to combine text, tables and graphics. | <ul style="list-style-type: none"> • enter test data into a model and record outputs • apply suitable test data to a spreadsheet model and evaluate the outcomes in relation to the objectives | <ul style="list-style-type: none"> • Use formatting features to clearly identify input cells and output cells. • Use test data pro forma for recording test runs of the models. • Ensure scrolling techniques are explained if working with low-resolution screens (sometimes cells are 'unseen'). • Homework could involve pupils completing their report. |
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