Differentiating existing learning sequences for English as an Additional Language students

Mathematics, Level 9, for EAL learners at Level C3

Existing learning sequences linked to particular learning areas in the Victorian Curriculum F–10 can be adapted to support differentiated teaching for English as an Additional Language (EAL) students. Teachers can adapt, remove or add to elements of their learning sequences in order to cater for all students in their classrooms.

1. Identify an existing learning sequence

**Existing learning sequence:** Stuck in the middle with you – Computational and algorithmic thinking in Mathematics

**Curriculum area and levels:** Mathematics, Level 9

2. Identify the level of language learning of your students

The EAL curriculum is a continuum structured as three EAL pathways (A, B, C). Each pathway describes a different stage of English-language learning (early, mid and late), and each pathway is divided into different levels of language learning (A1, A2, BL, B1, B2, B3, CL, C1, C2, C3, C4).

While the implementation of the EAL curriculum is the responsibility of all teachers, the EAL specialist plays a leading role in its delivery, as the expert in the field. Your EAL specialist will determine the most appropriate pathway for each EAL learner in your classroom and advise you of their current level of learning.

**The differentiation suggestions provided in this document are for students working at Level C3 of the EAL curriculum.**

EAL learners at Level C3 will typically be able to:

* listen, question and respond successfully in a wide range of social and academic contexts
* demonstrate a basic understanding of the main ideas, issues or plot developments in a range of accessible texts from across the curriculum.

3. Adapt the learning sequence to differentiate for EAL students

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| --- | --- |
| Existing learning sequence | Differentiated teaching for EAL learners at Level C3 |
| **Overview** | Overview |
| **Learning intentions:** * Students will use a sorting algorithm to sort numbers and hence find the median of a set (either with or without the use of digital technology)
* Students will describe some sorting algorithms, including how they work, advantages and disadvantages of both, and how they are similar or different from each other.
 | **Learning intentions:** * Students will use language effectively to use a sorting algorithm to sort numbers and hence find the median of a set (either with or without the use of digital technology)
* Students will use language effectively to describe some sorting algorithms, including how they work, advantages and disadvantages of both, and how they are similar or different from each other
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| **Relevant content descriptions in English: Reading, Level 9:**Apply set structures to solve real-world problems [(VCMNA307)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA307) | **Additional EAL Level C3 content descriptions:**Contribute to effective group work [(VCEALC678)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCEALC678) Prepare and deliver an oral presentation, after modelling and support [(VCEALC680)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCEALC680) Comprehend familiar and specific curriculum area vocabulary in a spoken or digital text [(VCEALL692)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCEALL692) Use specific curriculum area language, including technical terms [(VCEALL693)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCEALL693) Extract information from a range of visual representations, including tables, graphs and diagrams [(VCEALC697)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCEALC697) |
| **Relevant achievement standard:** [Students solve problems] … using a range of strategies including the use of digital technology. | **Relevant achievement standard:**At Level C3 students listen, question and respond successfully in a wide range of social and academic contexts … [They] demonstrate a basic understanding of the main ideas, issues or plot developments in a range of accessible texts from across the curriculum. |

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| Existing learning sequence | Differentiated teaching for EAL learners at Level C3 |
| Teaching and learning activities | Teaching and learning activitiesDifferentiated teaching is required to support EAL learners with the following learning activities. |
| **Activity 1: Explore sorting algorithms**For Activity 1, students must research at least two sorting algorithms and answer the following questions:* Why do we sort?
* What is a sorting algorithm?
* What does a sorting algorithm do?
* What are some different types of sorting algorithm? How do they work?

Give students time to conduct online research in pairs to find one or two sorting algorithms. Students should then present their findings on their chosen algorithms. Have students create videos or visual presentations demonstrating how their chosen algorithms are used to sort numbers or objects (for example, objects of different heights or weights), and to compare and contrast the different algorithms.Once students have completed their research, have each pair report back to the class and demonstrate one of their algorithms, reflecting on the advantages and disadvantages of this sorting method. Students could do this by demonstrating the sorting algorithm in person (much like the LEGO or robot animations) while describing the process, or they could use some other visual representation.Before moving on to the next activity, reflect with the class on their findings about the various algorithms.**Tip:** Use and clearly define the term ‘algorithm’ in this activity, to reinforce the process of following a set or sequence of instructions to solve a problem (see the [Victorian Curriculum Mathematics Glossary](http://victoriancurriculum.vcaa.vic.edu.au/LearningArea/LoadFile?learningArea=mathematics&subject=mathematics&name=Mathematics%20Glossary.docx&storage=Glossary)). You could give students the opportunity to come up with their own agreed class definition before, during or after the activity, and then compare it with the definition in the glossary. Discussion prompts:* Why do we need to sort lists of numerical data?
* How are the sorting algorithms similar? How are they different?
* Is one algorithm better suited to certain types of data? Why do you think that is?
* Where are sorting algorithms used? (Example answer: when searching for data.)
 | **Activity 1: Explore sorting algorithms**Activity 1 is a great opportunity to develop students’ understanding of sorting algorithms and prepare them for undertaking more hands-on, practical activities that follow.See [Appendix 1 – Vocabulary reference table](#App1) for a helpful vocabulary table that you can refer to and add to throughout the learning activities. You may need to pre-teach some of this vocabulary to students.As a class, view the following video, which demonstrates a sorting algorithm: * [LEGO Bubble Sort (AllTrueFalse, YouTube)](https://www.youtube.com/watch?v=MtcrEhrt_K0)

Play the video twice. During the first viewing, have students watch from beginning to end without stopping. During the second viewing, ask students to record the steps for sorting. Model recording the first two steps on the board after viewing the relevant section of the video:1. Compare the first two blocks on the left.
2. Move the taller block to the right.

Continue playing the video. Pause at the end of each step for students to copy the step down.At the end, ask students to compare their lists of steps in groups of three, each comprising both EAL and non-EAL students. Ask students to mark the differences in their lists. Elicit each step from the class as you provide a full list of steps. (Note that the steps in the middle have been truncated from the longer list.)1. Compare the first two blocks on the left.
2. Move the taller block to the right.
3. Compare the second and third blocks on the left.
4. Move the taller block to the right.
5. […]
6. Blocks are now sorted from shortest to tallest from left to right.

Tell students this is an example of an algorithm used for sorting objects (LEGO blocks). Ask students: ‘What is an algorithm?’ Have a brief class discussion before writing the definition of algorithm on the board. **Algorithm**: the process of following a set or sequence of steps to solve a problem.Ask students to copy the word and definition into their books. It may be necessary to explain ‘sequence’, using the list of steps above as an example.Place students in pairs to complete online research about at least two sorting algorithms. **Tip:** Pair EAL students with non-EAL peers. Ask EAL students to explain the instructions again to their partners. Visit pairs and provide support and feedback where needed. After researching, have pairs present their findings to the class.Prepare students to present their findings to the class. EAL students will need clear instructions for this task, so you should explain the task using both oral and written instructions as follows: 1. Look for two sorting algorithms on the internet.
2. Discuss with your partner the following questions:
* How do the two algorithms work?
* Where are they used?
* Is one algorithm better suited to certain types of data? Why do you think that is?
1. Prepare a three-minute presentation to the class on these findings. Please use visuals in your presentations, such as a video demonstration, PowerPoint slides or a poster.

**Tip**: EAL students need to be provided with a short list of suitable online resources to contain their search. The following online resources can be provided to students:* [Sorting (Runestone Academy)](https://runestone.academy/runestone/books/published/pythonds/SortSearch/sorting.html)
* [Sorting Algorithms Animations (Toptal)](https://www.toptal.com/developers/sorting-algorithms)
* [Comparison Sorting Algorithms](https://www.cs.usfca.edu/~galles/visualization/ComparisonSort.html)

At the end, ask the class, ‘So, what is a sorting algorithm?’ and write some voluntary answers from students on the board. Comment on the answers and write the definition on the board for students to copy down.**Sorting algorithm**: The process of following a sequence of steps to reorganise items in order. |
| **Activity 2: Let’s sort!**Have students conduct a simple sorting activity by hand. Sorting involves comparing one value with another in a list. If the first number is larger than the second, then the numbers must swap places. Then, the second number is compared against the third, and so on. Several passes are made to the list to ensure the numbers are sorted.  | **Activity 2: Let’s sort!**Allocate students into groups of three (comprising EAL and non-EAL students) and give each group a set of seven playing cards (from card number 3 to card number 9), which are not in order. Model, then ask them to complete the following steps:1. Shuffle the cards and place them in a line.
2. Sort the cards from smallest to largest number.
3. Record the sorting algorithm by writing down the steps or making a video.

At the end, ask students: * What type of sorting algorithm did you use?
* Why did you use it?
* Is this the quickest way to sort? How do you know?
* What is another possible algorithm for sorting the cards that you can use?
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| **Activity 3: In the middle**For this activity, have students search online to find real-world data to sort using their algorithm, sorting either by hand or using digital technology. Then, encourage students to select a topic in pairs or small groups. Students should decide on an appropriate number of data values to sort, depending on whether they are sorting by hand or writing a program using digital technologies.In addition to deciding on a sorting algorithm, students will need to clearly define (visually or in writing) the algorithm (process) they will use to find the median for a set of numbers.**Tip:** For data, students can use the following online resource:* [Choose your own statistics (ABC Splash)](https://education.abc.net.au/statistics-game/#/)

This is a great resource for students who want to explore data relating to topics such as weekly wages, life expectancy, and asylum seekers and refugees. To use the site, click on a topic to view a visual summary and then use the menu along the top, selecting ‘Interactive Graph’ to modify data filters, ‘More Information’ for background and context, and ‘Data Table’ for data summaries.[Australian Bureau of Statistics – Data by Region](https://itt.abs.gov.au/itt/r.jsp?databyregion) is another good source of data. Students can select a region and scroll down the page to investigate many topics.**Scaffold and support** Revise the definition of the median and how to find it. The ‘median’ is the value in a set of ordered data that divides the data into two equal parts. It is frequently called the ‘middle value’. Where the number of observations is odd, the median is simply the middle value. For an even set, the median is taken to be the average of the two middle values. For example, the median of the numbers 1, 3, 4, 5, 7 is 4, and the median for 1, 3, 4, 5 is the average of the two middle values – that is, (3 + 4) ÷ 2 = 3.5. The median provides a measure of location of a dataset that is suitable for both symmetric and skewed distributions and is also less sensitive to outliers than the mean.**Tip:** Connect data collection to real-world activities. For example, consider collecting ‘beep test’ data from your class during Physical Education. The median might show that 50% of students are scoring below the National Standard for the beep test. Students could then hypothesise why this might be the case and suggest future investigation or data analysis to explore their hypothesis further.**Example – Life expectancy in Australia**A group chooses ‘Life Expectancy’ from the [Choose your own statistics](https://education.abc.net.au/statistics-game/#/) online resource and uses the first of the two data tables, which contains the average life expectancy in Australia by state or territory, sex and Indigenous status. Students decide to find the median average life expectancy for males and females across all states and territories, using information from the data table (shown below).

| **Location** | **Total male (years)** | **Total female (years)** |
| --- | --- | --- |
| NSW | 79.5 | 82.9 |
| Victoria | 79.5 | 82.9 |
| Queensland | 78.9 | 82.6 |
| South Australia | 79.5 | 83.2 |
| Western Australia | 79.5 | 83.2 |
| Tasmania | 79.5 | 82.9 |
| Northern Territory | 74.3 | 78.9 |
| ACT | 79.5 | 82.9 |

Students use their chosen sorting algorithm to sort each set of data. For example, for the Male data they produce the following:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Total male (years) (unsorted)** | 79.5 | 79.5 | 78.9 | 79.5 | 79.5 | 79.5 | 74.3 | 79.5 |

 **Sorting algorithm.** (Students to show this process.)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Total male (years) (sorted)** | 74.3 | 78.9 | 79.5 | 7.95 | 79.5 | 79.5 | 79.5 | 79.5 |

 **Algorithm for how to find the median. (**Students to show this process.)Median average life expectancy for Australian males is 79.5 years.Once students sort their data and find the median, they reflect on what this means with respect to the context of the data and then present their findings.Discussion prompts:* What does this median mean?
* How does it compare with medians for other categories (in the example given, life expectancy for females)?
* Why do you think the median you found is higher or lower than another category?
* Was it easy to sort your data using your sorting algorithm? Why or why not?
 | **Activity 3: In the middle**Students continue to work in groups of three (comprising EAL and non-EAL students). Discuss the sorting algorithms that they have used or seen in the previous activities and the steps used in these. Show students the online resources [Choose your own statistics (ABC Splash)](https://education.abc.net.au/statistics-game/#/) and [Australian Bureau of Statistics – Data by Region](https://itt.abs.gov.au/itt/r.jsp?databyregion) one by one. Go through some examples of statistics with the class. For example, in [Choose your own statistics (ABC Splash)](https://education.abc.net.au/statistics-game/#/), select ‘Demographics’ to show students a map illustrating the population of each state and territory in Australia. Select ‘Life Expectancy’ and navigate to ‘Data Table’ to show students statistics of life expectancy in Australia. **Tip:** Images in infographics provide excellent opportunities for discussion and learning. For example, a map of Australian presents an ideal opportunity to explain the names and locations of the different states and territories, since EAL students may not be familiar with these. Invite students to share their prior knowledge and ask questions as you go through the examples in these two online resources.As a class, go through a sorting algorithm example from [Choose your own statistics (ABC Splash)](https://education.abc.net.au/statistics-game/#/) under ‘Life Expectancy’. (Students will benefit from verbal and written explanation of ‘life expectancy’ as a term.) For example, model extracting the Male data from the website to produce the following table:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Total male (years)** (unsorted**)** | 79.5 | 79.5 | 78.9 | 79.5 | 79.5 | 79.5 | 74.3 | 79.5 |
| **Total male (years) (sorted)** |  |  |  |  |  |  |  |  |

Project the table on the screen. Elicit a list of sorting algorithms students have worked on in Activity 1. Record these on the board. Recap the process for each sorting algorithm. Write the explanation for each algorithm on the board.Ask students: ‘What sorting algorithm can we use for this one?’ Use one of the algorithms students suggest, such as the bubble sort algorithm. Elicit each of the sorting steps from students and record these on the board. Perform the sort in the second row above.Show students the following illustration of median (see [Appendix 2](#App2)):Diagram of five stick figures in ascending height order to illustrate the 'median'. The two shortest figures are labelled '50% below'; the middle figure is labelled 'median' and the two tallest figures are labelled '50% above'.Diagram of six stick figures in ascending height order to illustrate the 'median'. The three shorter figures are labelled '50% below'; the point in the middle of the six figures is labelled 'median' and the three taller figures are labelled '50% above'.Provide each student with a printed resource on ‘median’ as follows (see [Appendix 2](#App2)):The **median** is the value in a set of ordered data that divides the data into two equal parts. It is frequently called the ‘middle value’. Where the number of observations is odd, the median is simply the middle value. For an even set, the median is taken to be the average of the two middle values. For example, the median of the numbers 1, 3, 4, 5, 7 is 4, and the median for 1, 3, 4, 5 is the average of the two middle values – that is, (3 + 4) ÷ 2 = 3.5. Show the sorted life expectancy data from the earlier part of the activity on the screen:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Total male (years) (sorted)** | 74.3 | 78.9 | 79.5 | 7.95 | 79.5 | 79.5 | 79.5 | 79.5 |

Ask students: ‘What is the median in this sorted data?’ (Median average life expectancy for Australian males is 79.5 years.)Ask students: ‘What does this median mean? How did you find the median?’ Then, elicit the steps and write them on the board. Tell students that these steps also form an algorithm for finding the median. **How to find the median:**1. Sort the value from smallest to largest.
2. Look for the one that is in the middle.

Return students to the same groups of three. Provide the following instructions in both written and verbal form:1. Choose a topic from [Choose Your Own Statistics](https://education.abc.net.au/statistics-game/#/) (ABC Splash) or [Australian Bureau of Statistics – Data by Region](https://itt.abs.gov.au/itt/r.jsp?databyregion).
2. Choose a data set under the chosen topic to sort using your group’s preferred algorithm.
3. Write down your algorithm or make a video of your group’s sorting.
4. Once the data has been sorted, find the median of the data.
5. Write down how you found the median.
6. Present your findings to the class.

At the end, ask students to reflect on their activity: * What type of sorting algorithm did you use?
* Why did you use it?
* Is this the quickest way to sort? How do you know?
* What is another possible algorithm for sorting the data?
* Was it easy to find the median of your data? What were your strategies?
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Additional resources

You can access the EAL curriculum on the [Victorian Curriculum F–10 website](https://victoriancurriculum.vcaa.vic.edu.au/english/english-as-an-additional-language-eal/introduction/rationale-and-aims).

You can access a range of resources to assist with implementing the EAL curriculum on the [VCAA English as an Additional Language webpage](https://www.vcaa.vic.edu.au/curriculum/foundation-10/resources/english-as-an-additional-language/Pages/default.aspx), including profiles of EAL learners, sample progressions through the EAL pathways, a language and learning interview, FAQs, professional learning opportunities and links to external resources.

Appendices

Appendix 1 – Vocabulary reference table

|  |  |  |  |
| --- | --- | --- | --- |
| **Content-specific vocabulary** | **Linguistic-specific vocabulary (verbs of instruction)** | **Language for interaction** | **Language for clarification** |
| algorithmsorting algorithmlife expectancymedian | Sort …Order …Find …Discuss …Choose …Present … | First you …Then …Next …Okay, now you have to …  | Can you say that again, please?What was the step again?Do you mean …? |

Appendix 2 – The median

The **median** is the value in a set of ordered data that divides the data into two equal parts. It is frequently called the ‘middle value’. Where the number of observations is odd, the median is simply the middle value.

For an even set, the median is taken to be the average of the two middle values.

For example, the median of the numbers 1, 3, 4, 5, 7 is 4, and the median for 1, 3, 4, 5 is the average of the two middle values – that is, (3 + 4) ÷ 2 = 3.5.



