For school teachers

Lesson plan – Year 8 science

Unit 1, Lesson 10: To conduct a diffusion experiment

This lesson plan was developed by Ochre Education and science teacher Darcie Clarke. It outlines her approach to teaching a Year 8 science lesson on conducting a diffusion experiment.

- Watch the lesson video
- Watch a video of Darcie talking about her teaching practices
- View the science unit plan example
- Download sample lesson plan template
- View all other online lessons and supporting resources

This lesson is part of a unit on cells, tissues and organs. Ochre Education and the Australian Education Research Organisation (AERO) have published 15 online lessons (and supporting resources) that make up this unit. This is the first of the lessons in the unit – you can watch the lesson video here and you can watch a video of Darcie talking about her practice here.

This lesson plan is a supplementary resource for this work. It includes guidance on how the lesson was structured and sequenced within the unit and can be used while interacting with the Ochre resources. The plan also allows teachers to see an example of planning for one lesson within a sequence of lessons and reflect on their own teaching and effective practice. The lesson plan is annotated to explicitly show some of the decisions that are made during the planning process.

Another way to use this lesson plan is as a starting point for discussions with colleagues to build collective capacity for lesson and unit planning. Teachers can also use the lesson plan to reflect on their own planning for lessons and units and guide future planning. A blank lesson plan teachers can use and modify as a resource for their own planning can be accessed here.

All the lessons from this unit can be accessed for free on either the AERO or Ochre Education websites.

Definitions

Learning objectives

Clear and easy to understand statements about what students are expected to be able to know, do and/or understand by the end of a period of instruction (not to be confused with the instructional tasks), and at what level this learning is to take place.

Success criteria

A clear statement about the measure that will be used to prove whether, and how well, a student has met the learning objectives by the end of a period of instruction. Success criteria are observable actions that a student can perform to demonstrate their understanding of the learning objectives. It is important that these elements are observable – avoid using phrases like 'students will understand that…' as we can't observe understanding. Instead, the criteria could be 'students will write, say, make or do something that indicates understanding'.

Tasks

Activities undertaken by students as part of the learning process. Carefully designed tasks can also assist students in mastering new knowledge or skills. Scaffolds and worked examples might be used to assist students with some tasks. Teachers can monitor their students' ability to complete tasks as part of a formative assessment approach to help determine whether students have demonstrated the success criteria.

Subject Science: Cells, tissues and organs

Year level/Stage 8

Lesson background

This is the tenth lesson in the cells, tissues and organs unit, which is the first unit undertaken in Year 8. It applies knowledge learned in the ninth lesson of this unit through an experimental context. It also builds on the science inquiry skills of planning and conducting experiments, as well as processing and analysing data and information.

This lesson background shows how the lesson is sequenced and positioned within the unit.

Learning objectives

To investigate the effect of temperature on the rate of diffusion through conducting an experiment.

Success criteria

By the end of this lesson, students will be able to:

- identify appropriate variables for an experimental context
- evaluate hazards to identify appropriate safety measures for an experiment
- construct a table of results to display data collected.

The success criteria are a series of clear statements that will be used to prove whether, and how well, a student has met the learning objectives at the end of a period of instruction.

Misconceptions

- A common misconception is that hazards and risks are terms with similar meanings that can be used interchangeably.
- Students can also find it challenging to distinguish between the independent and dependent variables, and commonly believe it is appropriate to have more than one independent variable in an experiment.
- Students commonly believe that units should go next to every data value in a table, as opposed to only in column titles. This comes from the belief that being more 'thorough', and including more information, is best scientific practice at the cost of clarity.

Misconceptions are incorrect knowledges and understandings that students have prior to the lesson, or may obtain during the lesson. Outlining these during planning can help with monitoring student learning, and recognising when corrective feedback is needed.

* In this column, you will find prompting questions to guide your planning for each lesson stage.

** In this column you will find prompting questions to consider when monitoring learning at each stage of the lesson.

Lesson stage*	Tasks What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning**
Review of previous learning		
How will you ensure that students have the prerequisite skills and knowledge to progress their learning in this lesson? How will you activate prior knowledge/help students retrieve relevant learning from previous lessons?	Run a quick introductory quiz to assess prior knowledge about diffusion, as well as skills relating to conducting experiments and processing data. The focus is on activation of prior knowledge around the process of diffusion, as well as correct conventions in experimental design and displaying data.*** 1. Overview of keywords: a. Diffusion b. Risk c. Hazard.	How will you gather evidence that shows you where your students are at in their learning?

*** This quiz acts as formative assessment to determine what students know and can do already. It can be done online, as a paper test or using mini whiteboards.

The questions in this quiz will highlight key words to students (the first of repeat exposures) and will expose common misconceptions, such as several variables changing in one experiment, and the confusion of risks and hazards.

The level of success of students in this quiz will also inform the pace of the lesson, and whether detailed review of prior understanding is needed

Lesson stage*	Tasks What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning**
(continued) How will you ensure that students have the prerequisite skills and knowledge to progress their learning in this lesson? How will you activate prior knowledge/help students retrieve relevant learning from previous lessons?	2. Opening questions and ideas:**** a. The definition of diffusion b. The factors affecting the rate of diffusion, including explanations why c. The purpose of variables in an experiment d. The connection between risks, hazards and safety measures e. Appropriate methods of displaying data.	(continued) How will you gather evidence that shows you where your students are at in their learning?

**** The ideas included in the quiz are either key concepts of prior knowledge, or common misconceptions. As this is the first unit covered in Year 8, I am assuming a low level of prior knowledge.

Students must have an understanding of diffusion and the factors affecting its rate in order to place the results collected in this experiment in context.

This is the first experiment conducted in this unit, however conducting experiments and processing data are part of the science inquiry strand that continues from Year 7. Due to this, questions that target knowledge of variables, identifying risks and displaying data will help me to assess the level of prior knowledge of students in this.

I can use this to structure the pace and level of support needed throughout the rest of the lesson, and the grouping of students for independent practice.

Lesson stage	Tasks What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
Explicit teaching of new learning ('I do') – review of diffusion and determining variables		
How will you communicate the learning objectives to students? How will you break down your content into sequential steps to avoid overloading your students' working memory? How will you model the learning to support student understanding?	**Whole class:** 1. Read the learning objectives and success criteria to students, referencing back to them as they are encountered throughout the lesson. 2. Read the lesson structure and keywords, so students can identify the next steps in learning and important concepts throughout the lesson.* 3. Explicit instruction of the concept of diffusion. This is a review of prior knowledge from the previous lesson. The same information is presented using a visually similar set of slides. a. Students complete the unfamiliar check for understanding.**	How will you help students retrieve information learned in previous lessons, units? How will you check for understanding and correct any errors or misconceptions before moving onto guided practice?

* Students need to have an understanding of the scope and sequence of a lesson. This helps them to visualise the next steps for their learning and to link the work produced with achieving the success criteria.

It is also important in supporting the development of metacognitive skills around assessing their own understanding and abilities, recognising when support is needed, and knowing how to access it.

** Presenting familiar diagrams will help students to retrieve the learning of key concepts surrounding diffusion from the previous lesson.

By using an unfamiliar check for understanding, students are being tested on their understanding of the concept, not their ability to remember questions they have previously seen.

In a classroom, I would use an online quiz, fingers held up, or mini whiteboards to complete this check quickly.

Checks for understanding are important formative assessment tools. Regular checks for understanding should be used to ensure mastery of a concept is achieved before moving on. This ensures students can demonstrate a correct understanding of a concept before connecting a new concept to this previous learning. This approach makes sure that misconceptions are not being embedded into students' understanding of a topic and that they are ready for the next steps in their learning.

If a high success rate is not achieved in this check, I will spend time explaining the incorrect answers, reiterating my instruction of the content with a focus on the commonly misunderstood aspects, and then a different check for understanding can be provided to test for understanding. Once a high success rate has been achieved, students are ready to progress to the next step in the lesson.

Lesson stage	Tasks What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
(continued) How will you communicate the learning objectives to students? How will you break down your content into sequential steps to avoid overloading your students' working memory? How will you model the learning to support student understanding?	4. Once students are confident with the concept of diffusion, explain the concept of variables. 5. Prior to defining variables, introduce the experimental method. This allows students to begin relating new knowledge of variables to how they fit within the experimental context. 6. Explain the difference between the three variables. 7. If the starter quiz has revealed a misconception about the number of independent variables, this can be explained in detail. 8. The pause point should be used to encourage discussion of this, as well as an explanation of what a 'good experiment' means. 9. Work through the check for understanding. This addresses the common confusion between dependent and independent variables.	(continued) How will you help students retrieve information learned in previous lessons, units? How will you check for understanding and correct any errors or misconceptions before moving onto guided practice?

Lesson stage	Tasks What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
Guided practice ('We do') – review of diffusion and determining variables		
What worked examples will you provide students? What scaffolds and instructional supports will you introduce, and how will students use these? How will students work together to progress their skills and understanding?	**Whole class:** 1. Read out the scenario the students are meant to be analysing. Explain the options for differentiation: a. Students can refer to their definitions for each variable while following the modelled example. b. Students who have a strong understanding can attempt this example and use the modelled solutions to check their understanding. 2. Model the thought process followed for students.* 3. Completing one variable at a time, reiterate the definition of the variable, and highlight the key information in the scenario.	How will you check for understanding and correct any errors or misconceptions before allowing students to independently practice?

* Here I am modelling the thought process that I am using to complete this task.
This makes the steps explicit for students to apply themselves in independent practice.

Lesson stage	Tasks What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
Independent practice ('You do') – review of diffusion and determining variables		
How will students display that they have mastered the skills and content? How will you work with students to provide support and to gain insight into their learning?	**Whole class:** Review the experimental method that the independent practice will be referring to. Explain the task to students and encourage them to complete the challenge task to develop a more sophisticated understanding of the significance of variables. **Small groups:*** For students who need more guided practice, gather them in a small group and model the steps needed to complete the task again, by identifying the definition for each variable and assisting them in highlighting significant information in the scenario. Once students are able to complete this they are encouraged to work independently. **Whole class:** Explain the answers to the independent tasks. Highlight common errors that may have been present, and explain choices made to achieve the correct answer.	What formative assessment will you gather to provide feedback to your students?

* Providing multiple scaffolds before independent practice means every student can demonstrate they understand the concept and the procedure before attempting it on their own.

This is a key step in ensuring mastery of a concept, as you can make sure students have the knowledge and skills needed before completing the independent task.

Lesson stage	Tasks What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
Explicit teaching of new learning ('I do') – risks, hazards and safety measures		
	Whole class: 1. Explicit instruction explaining the hypothesis. This is done so students can place the variables in context, and to structure scientific thinking while they complete the experiment. a. Students are given the opportunity to construct a hypothesis if they wish here.* 2. Explicit instruction of the terms risk, hazard and safety measure. Explain the relevance of each diagram and stress the difference between a risk and hazard. a. A check for understanding addresses this common point of difficulty for students in differentiating between risk and a hazard. If a high level of success is not achieved, explain this point further and provide another check for understanding, until students can demonstrate an understanding of this concept.	

* While constructing a hypothesis is not in the success criteria for this lesson, this is here to acknowledge that students may have a range of experience in practical Science drawn from their experience in Year 7 and there may be a range of skill in the classroom as a result.

This provides students with an opportunity to practice the skill of constructing a hypothesis, if they have learned this in Year 7, and also provides an opportunity for more capable students to extend their knowledge of variables.

Lesson stage	Tasks What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
Guided practice ('We do') – risks, hazards and safety measures		
	Whole class: 1. Guide students through the worked example, starting with a pause point. Use the pause point to identify hazards. Students can define risk and hazard. This approach models the next steps in learning – being able to apply this knowledge to a scenario. a. Provide students with the opportunity to pause the video to find hazards. Then, model the thought process of identifying hazards from a scenario. b. Complete the second part of the worked example. Once the hazard has been identified, explain to students how this connects to the risk and an appropriate safety measure. 2. Students who have a strong understanding can attempt this example and use the modelled solutions to check their understanding.	

Lesson stage	Tasks What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
Independent practice ('You do') - identifying risks, hazards and safety measures		
	Whole class: Explain the task to students.* Encourage students to complete the challenge, which removes the scaffold of having already identified the significant information from the scenario. **Small groups:** For students who need more guided practice, gather them in a small group and model the steps needed to complete the task again, by identifying the definition for hazard, risk and safety measure. Complete one row together, then encourage to attempt the rest of the task independently. **Whole class:** Explain the answers to the independent tasks. Highlight common errors that may have been present, and explain choices made to achieve the correct answer.	

* In a classroom, I will use this opportunity to ask questions to ensure all students understand the task. Here, these would involve clarifying what information the list contains, and where in the table students should put information once it has been categorised.

Lesson stage	Tasks What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
Explicit teaching of new learning ('I do') – processing data		
	Individual: Encourage students to complete the experiment and collect their own data.* **Whole class:** Begin the 'we do' task by first explaining the 4 key elements that are necessary in a table.**	

* Being able to complete the experiment and collect data is a form of experiential learning.

It provides students with the opportunity to practice implementing safety measures, and understand the necessity for them. This step involves reflection which is important for consolidating understanding of these concepts.

Being able to collect their own data will give students agency in their learning and increase engagement in the subsequent steps of the lesson.

** Explicit instruction here involves chunking content into smaller pieces that can be completed sequentially. This helps to break learning down into smaller pieces that are easier for students to comprehend.

For a skill such as constructing a table, this also creates a 'checklist' that can be followed. Students can complete each section one at a time, and check it off before moving on to the next. This helps students to complete one section to a high standard at a time and to make sure each section of the table is completed.

Lesson stage	Tasks What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
Guided practice ('We do') – processing data		
	Whole class: 1. Read out the scenario that will be used for the worked example.* 2. Model the thought process followed for students. Students will construct a table on paper that they can refer back to as 'gold standard' when completing the task independently. a. Before completing each step, provide students with the opportunity to do so themselves.** b. Highlight key mistakes and explain the choices you are making at this stage. These are including both variables in the title, and only including units in the column titles. 3. Read out the experimental results which will be used to construct the table.	

* Reading the scenario can help all students to have a clearer understanding of the information they need to process.

This helps students who may struggle to process information visually, and also minimises the skipping of information when students read independently.

** By copying down the table and attempting each step while you explain, students are active participants in their learning.

Hands-on activities will result in higher engagement and retention of information, which will translate into a higher success rate for students during independent practice.

Lesson stage	Tasks What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
Independent practice ('You do') – processing data: constructing a table of results		
	Whole class: Review the experimental method that the independent practice will be referring to. Explain the task to students and encourage students to use their own data if they have collected it. **Small groups:** For students who need more guided practice, gather them in a small group and model the steps needed to complete the task again. Once students can complete this they are encouraged to work independently. **Whole class:** Explain the answers to the independent tasks. Highlight common errors that may have been present, and explain choices made to achieve the correct answer.	

Lesson stage	Tasks What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
Lesson summary		
How will you show students how far they have come in the lesson? How will you review their learning? How will you help students reflect on, or summarise the most important parts of their learning?	1. Review the success criteria from the lesson, pointing to specific skills demonstrated by the students.* 2. Use the exit quiz to get a sense of what students know and are able to do as a result of the lesson.**	What evidence will you gather from your students to understand what you may need to review next lesson?

* This is an important step. It promotes the critical skill for students of reviewing and regulating their own learning- did I complete all the learning tasks? Did I achieve the success criteria for today? Is there anything I need to review before the next lesson?

** The exit quiz is a formative assessment of whether students can demonstrate skills and understanding relating to the success criteria.

It can be done in a range of ways: online, as a paper test, or using mini whiteboards.

The quiz allows students to test their understanding of the concepts and also provides me with data as to what they have understood. I will use this to inform retrieval practice and revision throughout the unit, and what the next steps in learning will be in the subsequent lessons.