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Science and EAL teachers' perspectives and practices in building word knowledge in implementing the new Victorian EAL curriculum

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Abstract: *The recent implementation of* The Victorian Curriculum F-10: EAL *requires content teachers who teach EAL students to be familiar with the revised EAL curriculum for the purposes of planning and developing approaches to assist learners' development in English. In the literature and in curriculum frameworks, word knowledge is considered an important aspect of EAL students' learning. However, little is known about what pedagogical practices teachers across the curriculum perceive as being important, and use, in developing EAL students' vocabulary. In this study, we investigated linguistically responsive vocabulary teaching in a Year 7 science class. Our aim was to elucidate teachers' perceptions and practices in teaching vocabulary in science. The qualitative case study drew on principles of linguistically responsive instruction (LRI), which refers to practices for meeting the needs of students in culturally and linguistically diverse classrooms. Analysis of interview and classroom data from an EAL teacher and a science teacher revealed a range of LRI practices for developing word knowledge based on understanding the distinction between conversational*

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and academic language, language learning principles, responsive teacher talk, plurilingual awareness, and the importance of social interaction for learners. We offer recommendations for a whole school approach to LRI, adaptation to online LRI, and curriculum development.

Key words: *EAL curriculum, linguistically responsive instruction, science, vocabulary, teacher collaboration*

Introduction

In Australian government[1] schools, 25% of students are English as an additional language (EAL) students. They represent over 2,000 linguistic and ethnic backgrounds (Australian Curriculum, n.d.). EAL students often receive between six to 12 months of intensive EAL education before transitioning to a mainstream school where they continue to learn English at the same time as content in a range of disciplines in English. The integration of EAL students in mainstream schools necessitates collaboration between EAL specialists and content teachers. Whole school approaches to EAL provision recognise that responsibility for language as opposed to content learning should be distributed and shared by all content specialists, not only EAL teachers (Creese, 2010; Edwards, 2014; Filipi & Keary, 2018; Hammond 2012; Haworth, 2009; Nguyen & Dang, 2021).

In Victoria, the recently revised *Victorian Curriculum F-10 EAL* (Victorian Curriculum and Assessment Authority (VCAA), n.d.) has created opportunities for collaboration between EAL and content teachers. This is due to the requirement that all teachers of EAL students need to be aware of their students' English language needs so that they can progress through the CL, C1, C2, C3 and C4 points along the Pathway C of the Curriculum, which applies to late immersion students in Years 7 to 10. The requirement does not necessitate that content teachers report against the levels on the pathway (the role of the EAL teacher). However, there is an expectation that content teachers become familiar with *The Victorian Curriculum F-10: EAL* for the purposes of planning and developing approaches to assist learners' development in English. In science, and specifically Year 7/8

(1) There are three educational sectors in the Australian school system: government, catholic and independent schools.

chemistry, which is the focus of this study, the Science Achievement Standard expects students to: "use appropriate scientific language, representations and simple word equations to communicate science ideas, methods and findings." (*The Victorian Curriculum F-10: Science*, VCAA, n.d.). One key area of language that is highlighted here and more broadly in Second Language Acquisition (SLA) research is vocabulary (Teng, 2019).

In this study, we investigated linguistically responsive vocabulary teaching in a Year 7 science class. Our aim was to elucidate the perceptions and practices of an EAL and a science teacher in teaching vocabulary in science. Our aim is linked to the principle in TESOL that language learners need direct language practice with an explicit focus on grammatical structure and vocabulary. The research question that the paper aims to address is: *How do the perceptions of and practices used by the EAL and science teachers align with the language principles of linguistically responsive instruction related to word knowledge?*

We begin by reviewing three key areas of the literature pertinent to this study: linguistically responsive instruction (LRI), vocabulary learning, and the learning of language in science.

Literature review

Linguistically responsive instruction

One of the prevailing issues in our increasingly culturally and linguistically diverse classrooms is the need for LRI practices across all subject areas to cater for students who are developing their English language skills. These practices include additional pedagogies and teacher knowledge based on understandings that are derived from educational psychology, and research in linguistics and SLA (e.g., de Jong & Harper, 2005; Lucas et al., 2008). There is also a need for teachers to advocate on behalf of EAL learners and to value the cultural and linguistic diversity that they bring to the classroom and to the wider school community (de Jong & Harper, 2005; Gallagher & Haan, 2018; Lucas et al., 2008). In other words, all teachers need to understand the socio-psychological/political aspects of language learning (de Jong & Harper, 2005). The *Australian Professional Standards for Teachers* expect all teachers to "[d]emonstrate knowledge of teaching strategies that are responsive to the learning strengths and needs of students from diverse linguistic, cultural, religious and socioeconomic backgrounds" (Australian Institute for Teaching

and School Leadership, n.d.). Therefore, it is important to understand how teachers make sense of, and demonstrate, such requirements in practice.

Recognition of the need to expand teacher knowledge, skills and beliefs to successfully meet the needs of EAL learners has led to the development by researchers of different frameworks or guidelines to assist teachers and to inform teacher education programs (see for example, de Jong & Harper, 2005; de Jong et al., 2013; Lucas et al., 2008). These guidelines encourage and support teachers to develop pedagogical practices that enhance learning for second-language learners and attend to the importance of diversity and multilingualism. The guidelines are informed by a set of principles and values including the need for teachers to: (i) understand the distinction between academic language and conversational English proficiency (based on Cummins, 2000); (ii) understand the importance of social interaction for learners; (iii) ensure that their classroom talk is responsive and provides scaffolded instructions (i.e. a revised and updated concept of comprehensible input (Krashen, 1982) that instead places emphasis on interaction and the responsive actions of speakers); (iv) ensure that students have a strong foundation in their L1; (v) understand the linguistic and discoursal differences between languages, and identify the linguistic demands of texts and tasks; (vi) appreciate the importance of knowing learners and creating a secure classroom learning environment; (vii) understand different cultures of learning; (viii) apply principles of language learning by giving attention to both language forms and meaning; (ix) apply strategies that enable students to leverage their L1 use; and (x) foster multilingual citizenship (based on de Jong & Harper, 2005; de Jong et al., 2013; Lucas et al., 2008). In this study, we focus on principles (i), (ii), (iii), (viii) and (ix) as they are most relevant to word knowledge of EAL students.

Vocabulary learning

Vocabulary has been highlighted as important for success in school, both for students generally (Hindman et al., 2016) and for EAL students in particular. Having an expanded vocabulary is crucial to EAL learners' everyday interactional and academic competence (Molle et al., 2022), evident for example in understanding teacher instructions, the language of subject

materials and texts, and for socialising in and outside the classroom. In content areas, the language encountered becomes the vehicle for language learning (Molle et al., 2022). While vocabulary is learned both intentionally (through formal instruction) and incidentally, both in and outside the classroom, research has shown that for the latter to be successful as a strategy, a certain proficiency threshold has to be reached and a strong vocabulary needs to be in place. Where this is not the case, students are unable to use contextual clues, including application of grammatical knowledge, to arrive at meaning (Teng, 2019).

Beck et al.'s (2013) concept of the three tiers of vocabulary (Tier 1, Tier 2 and Tier 3) has recently been taken up by the Department of Education in Victoria (DET Victoria) to encourage schools to adopt a similar pedagogic approach to vocabulary across curriculum areas. Tier 1 vocabulary refers to everyday, familiar words that students encounter as they socialise with others. Tier 2 vocabulary comprises high frequency words encountered in school that are common to content across the curriculum and that have a range of meanings. Tier 3 vocabulary includes words that are specific to particular content areas and therefore low-frequency.

In *The Victorian Curriculum F-10: EAL*, reference to the three tiers is evident in the descriptors for word knowledge, which is a sub-strand of the communication strand. In the speaking and listening, and reading and viewing modes (most relevant to this study), a number of performance indicators across the CL to C4 pathways in learning vocabulary are identified. These indicators refer to understanding of both general Tier 1 vocabulary (e.g., *identify key vocabulary and ideas; recognise words for everyday items... (C1); use topic-related compound words to extend vocabulary (C2)),* and Tiers 2 and 3 content area vocabulary (e.g., *recognise topic-specific vocabulary that has been taught (C1); use words with multiple meanings across curriculum areas (C3)* (both Tier 2), *use specific curriculum area language, including technical terms (C4)* (Tier 3)). The descriptors provide a useful guide for examining how teachers plan to give attention to vocabulary and how this translates to actual practice in the classroom.

Next, we consider language learning in science education, that is the context of the current study. In particular, we focus on issues associated with teaching and learning specialised vocabulary in junior secondary chemistry.

Learning science and language

Science education has specialised language and patterns of use that are specific to the discipline (Halliday, 1978). Acquiring and being able to use these language features is therefore an important enabler of student learning and academic success.

Students commonly find the language of science challenging, which can act as a barrier to developing understanding. This challenge is further complicated when science teaching is in the language that is not their own (Rees et al., 2018). Learning chemistry presents additional challenges because language demands include not only the formal ways of representing chemical processes and structures, but also graphical and symbolic language. Cink and Song (2016) reported case studies of senior students from diverse ethno-linguistic backgrounds who viewed the language of chemistry as a barrier to continuing their study of the subject. Consequently, "a number of authors ... have argued for the importance of explicitly teaching language and developing language skills within chemistry teaching" (Rees et al., 2018, p. 756).

Compounding these challenges is the situation that science teachers are not usually trained in language learning, nor how to integrate language and content instruction. Particularly in a secondary school context, teachers tend to view themselves as content specialists, not as teachers of language. As successful science learners themselves, it is perhaps not surprising that science teachers pay little attention to the language demands associated with the subject matter, and/or the ethno-linguistic backgrounds of their students.

One approach that has been advocated to support students' science language learning is through explicitly teaching Tier 2 and 3 words so that students can begin to access and communicate their scientific content knowledge (VCAA, Literacy Teaching toolkit, n.d.). In chemistry, some examples of Tier 2 words include *mixture, element, compound;* while Tier 3 words include *matter, atoms, molecule.* Strategies that can be employed to teach both science and language for these terms include: identifying and talking about similarities and differences between everyday and specialised use of terms (e.g., mixture in the kitchen and the laboratory—Tier 2), and providing hands-on experiences that enable students to build memory images of specialised terms (e.g.,

building and drawing molecules—Tier 3). Additionally, teaching language functions can promote higher-order thinking and concept development; for example, through providing students the opportunity to reflect on their learning and understanding of new terms (Stoddart et al., 2002).

The above review highlights the need for additional understanding about language and EAL learning as part of every teacher's knowledge and skill set. The centrality of vocabulary acquisition is one aspect of language that the review has shown to be critical. The review has also shown how vocabulary and concepts specific to science can be particularly challenging and require linguistically responsive approaches to enable students to remember, understand and apply them.

The current research

The school site for this research (described below) has adopted the three tiers of vocabulary as a whole school focused approach to literacy development across all content areas. This model, together with the principles of linguistically responsive pedagogies, but narrowed to centre specifically on word knowledge, plurilingual awareness, and the importance of social interaction, informs the theoretical framework for data analysis. Also important to the analysis is how teacher confidence and knowledge about language occur in the context of collaboration between the EAL and (science) content teachers.

Methods

Context and participants

The study took place in a secondary school in the South East of Victoria, Australia. Ethics approval was obtained from the authors' university, and permission from the DET Victoria and from the school's principal. Consent to participate was sought and received from the two teachers, the students and the parents of the students in the science class, which included four EAL students (at Level C1).

The school offers an extensive EAL program with the support of multicultural aides to cater for EAL students from Year 7 to Year 12. An EAL teacher (Anne-Marie, pseudonym), who was also the EAL coordinator for the school at the time of data collection, and a science teacher (Ellie, pseudonym) participated

in this study. Anne-Marie had been teaching EAL at the school for 11 years. Her role in addition to teaching included providing professional development (PD) for content teachers and EAL teachers, and working with individual content teachers who had EAL students in their classes. She had a strong understanding of the revised EAL Curriculum and had been actively using it in her own teaching, and to support content teachers. Ellie had been teaching science for approximately four years at the same school. At the time of the study, she had taught Year 7 every year and had always had EAL students in her classes. Although Ellie recognised EAL students' needs for language support in learning science, she reported feeling unsure about how to address these needs. She had no formal training in supporting language learning, apart from one PD session provided by Anne-Marie for all teachers early in the year in which this study was conducted. She reported having a basic knowledge of the EAL Curriculum but that she did not explicitly refer to it in her planning and teaching. When a science teacher was sought to work with Anne-Marie to plan and teach a Year 7 science unit with language learning in mind, Ellie volunteered to participate as she was keen to develop her skills in this area.

Based on information gleaned from the interviews conducted, collaboration between the EAL teachers and content teachers in the school usually occurred in informal and incidental ways. Teachers also shared resources on a virtual platform. As part of this project, Anne-Marie and Ellie met several times; however, these meetings tended to be organised 'on the fly' when Ellie needed to debrief and discuss strategies for teaching vocabulary in her science classes. Three factors worked against more formal collaboration structures: working in different subject teams, clashes in the timetable, and the unexpected need to go online which disrupted regular face-to-face planning meeting times. Consequently, Anne-Marie was not involved in co-teaching with Ellie. However, the two teachers did organise a formal meeting towards the end of the unit to discuss and plan differentiated assessment tasks so that the EAL students could be better supported in achieving positive learning outcomes.

Data collection and analysis

Data were collected using two individual interviews with Anne-Marie and two group interviews with both Anne-Marie and Ellie,

and video-recordings of five science classes (three online, two face-to-face). Each audio-recorded interview lasted between 45–60 minutes. All interviews were semi-structured and focused on how the teachers interpreted *The Victorian Curriculum F-10: EAL* in relation to *The Victorian Curriculum F-10: Science,* how they used the curricula in their planning and teaching, and how they described or reflected on their teaching and collaboration practices with reference to word knowledge. Lesson recording was performed either by a technician (in the case of face-to-face classes) or by the science teacher (in the case of online classes during COVID-19 lockdown periods in 2021). These were then professionally transcribed for detailed analysis. Additional features in the classroom extracts selected for analysis to capture some prosodic and embodied features from conversation analysis (Jefferson, 2004), were transcribed by the first author in Courier New 10 using notations that appear in Appendix 1. To distinguish the classroom and interview extracts, the transcriptions for the interviews are in italicised Times New Roman 12. Times New Roman 12 is also used in the classroom extracts to describe what is going on.

To answer the research question, the interviews and lesson recordings of Days 1 and 3 (face-to-face) and Day 2 (online) of the science unit were first coded against the teachers' perceptions and practices in the five LRI principles within the area of developing EAL students' word knowledge (Table 1). The analysis was performed by each of the three authors independently. The team discussed the analysis frequently to resolve discrepancy, to decide on categories where there might be overlap by going back to the data, and to compare and aggregate the findings during the analysis rather than establishing an inter-coder reliability rating at the end of the process. In proceeding through the coding, examples of data that could be coded to more than one principle emerged. This was particularly the case for principles (iii) and (viii) which were difficult to separate. Ultimately, the decision to place them in one or other of the principles was based on whether the strategy was primarily linguistic in focus highlighting how the teacher attended to it (viii), rather than how the teacher's talk was responsive (iii).

Table 1: A working document for recording data analysis

LRI principles relevant to vocabulary knowledge	**Strategies** ***(N.B. Only one example is given for each principle below; see Appendix 2 for the full range)***
(i) understand the distinction between academic language and conversational English proficiency	e.g., using life experience/ knowledge of the everyday world to explain scientific concepts
(ii) understand the importance of social interaction for learners	e.g., encouraging questions, responding and reacting, elaborating, assessing
(iii) ensure that classroom talk is responsive and provides scaffolded instructions	e.g., using embodiment including hand gestures and facial expressions in explaining and in response to students
(viii) apply principles of language learning by giving attention to both language forms and meaning	e.g., focusing on pronunciation and sounding out new words in context
(ix) apply strategies that enable students to leverage their L1 use	e.g., drawing attention to the use of the L1 in resources

Before examining how the teachers planned, introduced and taught vocabulary with reference to *The Victorian Curriculum F-10: EAL,* as well as *The Victorian Curriculum F-10: Science* in Ellie's case, it is important to note that the content descriptors are framed from the perspective of what the learner should be able to do. The LRI framework and the three tiers approach to vocabulary, however, are framed from the perspective of the teacher; specifically, teacher knowledge about language relevant to support learning. This notwithstanding, by limiting analysis to the sub-strand word knowledge as one feature of language in *The Victorian Curriculum F-10: EAL*, we have sought to relate the descriptors to the identified approaches that Ellie used to introduce new vocabulary and science concepts, and to the related points raised by the teachers in the interview.

Findings

In triangulating the video classroom data with the teacher reports in the interviews, we tracked the alignment of the approaches and

reports with the three tiers of vocabulary used by the school across all content areas and the LRI principles (listed in Table 1). This generated 25 verbal and nonverbal strategies for introducing and teaching vocabulary identified in the data. These appear in Appendix 2 as stated above.

In the discussion below, since all the principles are interrelated and overlap to some extent, we have organised the discussion by combining principles (i), (iii) and (viii) (see Table 1) together in the initial subsection. The next two subsections focus on the remaining two LRI principles, (ii) and (ix).

Understanding the distinction between everyday and academic language, applying principles of language learning, and responsive teacher talk

In this section, we present findings about three LRI principles, including (i) the distinction between everyday conversational and academic language, (iii) responsive teacher talk, and (viii) explicit attention to linguistic form and language function essential to second language learning through an explicit focus on vocabulary.

In science, Brown and Ryoo (2008) maintain that EAL learners learn best when exposed to science concepts in everyday language before being introduced to the scientific terms. The first lesson of the unit provides such an example. Here the class was involved in drawing and labelling a picture of an atom by recalling some of the previously introduced terms. Ellie was using the whiteboard and the students were using their exercise-books.

(Ellie, Lesson 1)

1T: ...the label i'm looking for (0.8) is about {the centre (0.4) of the
{((makes a circling gesture with her hands))
2 atom.
3 (0.3)
4 {rather than calling it the centre or the middle there's a
{((Jack starts to put his hand up, then retrieves it))
5 {<science> word that we need to use.
{((gestures))
6 ((0.4, during which she casts her eyes over the class.))
7 jack?
8 S: is it like the core?
9 T: oh you're so:: close. sometimes it's referred to as the core. if you

10 look it up on the internet, they might use that word sometimes.
11 <the word we use> (0.3){starts with N (0.6) and it's not neutron.
{((writes N on the board,
Tim raises his hand))
12 (1.0)
13 tim?
14S: is it nucleus?
15T: the nucleus, well done. {(0.8) <the nucleus.> so that's how you
{((writes on the board))
16 say it. nu::cleus.

In this typical teacher-controlled, instructional initiation, response, evaluation (IRE) sequence (Mehan, 1979), Ellie is eliciting the label, *nucleus*. In her initiating turn in line 1, she is using an everyday term—*centre,* which is a Tier 1 word—to build on students' already known or familiar vocabulary and replace it with the Tier 3 technical word, *nucleus*. It therefore provides an opportunity for students to understand how everyday words can have a special meaning in academic content. Her multimodal packaging (Filipi, 2018) using hand gestures, the prosodic features of slowing down her speech, intonational marking, pausing, writing the word on the board and modelling its pronunciation (that's how you say it), all combine to emphasise *nucleus* as the key word, and scaffold and facilitate student recall and language learning, actions which show evidence of principles (i), (iii) and (viii). Teachers may not be aware that they are producing these linguistic strategies, and they were not mentioned during the interviews. These strategies are nonetheless recognised as being important in EAL teaching.

In their interviews, both teachers referred to more established strategies, including (Kahoot) quizzes, glossaries, dictionaries, pronunciation and role-play. Ellie identified the use of visual pedagogy and physical representations as important, illustrated in the following response to a question about how to confront EAL learners' limited language.

(Ellie, Interview 3)

> I'm trying to be as visual as possible ... that means sort of simulation. Like there is a lot of online simulators that show little bits of atoms and they can click and put things together and just see it, and often there is almost no writing on the screen for a lot of those sorts of

> simulations. I've tried to get them sort of standing up and role-playing things as a class. So moving around acting as parts of the atom without having to talk too much. ... They can put that time in to just remember what the name is of their component that they're acting out? So just a word or two words and then work up from there, so hopefully they can then get a definition later or they can explain it later.

Visual pedagogy (Sibold, 2011) and kinesthetic, physical, embodied representations of specialised language (Reid, 1987), can enhance students' exposure to language. They support the process of language learning in context by drawing attention to contextualised words and assisting students in remembering them. Building a solid language base is vital for later, higher order skills development.

Having to teach online due to COVID-19 presented Ellie with additional challenges that led her to reflect on her use of language. In the next extract, she reported the need to analyse her language choices and phrasing in giving instructions to ensure students' comprehension (principle iii).

(Ellie, Interview 4)

> So I find that a particularly challenging part of remote learning, not being able to see faces and gather that informal feedback. I did try to reach out through chat messages to them sometimes, but then I sort of had to really think about what language I was using when I was typing those messages and making sure that that wasn't too complex or I wasn't writing too long of a sentence and my message was getting lost in it. So that was helpful, but then again, I think that was more challenging than being in person and being able to show them and point to things in their book or, you know, help them like that.

Ellie's reference to the lack of non-verbal cues highlights an important element in providing 'on the fly' feedback that enables adjustments to be made based on decisions taken in the moment (cf Schön's (1983) concept of *reflection-in-action*). She also draws attention to the reflective space that online teaching can provide in being able to revisit her chat messages for length and complexity. Also evident is analysis of language that Gibbons (2002) suggests is important in teaching EAL learners.

Ellie's concern aligns with Lucas et al.'s (2008) principle that EAL students need exposure to teacher talk that is responsive and comprehensible, and just beyond their current level of proficiency (principle iii). It is important to note, however, that such a concept needs to take interaction into account. In other words, the notion of comprehensibility and 'input' do not exist in an interactional vacuum but are established in concert with students, and fundamentally as a result of interaction.

From the online classroom data, there is evidence of Ellie making adjustments in her teaching through the use of paraphrasing, repetition, prosodic marking, and embodiment, all revealing attention to language (principle viii). Such actions also reveal how pedagogical decisions are made in the moment in response to a specific need or situation. In the following extract, Ellie was discussing the periodic table during the online class.

(Ellie, Lesson 2)

1T: um: i can also show you ((2.0 during which she brings up a slide))
2 the definition of what an element actually IS in case
3 anyone is unsure. (0.4) <so an element is basically the simplest
4 type:: of material or the simplest form of matter ((The latter
5 definition is written on the slide.)) that we know exists.> ...
6 so each one is {unique, each one has a {different
{((cusped hand gesture)) {((gesture is repeated))
7 structure ... for the atom inside it,

The terms 'element' and 'atom' were introduced in the previous lesson. In showing the definition on the slide, Ellie is expecting that some students may need a reminder. Importantly, the definition is presented in both oral and written modes. Ellie does not simply read aloud the definition, she also paraphrases and simplifies the wording from simplest type:: of material (formulated orally using everyday Tier 1 language) to the simplest form of matter (formulated in writing on the screen using the Tier 2 and 3 science specific terms *form* and *matter*). Reformulating (a form of paraphrasing) is also used in her next utterance (*unique* and *different*, line 6) to underscore that each element is unique. Through the reformulation, combined with repetition of the concept, and prosodic marking, Ellie draws attention to a key feature and adjusts her teacher talk to facilitate student understanding.

Plurilingual awareness: Establishing a place for L1 use

As well as referring to the whole school Tier 1, 2, 3 approach, Anne-Marie also referred to *The Victorian Curriculum F-10: EAL* as a source of teaching ideas. One strategy she highlighted in particular was plurilingual awareness, also identified as a key LRI principle (de Jong et al., 2013; Lucas et al., 2008). In her interview, she notes the use of students' L1 as a resource, which she describes as a practice which has only recently been encouraged in EAL learning.

(Anne-Marie, Interview 1)

> So with this change ... we were able to encourage students to use their L1 ... obviously not to an extreme level but in terms of clarifying ideas, giving instructions, helping them with answers to questions, being able to use their L1 a little bit more, use translators, use other students in the class, use my aides in the class ... Encouraging them to talk to each other about the new, the new vocabulary, the new language, and then bringing it into an English kind of forum if you like.

Both teachers expressed a lack of confidence in using L1 as a strategy though, including how much of the students' L1 to use, as noted by Anne-Marie. Their lack of confidence is encapsulated by Ellie:

(Ellie, Interview 2)

> I don't think I was completely confident in what to do in that space ... I want to make sure that it's done well. So I feel like it's something I'd have to sit and plan and ask for examples of what other people have done before I'd feel really good and confident about using it properly myself.

However, on one occasion, during a simulation task, Ellie does encourage the use of Mandarin.

(Ellie, Lesson 1)

1T: it's really cool and you can put it in chinese as well which is
2 awesome. that's good.

Here Ellie is drawing the student's attention to the use of her L1 as a resource in the software application being employed.

Importantly, her positive assessment (awesome) provides encouragement in using the L1. This was the only example of a plurilingual strategy observed during the five lessons.

Understanding the importance of peer social interaction

Ellie reported struggling to find ways to encourage social interaction in the online space during the COVID-19 lockdown. She had no access to features such as breakout rooms that could have enhanced interaction. To compensate, Ellie devised tasks that encouraged students to use their home as an interactive space and then to share their learning with their peers.

> *(Ellie, Interview 4)*
>
> There were a couple of little collaborative activities I did try to get students to do ... Some students had a go, some students didn't really have a go ... things like getting them to walk around the house and find items to build an atom with or to represent an atom with and then sharing that with their peers. So I feel like that was a nice way to involve their house and get them talking about things at home at the same time as working through the ideas we were learning.

During the online class, this activity translated to the following instruction.

(Ellie, Lesson 2)

1T: what you can then do if you are feeling confident is have a go at
2 building a particular atom from the periodic table using materials
3 around your house. (0.4) so you might have lego or playdough or food
4 for breakfast. try and build a picture of a particular atom called
5 fluoride ... and i would love for you to actually take a picture of
6 what you build and send it as a reply to this lesson plan. (0.5) so
7 actually share it with other people and show them what you have
8 made and show them what you have figured out about it by looking at
9 the periodic table.

Noteworthy here is the optional nature of the activity which allowed students to attempt the task if they felt "confident". The importance of physical representations and hands-on activities for learning science concepts has already been discussed above, so potentially this is a missed learning opportunity for some students

in an online space where access to embodied features is missing or not prominent. With respect to EAL, it is important to have high expectations of EAL learner participation (Mohr & Mohr, 2007). As well, instructions need to be clear and explicit to remove doubt or uncertainty about task accomplishment. Finally, creating opportunities for students to share with peers what they have made or found is pivotal in providing practice in giving explanations and talking through the introduced science concepts. While important to science, these are broadly applicable skills across all curriculum areas. In terms of plurilingual strategies, this could also be done in a shared L1 in breakout rooms as well as in English.

Conclusion and recommendations

In this study, our main purpose was to explore the perceptions and practices of a science teacher and an EAL teacher, about the development of EAL learners' English language skills that underpin the revised EAL curriculum, taken up through attention to vocabulary. The analytic framework that informed the study was driven by LRI that draws on SLA and inclusion research to provide a set of key principles to guide teaching (e.g., de Jong & Harper, 2005; Lucas et al., 2008). The principles address the often-cited need (e.g., Creese, 2010; Edwards, 2014; Filipi & Keary, 2018; Hammond 2012; Nguyen & Dang, 2021) for distributed and consistent pedagogies that place the onus for language development on all teachers and not just on EAL specialists.

The interview and classroom data suggest that both teachers understood and practised the LRI principles relevant to informing vocabulary teaching, even if they expressed a lack of confidence in adopting plurilingual strategies (both Anne-Marie and Ellie) and a lack of familiarity with *The Victorian Curriculum F-10: EAL* (Ellie), as well as concern for the few opportunities for social interaction when teaching moved online (Ellie). Thus, while an impressive range of vocabulary strategies that aligned with the descriptors in the EAL curriculum for word knowledge were clearly evident in the teachers' perceptions and face-to-face classes, these were largely absent from the science teacher's online practice (Ellie). To a large extent, teaching online without the availability of features such as breakout rooms to encourage group activities, led to a more transmissive and teacher-centred

approach to teaching vocabulary. Despite the constraints of their situations, the teachers were able to implement the LRI principles related to word knowledge development, such as adjusting teaching through the use of paraphrasing, repetition, prosodic marking, and embodiment to ensure students' comprehension (principle iii) and encouraging the use of students' L1 (principle ix). These strategies were not only responsive to the students' learning needs but also aligned with the curriculum frameworks in the area of word knowledge.

A further finding from the study pertains to the EAL curriculum. Using the LRI principles to frame our analysis was useful in showing how the principles underpinned the revised curriculum. The principles were evident in particular in the emphasis on: language learning in word knowledge and the distinction between everyday and academic language (the three-tier vocabulary model); responsive teacher talk; plurilingual awareness and the principle of using the L1; and the importance of social interaction for developing students' English.

We recognise the limitations of this study as it represents the perceptions and practices of two teachers in one school. While this situation inevitably limits generalisability, the findings elucidate examples and insights that may resonate with other teachers and schools, and provide a basis for expanding this work.

Finally, based on this research, we offer the following four recommendations for teachers and stake-holders in the implementation of the revised EAL curriculum:

- It would benefit learners if EAL teachers could meet regularly (even if briefly) with content teachers and plan lessons jointly in order to achieve a more language informed pedagogy that is married with content teacher expertise. This would enable content teachers to feel more confident and supported in addressing EAL learners' needs to further develop their English language while learning content, and to become familiar with the EAL curriculum.
- The shift to online learning precipitated through COVID-19 provides opportunities to consider how this space may be productively used to support EAL learning by bringing together language, content, technology and pedagogy across all content areas. This could be achieved, for example, by using lesson recordings to review content, encouraging students to ask questions in less

public ways such as one-on-one posts, and grouping EAL students together for additional focused and scaffolded activities in English and/or the L1 through features such as breakout rooms. An expert in technology-enhanced learning could also be employed to support the teaching team in these aspects.

- In working with the revised EAL curriculum, it was evident that the strands were addressing and specifically relevant to English content only. *The Victorian Curriculum F-10: EAL* needs to be relevant to *all* content areas. It is also important for all teachers to be able to learn about the pivotal role of language in each discipline's curriculum through targeted PD or accessible resources.
- It is important that schools provide the necessary infrastructure and support for EAL teachers and content teachers to discuss EAL learner needs in ongoing planning, and not simply as "one offs".

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Appendix 1

The following transcription notations are based on Jefferson (2004) and used in the classroom transcripts.

[– overlapped talk (when speakers speak at the same time)
{ – gesture co-occurring with words (from Filipi, 2007)
xxx – underlining to indicate word stress
: – sound stretching
(0.0) – pauses and gaps measured in tenths of a second
< > – talk that is slower than the surrounding talk
(( )) – a comment to describe nonverbal behaviour

Appendix 2

LRI principles relevant to vocabulary knowledge	**Strategies derived from the data analysis**
(i) understand the distinction between academic language and conversational English proficiency	1. Characterising science as being different from the everyday by drawing attention to different uses of words/concepts 2. Using life experience/knowledge of the everyday world to explain scientific concepts and the ways in which they are similar and related but different from their everyday uses
(ii) understand the importance of social interaction for learners	3. In whole and individual class activities, encouraging questions, responding and reacting, elaborating, assessing and inviting further thinking by using both verbal and nonverbal features such as smiling and nodding 4. Encouraging students to apply concepts at home and sharing with others (at home and in class) what they found; for example, by sharing visual understanding of a concept with peers

(iii) ensure that classroom talk is responsive, and provide scaffolded instructions	5. Pausing, e.g., to allow students to formulate an answer 6. Introducing a topic/the lesson by preparing students for what they will see and need to look out for 7. Reformulating, rephrasing 8. Offering hints and elaborating 9. Repeating keywords
(viii) apply principles of language learning by giving attention to both language forms and meaning	10. Using embodiment including hand gestures and facial expressions in explaining/ introducing new words in context 11. Connecting, and transferring ideas or processes to other phenomena, concepts 12. Relating the concept to a shape (looks like) 13. Using diagrams and visual pedagogy 14. Making links to common or accepted usage 15. Using different colours or patterns to convey different labels on diagrams 16. Using hypotheticals 17. Using anthropomorphism 18. Using mnemonics and associations 19. Using prosody to mark key words 20. Using synonyms 21. Drawing attention to spelling of unfamiliar or new words 22. Suggesting how to manage not knowing a word 23. Focusing on pronunciation and sounding out 24. Using word attack skills and collocation
(ix) apply strategies that enable students to leverage their L1 use	25. Drawing attention to the use of the L1 in resources

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