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| **Mathematics** | **Year 3** | | | |
| **Title:** What are the chances… | | | Duration: 5 x 45 minute lessons | |
| **Unit Outline** | | | | |
| Chance and data representation are evident in the everyday lives of children and adults alike (Van de Walle, Bay-Williams & Karp, 2014). For example, graphs and statistics are used in journalism, the weather and advertising; and children can access opinion polls on youth targeted websites (Van de Walle, Bay-Williams & Karp, 2014). Chance and data representation provides opportunities to practice mathematics for real-life situations. Furthermore, learning statistics and probability develops understandings and skills that are necessary to “make informed judgements” (ACARA, n.d., p. 1) in this age of information. It also assists students with visual literacy as they are interpreting and reading the whole picture, and develops reasoning skills which is a higher-order thinking skill. Additionally, they learn subject-specific vocabulary (ACARA, n.d.). | | | | |
| **Key Inquiry Question/s:** | | | | |
| What is the chance of particular event occurring? | | | | |
| **Year Level Description:** | | | | |
| The proficiency strands understanding, fluency, problem-solving and reasoning are an integral part of mathematics content across the three content strands: number and algebra, measurement and geometry, and statistics and **probability**. The proficiencies reinforce the significance of working mathematically within the content and describe how the content is explored or developed. They provide the language to build in the developmental aspects of the learning of mathematics. The achievement standards reflect the content and encompass the proficiencies.  At this year level:   * understanding includes connecting number representations with number sequences, partitioning and combining numbers flexibly, representing unit fractions, using appropriate language to communicate times, and identifying environmental symmetry * **fluency** includes recalling multiplication facts, using familiar metric units to order and compare objects, **identifying and describing outcomes of chance experiments**, interpreting maps and communicating positions * **problem-solving** **includes formulating and modelling authentic situations involving planning methods of data collection and representation**, making models of three-dimensional objects and using number properties to continue number patterns * **reasoning** includes using generalising from number properties and results of calculations, comparing angles and **creating and interpreting variations in the results of data collections and data displays**.   (ACARA, 2016) | | | | |
| **Year Level Achievement Standard:** | | | | |
| **By the end of Year 3**, students recognise the connection between addition and subtraction and solve problems using efficient strategies for multiplication. They model and represent unit fractions. They represent money values in various ways. Students identify symmetry in the environment. They match positions on maps with given information. Students recognise angles in real situations. **They interpret and compare data displays.**  Students count to and from 10 000. They classify numbers as either odd or even. They recall addition and multiplication facts for single-digit numbers. Students correctly count out change from financial transactions. They continue number patterns involving addition and subtraction. Students use metric units for length, mass and capacity. They tell time to the nearest minute. Students make models of three-dimensional objects. **Students conduct chance experiments and list possible outcomes.** **They conduct simple data investigations for categorical variables.**  (ACARA, 2016) | | | | |
| **Links to other learning areas:** | | | | |
| This unit links to the learning area of science. Science has a strong focus on inquiry skills that include questioning and predicting, planning and conducting, processing and analysing data and information, and communicating through representations (ACARA, 2016a). These skills are transferable from mathematics, particularly chance and data representation, to science. | | | | |
| **Student Prior Knowledge:** | | | | |
| |  |  |  | | --- | --- | --- | | **Knowledge** | **Skills** | **Processes** | | Likelihood | Justifying likelihood of event |  | |  | Classifying likelihood of event |  | | Language of chance | Describe outcomes as ‘likely’ or ‘unlikely’ |  | | Collecting data | Posing question | Analysing whether the question will gather appropriate responses | |  | Identifying appropriate way to collect data | Questionnaires | |  |  | Tallies | | Representing data | Representing responses | Creating graphical displays | |  |  | Creating lists | |  |  | Creating tables | | Interpreting data | Answering simple questions about graphs |  | |  | Describing displays |  | |  | Identifying categories with the least and most number of objects |  | |  | Comparing the usefulness of different data displays |  | | Categorical data | Identifying categories of data |  | |  | Sorting data by categories |  |   Students have previously covered:  *Statistics and probability*  *Chance*  YEAR 1   * Identify outcomes of familiar events involving chance and describe them using everyday language such as ‘will happen’, ‘won’t happen’ or ‘might happen’ (ACMSP024) * The achievement standard – students classify outcomes of simple familiar events.   YEAR 2   * Identify practical activities and everyday events that involve chance. Describe outcomes as ‘likely’ or ‘unlikely’ and identify some events as ‘certain’ or ‘impossible’ (ACMSP047) * The achievement standard – they describe outcomes for everyday events.   *Data representation*  FOUNDATION   * Answer yes/no questions to collect information and make simple inferences (ACMSP011)   YEAR 1   * Choose simple questions and gather responses and make simple inferences (ACMSP262) * Represent data with objects and drawings where one object or drawing represents one data value. Describe the displays (ACMSP263)   YEAR 2   * Identify a question of interest based on one categorical variable. Gather data relevant to the question (ACMSP048) * Collect, check and classify data (ACMSP049) * Create displays of data using lists, table and picture graphs and interpret them (ACMSP050)   (ACARA, 2016) | | | | |
| **Learning Objectives: What will students know, understand and do …** | | | | |
| KNOW  I want students to know:   * that experiments can help predict the probability of an event occurring. * that chance has no memory. * that data from experiments can be displayed in lists, tables and graphs.   UNDERSTAND  I want students to understand that:   * the more trials the closer experimental probability is to theoretical probability. * data representation affects the usefulness of a graph.   DO  By the end of this unit, students will have the opportunity to demonstrate their ability to:   * predict the outcomes of chance experiments. * compare the variation in trial results. * create displays for data collected through chance experiments. | | | | |
| **Unit Learning intentions: Written for the students …** | | | | |
| KNOW  I want you to know:   * how to predict whether an event will occur. * about the randomness of results from trials. * about different ways to display data.   UNDERSTAND  I want you to understand:   * the more trials completed the closer we get to knowing the actual likelihood of an event occurring. * how to represent data for a purpose.   DO  I want you to be able to:   * predict the possible outcomes for a particular event. * describe the differences between trial results. * create a graph using the data collected from experiments. | | | | |
| **Content descriptors:** | | | | **General capabilities and cross curricula priorities** |
| **1.** | | **2.** | |  |
| *Statistics and probability*  *Chance*  Conduct chance experiments, identify and describe possible outcomes and recognise variation in results (ACMSP067)   * conducting repeated trials of chance experiments such as tossing a coin and identifying the variations between trials | | *Statistics and probability*  *Data representation and interpretation*  Collect data, organise into categories and create displays using lists, tables, picture graphs and simple column graphs, with and without the use of digital technologies (ACMSP069)   * exploring meaningful and increasingly efficient ways to record data, and representing and reporting the results of investigations | | Literacy  Students will be required to understand vocabulary for explaining likelihood and chance of events occurring, as well as compose spoken, written and visual texts to provide reasoning for responses (ACARA, 2016). Additionally, they will learn how to display data to make meaning (ACARA, 2016).  gc_numeracy Numeracy  Students will be required to interpret chance events to predict possible outcomes and interpret data to understand variation in trial results.  gc_ict ICT competence  Students will investigate chance by using online resources, along with creating graphs from collected data.  gc_critical Critical and creative thinking  Students will be required to think critically about experiments by applying logic and reasoning to explain outcomes of events. They will also transfer data from experiments into graphs. |
| Rationale for Unit Design: | | | | |
| This unit has been designed to provide students with a variety of hands-on activities to develop the concepts of chance and to represent collected data from experiments. In planning the unit, it was expected that Year 3 students would be operating at the material language stage and moving towards mathematics language (Jamieson-Proctor & Larkin, n.d.). Lessons include hands-on materials such as two-sided coins, spinners and dice.  Image result for language model for mathematics  The lessons were based on the framework for developing probability concepts as it ensures the development of probabilistic reasoning (Booker, Bond, Sparrow & Swan, 2010).   1. “Identify the attribute 2. Compare and order the likelihood of outcomes 3. Measure probabilities 4. Report the probability” (Clothier, 2016)   Assessments are predominantly for learning with a summative assessment concluding the unit. The ongoing formative assessment provides an understanding of whether students have misconceptions and provides information about their level of reasoning for decisions or choices; and the range of formative assessments ensure all students’ abilities are catered for (Reys et al., 2012). Formative assessment also influences instructional decisions for the following lessons. Feedback has been intertwined with instruction through class discussions that influence the student’s understanding and adjusts their schema so they can attempt more challenging problems (Hattie & Timperley, 2007). Students also receive peer feedback while working in groups which can have a greater effect on learning than being corrected by the teacher (Hattie & Timperley, 2007).  Differentiation was considered in planning the unit. Considerations include adjusting time on activities, providing visual cues, circulating between students, modelling tasks, use of manipulatives, word wall to support language development and cooperative group learning (Reys et al., 2012). Extending prompts have also be considered. | | | | |
| **Introduction to lessons: *Your rationale for your choices and approaches.*** | | | | |
| A range of choices were made to ensure effective learning takes place for the concept of chance and data representation.  These include:   * working in pairs or small groups during investigations. This strategy ensures all students are engaged, and less confident students will be supported by peers. They also develop an understanding that chance is ‘objective’ and not subjective. * whole class discussions - focusing on the reasoning for results to identify misconceptions and ensure they are addressed. * exploring chance with experiments so students can develop an understanding that the number of trials impacts the experimental results. * many activities that reinforce the concepts of chance including the probability continuum, randomness, experimental probability and theoretical probability. * activities and games which “encourages logico-mathematical thinking” (Nesbit & Williams, 2009, p. 27) and improves student motivation. * hands-on experiences with concrete materials to address the stage of learning (materials language). * virtual manipulatives to provide visual support and support large numbers of trials. * questioning that develops student reasoning and understanding. | | | | |

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| **Learning Sequence** | | | | |
| **Lesson 1** | | **Assessment *of*, *for* and *as* aligned with the content descriptors** | **Required adjustments** | **Resources** |
| **Lesson Objectives (KUDS):**  **Students will:**   * **know that chance has no memory.** * **understand the more trials completed the closer we get to knowing the actual likelihood of an event occurring.** * **be able to predict the possible outcomes for a particular event** | |
| **Learning experiences and teaching strategies:** | |
| **Time:**  10 mins  20 mins  5 mins  10 mins | Introduction   * Introduce probability to students as a whole class. * Ask students what they already know about probability. * Explain to students that probability is the likelihood of an event happening. * Revise the language for describing the likelihood of an event happening.   (Will happen, won’t happen, might happen, certain, impossible, likely, unlikely)   * Discuss language in context of the likelihood of an event happening. Ask students to justify their response.   E.g. *What are the chances the school bus will pick up students today? What are the chances the lunch bell will ring at 12:00pm?*   * Distribute word cards to students randomly and ask them to place them on the line in the correct order.      * Class discussion for agreement that all word cards are in the correct order.   Activity  We are at a … game and the pre-game coin toss determines which team starts. What should the team call out to give them the best chance of winning the coin toss?   * Organise students into small groups and provide students with a coin and tally sheet. * Advise students to work in their groups to trial 20 coin tosses and write a tally of the number of ‘heads’ and ‘tails’. (use maths book for tally)   Generate discussions about what the next coin is likely to be and why they think that.   * Discuss the results.   E.g. Who was surprised with the result? Why? Who thought that the results would be ‘opposite to what occurred’? Why? Did any groups get 10 heads and 10 tails? Why do you think that is? Or why they didn’t?   * Discuss ways they predicted what the next coin would be? (feedback on misconceptions, model coin toss and predicting may be necessary to overcome misconceptions and to prove the randomness of results) * Ask students what were the possible outcomes for tossing a coin? (“so there are 2 outcomes when tossing a coin, and we could get either heads or tails, so 1 out of 2 outcomes”) * Ask groups whether they would select ‘heads’ or ‘tails’. Why? (clarifying understanding of randomness) * What would happen if I tossed the coin more? Would the results remain the same, or would they change. * Use http://www.shodor.org/interactivate/activities/Coin/   to demonstrate how the number of trials impacts the number of heads or tails tossed.   * Close lesson with demonstration and discussion of how the balance between ‘heads’ and ‘tails’ changes depending on the number of trials. | *Assessment for learning*  Specific teacher observations will provide evidence of learning. This will be collected during the experiment and during class discussions. A checklist with space for comments will provide a foundation for observations.  This caters for all students because their current understanding is being assessed against what they understand at the end of the lesson. Therefore, improvement should be evident for all students.  Students will receive immediate feedback from teacher and peers during class discussions. It will provide an opportunity for students to adjust their schema.  *Hinge questions:*  What will the next result be?  What results are possible?  *Students will have achieved the lesson objective:* when they recognise that each trial is independent and does not impact the result of the next trial. | Introduction  Word wall is a visual support for subject-specific vocabulary (Acara, 2014).  Activity  Select a sport that students have shown an interest in to improve student engagement.  *Extending prompt*:  If you had 2 coins and were required to get 2 heads, would your chances of winning be higher or lower?  Instructions for the activity will be placed on the board for students that may require more than oral instructions. | Introduction  Word cards for ‘will happen, won’t happen, might happen, certain, impossible, likely, unlikely’ (Appendix A)  Line and pegs  The introduction allows students to revise the language of chance from Year 1 and Year 2 and provides a foundation for these five lessons.  Activity  Maths book  Coin per group  Overhead projector with PC connection  <http://www.shodor.org/interactivate/activities/Coin/>  The activity develops the students understanding of randomness through coin tosses. Through observations the teacher is able to recognise any misconceptions regarding the concept that chance has no memory. There are many opportunities for students to discuss different results. Lastly, students will have a visual representation of how the results change depending on the number of trials. |
| Any additional information/description/explanations:   * Seat students on the floor for the warm-up activity. * Set up word wall and organise pegs to put likelihood words in a continuum. * Students’ desks organised for group activities. * Hands-on manipulatives important for Indigenous and Torres Strait Islander students, and students for whom English is an additional language (ACARA, 2014). * Photocopy tally sheet. * Group work encourages and extends probabilistic thinking (Nisbet, Jones, Langrall & Thornton, 2000) | | | | |

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| **Lesson 2** | | **Assessment *of*, *for* and *as* aligned with the content descriptors** | **Required adjustments** | **Resources** |
| **Lesson Objectives (KUDS):**  **Students will:**   * **know that experiments can help predict the probability of an event occurring.** * **understand the more trials completed the closer we get to knowing the actual likelihood of an event occurring.** * **be able to describe the differences between trial results.** | |
| **Learning experiences and teaching strategies:** | |
| **Time:**  10 mins  30 mins  5 mins | Warm-up activity  (Adapted from Mavis, 2012)   * Show students a coin with heads and tails. * Students are advised to choose whether the next toss will be heads or tails. * If they select heads, they place their hands on their head; if they select tails, they place their hands on their behind. * The teacher flips the coin.   If the coin lands with heads up, then all students with their hands on their head sit down.  If the coin lands with tails up, then all students with their hands on their behind sit down.   * The coin continues to be tossed until one student is left standing (the winner).   Activity  (Adapted from New Zealand Government, n.d.)   * Advise students that they will be completing an experiment with spinners. * Organise students into small groups of three with team roles (manager, scriber, spinner) * Show students three different two-colour spinners. * Ask the groups of students to select a spinner that represents a statement of likelihood. (Plickers)   E.g. I am certain to spin green. It is impossible to spin green.   * Ask students for ways they can record what colour they spin.   E.g. tally sheet, frequency table   * Distribute frequency table templates, then explain and model. * Advise students to test the spinner with 20 spins and record the results. * Discuss whether the results are what they expected and explore their reasoning. * Ask students to test the remaining two spinners with 20 spins each and record the results using the same method. * Discuss with students whether their prediction was right. Why did they choose that spinner originally? What is the reason for different/same results? What would happen if we did another 20 spins? * Ask groups to discuss and order the spinners according to the likelihood that they will land on green (or other likelihood statement). * Discuss with students whether the outcomes are equally or not equally likely. * Place pictures of spinners on the probability continuum created in lesson one.   Conclusion   * Advise students to open their maths book and write a few reflective sentences that explain the reason for the differences between trial results. | *Assessment for learning*  The purpose of assessing is to understand whether students are developing an understanding of the concept of chance and what misconceptions students still have.  Anecdotal notes: will be made on students’ ability to compare the different spinners and reasoning for their answers; ability to order the spinners according to likelihood. Also observe the use of vocabulary specific to chance. Sticky note for each student on a clipboard.  Reflection:  Students will reflect on the results from each spinner and write a few sentences that explain the reason for the differences between trial results.  Plickers provides a snapshot of the students choices which can be explored further in class discussions.  Assessment strategies cater for the needs and abilities of all students by providing multiple opportunities to demonstrate understanding, knowledge and skill.  *Students will have achieved the lesson objective:* if they selected the correct spinner for the statement of likelihood; they were able to provide reasoning for differences between experiments; and they understood that if we continued to count spins the results would vary.  *Hinge questions:*  Why is it more or less likely?  How could we change this spinner so that there was an equally likely chance?  Classroom discussions are included so immediate feedback allows students to evaluate their own work and identify misconceptions. Peer feedback during group activities supports and challenges learning (Van de Walle, Bay-Williams & Karp, 2014). | Activity  Students are working in small groups of three so students have shared responsibility and participate in the experiment.  The groups will be mixed ability so students that lack an understanding of the concept of chance will be supported. They will also be supported through whole class discussions.  Gradual release of responsibility scaffolds student learning in regards to frequency table.  Opportunity for self-reflection at the end of the lesson.  Self-reflection can be challenging so writing prompts can be provided for support. | Warm-up activity  1 coin  The warm-up activity will reinforce the concept of randomness.  Activity  3 spinners per group (Appendix B) or  iPads with link to http://www.scootle.edu.au/ec/viewing/L2376/ma\_004\_csiro\_200/index.html (Appendix B)  http://www.teachingprobability.org/sites/teachingprobability.org/files/small_Ch4%20Game%202%20YG1.png  Image result for images 2 colour spinners  http://www.teachingprobability.org/sites/teachingprobability.org/files/small_Ch4%20Game%202.3%2C5.2%20YG.png  Pen  Frequency table template (Appendix B)  Probability continuum created in lesson one.  Maths book  Sticky notes on clipboard |
| Any additional information/description/explanations:   * Prompts for reflective sentences are provided to assist EAL/D students to create more complex sentences (ACARA, 2014). * Organise space for groups of three for main activity. * Photocopy frequency table template. | | | | |

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| **Lesson 3** | | **Assessment *of*, *for* and *as* aligned with the content descriptors** | **Required adjustments** | **Resources** |
| **Lesson Objectives (KUDS):**  **Students will:**   * **that experiments can help predict the probability of an event occurring.** * **Understand the more trials the closer experimental probability is to theoretical probability.** * **compare the variation in trial results.** | |
| **Learning experiences and teaching strategies:** | |
| **Time:**  10 mins  35 mins | Warm-up  Pig  (Adapted from Kawas, 2000)   * Advise students the name of the game and the object of it.   + The object of the game is to accumulate the highest number of points from rolls of the dice.   + Before I roll the dice you choose whether you want to continue playing the round.   + If you decide to stop stand quietly behind your chair, and you will rejoin after a one is thrown. This is the reset point for the round.   + If I roll a one anyone still playing (i.e. seated) will be out and cannot accumulate any more points. * Ensure students understand the objective and answer any questions. * Toss the die and ask students to write down the number, and add the numbers to find a total. * Continue to toss the die until a one is thrown. All players still accumulating points are out for that round. * Standing students return to the game and continue accumulating points. * Play for three rounds and at the end the student with the highest point value wins.   Activity  (Adapted from Victoria State Government Education and Training, 2014, game 1)   * Organise students into pairs and provide each group with a die. * Ask students to select player 1 and player 2. * Advise pairs of students to draw a table with two columns labelled ‘player 1’ and ‘player 2’. * Gain class attention to the rules. * Advise students that player 1 wins if they roll a 5 or 6, and player 2 wins if they roll 1, 2, 3 or 4. They will record the wins on the table they created. * Each student will have 20 rolls of the die. * Check for understanding and clarify any questions. * Ask students to predict which player will win. (Plickers survey) * Advise students to play the game. * Discuss the results of the game.   E.g. Did player 1 or player 2 win? Why do you think that player 1 or 2 won?   * Each group presents their results and their reasoning for the difference in results. * Discuss why the results for each team are different.   What is my chance of rolling a 1?  E.g. the possible outcomes for each player (player 1: 2 outcomes out of 6 possible outcomes); randomness; likelihood of each player winner   * Ensure students keep the results from the trials for the next lesson.   This activity is extended in Lesson 4. | *Assessment for learning*  Oral presentation of results from activity. Students will provide their reasoning for the results of the trials. This will provide an opportunity for peer and teacher feedback. Each group will speak for approximately 2 minutes. Students have the opportunity to rethink their reasons when they hear from other groups.  Keep notes of the reasoning to demonstrate the students’ current understanding.  Plickers will be used to capture quick responses to multiple choice questions.  This assessment is verbal so student with inefficient writing skills are catered for.  *Students will have achieved the lesson objective:* when they demonstrate the ability to predict results and reasoning supports the prediction; and an understanding of variances to results.  *Hinge questions:*  Was this a fair game?  What made the game fair/unfair?  How could the game be changed so it was fair? | Warm-up  Display instructions for playing pig on the board for students that are more visual.  Students can focus on writing down the numbers and add them at the end of the game to get their total.  Use of calculators permitted for accuracy however, mental computation is preferred.  Wait time between each coin toss can be adjusted to suit student abilities.  *Extending prompt*:  Students can use multiplication instead of addition.  Activity  *Extending prompt:*  Change to a 10-sided die.  Image result for 10-sided die  *Enabling prompt:*  Change to a 4-sided die or a die that uses colours instead of numbers.  Image result for blank 4-sided die  Mixed-ability pair work to ensure students are supported, with the addition of support from the teacher. | Warm-up  1 Die  Pen & paper  A teacher aide could assist by taking a group of students to work at a pace suitable for them.  Activity  Dice (1 per pair)  Notebook, pen |
| Any additional information/description/explanations:   * Organise pairs for activity. * The main activity will involve multiple class discussions to consolidate learning. * Book class set of iPads. | | | | |

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| **Lesson 4** | | **Assessment *of*, *for* and *as* aligned with the content descriptors** | **Required adjustments** | **Resources** |
| **Lesson Objectives (KUDS):**  **Students will:**   * **know that data from experiments can be displayed in lists, tables and graphs.** * **understand that data representation affects the usefulness of a graph.** * **create displays for data collected through chance experiments.** | |
| **Learning experiences and teaching strategies:** | |
| **Time:**  30 mins  15 mins | Activity continued from lesson 3   * Ask students to list different ways they have collected data from previous chance experiments. * Discuss the methods and whether they were useful, easy to use, or easy to compare data. * Advise students that they will be looking at ways to represent the data from the experiment in the previous lesson.   Model how to create a frequency table in a spreadsheet.   * Advise students that you will demonstrate how to create a table with the results of 20 trials of throwing a die. * Ask students what sort of information would they include in the graph   E.g. 1, 2, 3, 4, 5, 6  Ensure students understand that these are known as the sample space.   * Demonstrate how to set up the spreadsheet and enter tally marks for each throw using ‘1’.     YOU DO   * Ask students to move into their pairs from the last lesson. * Ask two students to distribute the iPads. * Advise students to open a blank spreadsheet and enter the possible outcomes across the page.   Add trial results.   * In their groups, students discuss the results as represented in the table. * Bring groups back to attention and open the discussion to the whole class.   Is this easy to read? Can you tell which number was rolled the most/least?  Model how to create a graphical representation.   * Ask students to place their iPads at the top of their desk. * Demonstrate how to create a pie graph * Discuss what information is available in the graph or what information is missing. * Ask students to use the graph to explain the likelihood of landing on a certain number. * Change the type of data representation so students can assess whether the information is still meaningful. E.g. bar chart * Ask students to create their own circle graph. (Support individual students) * Advise students to print their table and graph, and place their names on it. * Ask students to self-assess their graph using the prompts:   Does your graph have a title?  Does your graph have a legend?  Do you have all the sample space evident in the graph? (write on same sheet as printed graph)   * This forms an exit pass to move to an online activity.   Once students have finished their circle graph they can transition to the online activity.  Warm-down   * Online activity   http://splash.abc.net.au/res/i/L2380/index.html  This activity combines the concept that chance has no memory, and the law of large numbers. It includes data representation for collected data which ties in with this lesson. | *Assessment for learning*  Observations from group work as students discuss their graph and again during the whole class discussion.  Self-assessment of graph so students know what they need to consider when creating a graph.  The assessment is scaffolded so all students can successfully create a graph.  Feedback will occur throughout class discussions so any problems can be rectified. The exit pass provides an opportunity for the teacher to feedback immediately if there are any problems.  *Student will have achieved the lesson objective*: if they created a graphical representation of their data with the appropriate labelling.  *Hinge questions:*  On the graph, what were some of the similarities/differences between the results?  What can you tell from the graph? | Activity  Lesson starts by activating existing schemas regarding ways data has been collected in previous lessons.  Visual support with modelling projected on whiteboard.  Students complete the table and graph in pairs so they have peer support if the teacher is assisting elsewhere.  Lesson is structured so students have time to finish their table and graph before moving onto an online activity. | Activity  Laptop with projector  Spreadsheets  Class set of iPads  All students have an iPad as hands-on activities are more valuable for developing an understanding of the task and for retaining what they have learnt.  Teacher aide to support students with technology |
| Any additional information/description/explanations:   * Bookmark link for online activity on class set iPads * Prompts for reflective sentences are provided again (ACARA, 2014). * Tasks are modelled for students followed by them working mostly independently but with support available. | | | | |

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| **Lesson 5** | | **Assessment *of*, *for* and *as* aligned with the content descriptors** | **Required adjustments** | **Resources** |
| **Lesson Objectives (KUDS):**  **Students will:**   * **know that chance has no memory.** * **understand that the more trials the closer experimental probability is to theoretical probability.** * **compare the variation in trial results.** | |
| **Learning experiences and teaching strategies:** | |
| **Time:**  5 mins  10 mins  20 mins  15 mins | Peg Combo  (Adapted from Nisbet & Williams, 2009)   * Distribute brown paper bags and advise students not to look in the bag but they can know there are 4 pegs in the bag.   Single peg   * Ask students to remove one peg and attach to the bag. Hold the bag up. * Count the number of each colour drawn. * Create a table and collect data. (Label the colour columns with name of colour once they are drawn so students are not assuming there are two colours)  |  |  |  | | --- | --- | --- | | Trial | Colour 1 | Colour 2 | | 1 |  |  | | 2 |  |  | | 3 |  |  | | 4 |  |  | | Total |  |  |  * Ask students to return their pegs, and draw out another, clipping it to the bag. * Count and record for trial 2. * Repeat for trial 3 and 4. * Calculate the totals for each colour. * Ask students whether they think there are any other colour pegs in the bag. Why? * Ask students how many of each colour peg do they think is in the bag. Why? * As a class predict and discuss what would happen if more trials were carried out.   Two pegs   * Repeat the activity with students drawing and replacing two pegs each time. * Advise students that they place the first peg drawn on the paper bag, and the second peg drawn is attached to the first peg (required for counting). * Ask students what outcomes are possible in this experiment.   Explain to students the combinations can be represented in a tree diagram.   * Co-construct a tree diagram.   Ask students what the possible outcomes are when they draw the first peg (colour 1 or colour 2). After I draw colour 1, what colour peg can I draw (again colour 1 or colour 2). Repeat with colour 2 as the primary draw.   * Draw table including the possible outcomes from the tree diagram.      * Calculate the totals for each colour. * Ask elbow partners to compare the numbers for each combination, and discuss variances between each trial. Also discuss variances between the combinations. * Bring attention back and discuss observations as a whole class. * As a class predict and discuss what would happen if more trials were carried out. * Ask students to distribute iPads and access spreadsheets to create a bar graph to represent the data. * Advise students they require four columns labelled with different combinations. Then enter the total for each column underneath. * Remind students to label axis, title and have appropriate units on the axis. * Advise students to have a peer assess their bar graph before presenting to exit class. | *Assessment for learning*  Classroom observations:   * Understanding randomness * Describing possible outcomes * Order the likelihood of the outcomes   Exit pass:  Bar graph – peer-assessed for labels and axis units before presenting to the teacher.  *It will be evident that students have achieved the lesson objective:* if they understand that the next peg drawn can be colour 1 or 2; they can communicate that experimental probability gets closer to the theoretical probability with a greater number of trials; and can detail why the results vary across trials and combinations.  Feedback will be provided through the class discussions which are designed to consolidate their understanding of the concepts of chance. Students will also receive immediate feedback when they present their bar graph as an exit pass.  *Hinge questions:* | Activity requires active participation from all students as they draw and replace pegs to gather data.  Students have visual support as data is recorded using tables which will be displayed.  Elbow partners are used to encourage deeper thinking and discussion about results.  *Extending prompt*:  Increase the number of pegs.  Alter the ratio of colour pegs.  *Enabling prompt*: may be required by some students to complete the graph independently. | 2 pegs of one colour per student  2 pegs of another colour per student  Brown paper bag (or one they cannot see through)  Laptop with projector  Spreadsheets  Class set of iPads  Printer |
| Any additional information/description/explanations:   * Prepare brown bags with 4 pegs each. * Book class set of iPads. * Desks can be organised to face the board or in a U-shape to encourage discussion. | | | | |
| **Conclusion:**  The culminating activity is a summative assessment which will be an independent investigation. Students will be provided a range of manipulatives including coins, dice, cards and spinners from which they will select one to use in their investigation.  Students will create a multimodal presentation that includes:   * the aim of their investigation * the method for conducting investigation * a prediction for the outcome * how they collected data * results of the investigation * representation of the results * an interpretation of data that includes the outcomes of the investigation and how they compared to the prediction   (Adapted from Villis, 2014) | | | | |
| **Feedback to Students:**  A number of opportunities are planned to provide ongoing feedback to students. These include immediate feedback during class discussion as well as one on one conversations during activities which enables students to maintain motivation and achieve the objectives for the lesson. Additionally, students listen to other conversations between peers and the teacher, in which feedback is provided, to improve or adjust their own understanding.  Students are asked to reflect on the activities and their reasoning for answers which encourages higher-order thinking skills. Exit passes provide an opportunity to feedback what is done well or what needs to be improved.  Activities were selected for specific learning opportunities that develop an understanding of the concept of chance, and provide multiple opportunities to provide feedback on misconceptions. Warm-up activities and online games provide additional practise to improve students understanding of the concepts related to chance. | | | | |

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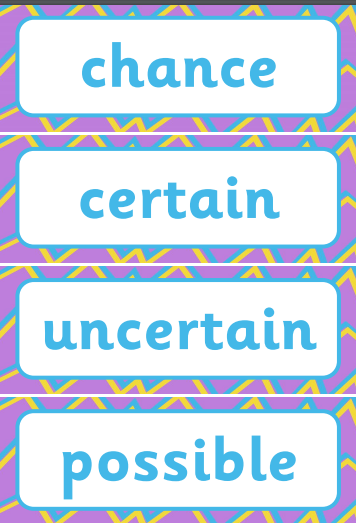
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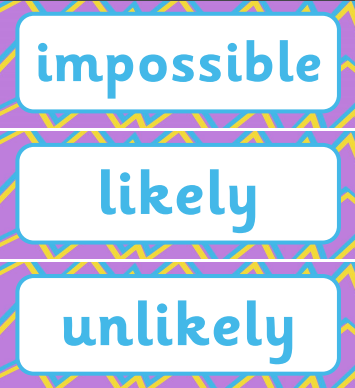
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Appendix A – Resources for lesson 1

Word wall



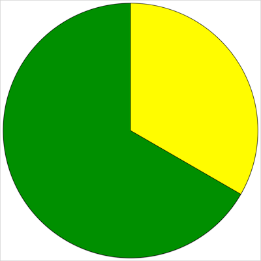


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Appendix B – Resources for lesson 2

Spinner templates







Frequency table

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Group: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Spinner 1 | | Spinner 2 | | Spinner 3 | |
|  | Green | Yellow | Green | Yellow | Green | Yellow |
| Tally |  |  |  |  |  |  |
| Frequency |  |  |  |  |  |  |

Group: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Spinner 1 | | Spinner 2 | | Spinner 3 | |
|  | Green | Yellow | Green | Yellow | Green | Yellow |
| Tally |  |  |  |  |  |  |
| Frequency |  |  |  |  |  |  |

Group: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Spinner 1 | | Spinner 2 | | Spinner 3 | |
|  | Green | Yellow | Green | Yellow | Green | Yellow |
| Tally |  |  |  |  |  |  |
| Frequency |  |  |  |  |  |  |

Spinners

http://splash.abc.net.au/res/i/L2380/index.html

