Data Handling

Exemplar 12 :
Tossing a Coin

Objective : To recognize the relation between the empirical and theoretical probabilities

Learning Unit : Simple Idea of Probability

Key Stage : 3

Materials Required : Coins, *Excel* and the file dh12_e.xls

Prerequisite Knowledge : Meanings of theoretical probability and empirical probability

Description of the Activity :

1. The teacher divides students in pairs. One student tosses a coin and the other student records the results. Students can swap their roles during the activity.

2. The worksheet together with one coin is distributed to each group. Students toss the coin and complete Question 1. They use the results in Question 1 to answer Questions 2, 3 and 4.

3. Students open the *Excel* file dh12_e.xls to complete Question 5.

4. Discussion can be held among the groups in answering Questions 6 and 7. The teacher can invite some representatives from the groups to express their views to the class.

5. To conclude the activity, the teacher guides students to draw a conclusion on the relation between theoretical probability and empirical probability.

Worksheet : Tossing a Coin

1. Toss the coin according to the number of times in the table below. Record the results in the table.

No. of Tosses m	Heads		Tails	
	Tally	No. of Heads h	Tally	No. of Tails t
10				
20				
30				
40				
50				

Table 1

2. From the results in Table 1, can you discover any relation between the number of heads and the number of tails for different numbers of tosses?

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3. Using the results in Table 1, find the empirical probabilities in the following table.

No. of Tosses m	P(Head) $= \dfrac{h}{m}$	P(Tail) $= \dfrac{t}{m}$
10		
20		
30		
40		
50		

Table 2

4. From the results in Table 2,

    (i)   what do you notice about the relation between P(Head) and P(Tail) in each row?

    (ii)   what do you notice about the relation between the different values of P(Head) in the second column?

    (iii)   what do you notice about the relation between the different values of P(Tail) in the third column?

5. Open the file dh12_e.xls. You will find a simulation programme of tossing a coin.

Choose the number of tossing from the pull-down menu in cell C3 on the spreadsheet and then press the **toss** button to start the tossing simulation. Record the results in the table below and then work out the values of P(Head) and P(Tail).

No. of Tosses m	No. of Heads h	No. of Tails t	P(Head) $= \dfrac{h}{m}$	P(Tail) $= \dfrac{t}{m}$
50				
100				
150				
200				
250				
300				
350				
400				

Table 3

6. If you toss the coin 500 times,
    (i)   how many times do you expect the 'head' to show up?
    (ii) guess the value of P(Head) .

7. What is the theoretical probability of obtaining a head when tossing a coin? Compare this value with your answer obtained in 6(ii), what do you notice?

Notes for teachers :

1. In Question 1, instead of tossing the coin up to 50 times, students can collect the results from their classmates to add up to a total number of 50.

2. For more able students, this exemplar can be used as a self-learning task. For less able students, the teacher may consider using this exemplar for demonstration and also plotting a line graph for the students to see the trend of the empirical probabilities.

3. As students need to use the *Excel* file in the activity, the teacher should prepare enough diskettes containing the file for students to use in the lesson. Alternatively, the file can be loaded to a computer server for the access of students.

4. In summing up the activity, the teacher can point out to students that the theoretical probability only tells us what is likely to happen and does not tell us exactly what will happen.