re(Solve) MATHS BY INQUIRY Hot Streaks

Summary of learning goals

- To develop tests for randomness in order to distinguish between random and non-random results. Students use their understanding of randomness to investigate the existence or otherwise of the 'hot streak' phenomenon in basketball.

Australian Curriculum: Mathematics (Year 9)

ACMSP226: Calculate relative frequencies from given or collected data to estimate probabilities of events involving 'and' or 'or'.

Summary of lessons

Who is this sequence for?

- This sequence is for students who are familiar with using spreadsheet programs to analyse data and who are ready to create their own methodologies to explore more complex datasets.

Lesson 1: Pick the Fake Data

Students choose between flipping a coin 50 times and recording the results or making up a fake sequence of 'random' results. They then experiment with different statistical methods to find a strategy for identifying whether other students' results are fake or are truly randomly generated.

Lesson 2: Do Hands Get Hot?

Students learn about the hot hand phenomenon in basketball. Using their findings from Lesson 1: Pick the Fake Data, students explore different methodologies to prove whether the phenomenon exists.

Australian Academy of Science

Reflection on this sequence

Rationale

Randomness is a fundamental, but often misunderstood, concept in statistics. Misunderstanding randomness lies at the heart of the gambler's fallacy, which is the belief that if something happens more frequently than normal during a given period, it will happen less frequently in the future. This sequence looks at the reverse of this in the context of a hot streak in basketball – does success lead to more success?

reSolve mathematics is purposeful

- The sequence deals with the fundamental idea of randomness, which is essential for developing statistical reasoning.
- The sequence uses a very large dataset to address a real-life problem that is of interest to sports statisticians.

reSolve tasks are inclusive and challenging

- Students engage in a common activity of generating and analysing fake or random data as an introduction to how large datasets might be analysed.
- Lesson 2: Do Hands Get Hot? deals informally with the concept of conditional probability.

reSolve classrooms have a knowledge-building culture

- The use of spreadsheets allows students to compare data and make decisions about the randomness, or otherwise, of a given dataset.

Further reading

For discussion on appropriate methodology for testing the existence of the hot hand, see:

Gilovich T, Vallone R and Tversky A, 1985, 'The hot hand in basketball: On the misperception of random sequences', *Cognitive Psychology* 17: 295–314.

Burns BD, 2001, 'The hot hand in basketball: Fallacy or adaptive thinking?', *Proceedings of the Annual Meeting of the Cognitive Science Society*, 23.

Korb K and Stillwell M, 2003, 'The story of the hot hand: Powerful myth or powerless critique?' presented at the International Conference of Cognitive Science.

Miller JB and Sanjurjo A, 2018, 'Surprised by the gambler's and hot hand fallacies? A truth in the law of small numbers', *Econometrica*, 86: 2019–47

Woo E, 2018, *Woo's Wonderful World of Maths*, Pan Macmillan Australia, Sydney. This book discusses sequences of fake or random heads and tails in Chapter 18 Conspiracy theory.

Acknowledgements

The NBA data used in Lesson 2: Do Hands Get Hot? are taken from www.basketball-reference.com.