



Games of chance

Objectives

To show how ICT can be used to test hypotheses.

To show that ICT-based models can be used to predict outcomes.

To explore the effects of changing the variables in an ICT-based model.

Activity description

In this activity the pupils investigated the fairness of games of chance, using spreadsheets to model the chances of winning.

The teacher asked them to consider how such models are used in society. Then the class discussed fruit machines and what the chances are of winning and of making a profit. The class also discussed issues of gambling addiction.

After an animated class discussion, the teacher reminded them about the rules of probability that they had learnt in their mathematics lessons, and how spreadsheets can be used to generate random numbers. Next, he introduced them to the skills and techniques needed when using a spreadsheet to model processes with a limited range of random outcomes. All pupils were then expected to investigate fairness by building or modifying a model that used random number generation.

The class discussed the concepts of trials and methods for summarising results through, for example, conditional totalling and using charts. The pupils had to note the summary behaviour of a single die and coin for a large number of trials to understand what constitutes fairness for the simple models they were using, and to introduce the functions of the spreadsheet.

Next, the teacher asked the pupils to extend these models in several ways. He demonstrated how to use other simple spreadsheet functions to record the modelling, including which elements of the sheet were inputs, outputs or processes.

The class was introduced to the concept of a counter to extend the range and process of modelling, and the use of functions to allow non-numeric outputs. By now, some pupils had been given enough background to attempt to build more complex models. The teacher asked them to investigate the fairness of a three-reel fruit machine by building a model, so that 'payouts' were made when the first two or all three symbols on the fruit machine were the same.



Commentary

In this example Anita has succeeded in creating a working model of a fruit machine, so that the balance of payouts over cost per trial can be found for any number of trials. She has made efficient use of counters for the number of times played and money won. Furthermore, she has used an effective combination of conditional functions to identify when the payout conditions are met. She has created a non-numeric display, choosing characters that are commonly found on fruit machines.

Anita discussed making a fruit machine for children with childish symbols on it, but she and her classmate agreed that fruit machines should not be intended for minors.

Anita understood that levels of payout can be fixed independently of the probable likelihood of the payout outcomes. She commented that she understood it was not possible for someone playing a fruit machine to make a profit over a long period of time.

Anita's use of the spreadsheet and changing what constituted a 'win' showed that she was able to develop and refine her work to enhance its quality and use ICT-based models to make predictions and vary the rules within models. By trialling the probability of making a profit, first with coins then dice and then with the fruit machine, she has shown that she can develop, try out and refine sequences of instructions to control events. Anita's use of a counter has demonstrated integration and efficiency in the use of ICT-based tools.

Anita investigated people's attitudes towards gambling and thought about gambling among children, which shows that Anita could discuss the impact of ICT on society.

This example illustrates aspects of attainment at level 6.

To make further progress, Anita could develop the model to resemble a fruit machine more exactly and reflect on other models that represent games of chance.



Items of work

Screenshot of active spreadsheet modelling a fruit machine

	A	B	C	D	E	F	G	H	I
1	Times Played:	104							
2	Money Won:	20					Cherry	Cherry	Cherry
3	Money Spent:	1040					Bell	Bell	Bell
4	Profit:	-1020					Star	Star	Star
5							Plum	Plum	Plum
6							Watermelon	Watermelon	Watermelon
7							Lemon	Lemon	Lemon
8							LOSE		0
9				Watermelon	Plum	Plum	LOSE		0
10					5	4	4		0
11									
12									



Screenshot of spreadsheet formulae

	A	B	C	D	E	F
1	Times played	=B1+1		Cherry	Cherry	Cherry
2	Money won	=B2+E10		Bell	Bell	Bell
3	Money spent	=B1*10		Star	Star	Star
4	Profit	=B2-B3		Plum	Plum	Plum
5				Watermelon	Watermelon	Watermelon
6				Lemon	Lemon	Lemon
7						
8	=CHOOSE(A9,D1,D2,D3,D4,D5,D6)	=CHOOSE(B9,E1,E2,E3,E4,E5,E6)	=CHOOSE(C9,F1,F2,F3,F4,F5,F6)	=IF(A9=B9,"win","lose")	=IF(D8="win",10,0)	
9	=INT(RAND()*6)+1	=INT(RAND()*6)+1	=INT(RAND()*6)+1	=IF(B9=C9,D8,"lose")	=IF(D9="win",50,0)	
10					=SUM(E8:E9)	
11	This shows the fruit machine formulae adapted for Excel 2000					
12	Note that the column headings are different from the original to allow the display of the whole formula					
13	Note also that it is necessary to choose iteration and maximum iteration=1 in the Tools, Options, Calculation menu.					
14						
15						



About this entry

Subject:	ICT
Year:	8
Key stage:	3
NC programme of study:	p1a, p1c, p2a, p4a, p5c
Evidence for:	level 6
This work shows evidence of:	Reviewing, modifying and evaluating work as it progresses
Scheme of work:	04:Models: rules and investigations