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

Presenting author: Minh Hue Nguyen

Co-authors: Anna Filipi & Amanda Berry

Faculty of Education, Monash University

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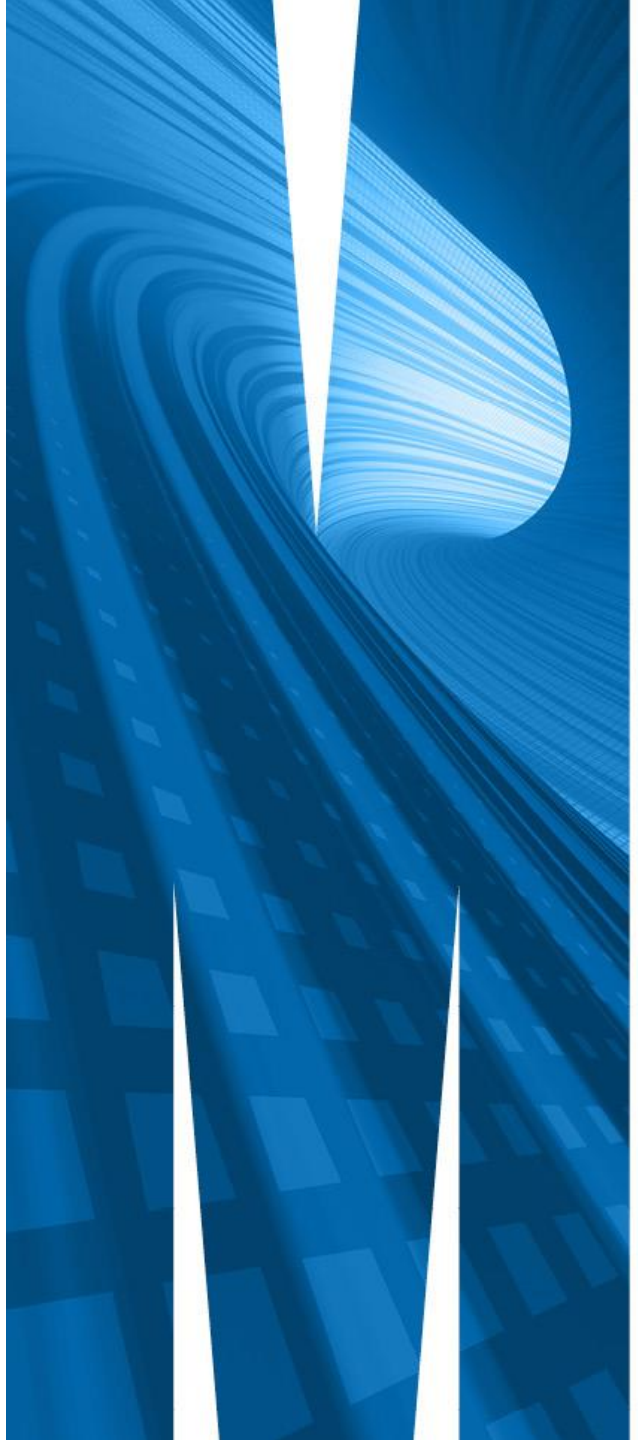


Context: EAL students in Australian schools

- Australian govt. schools - **25% of students** are English as an additional language (EAL), with over 2,000 culturally and linguistically diverse backgrounds.

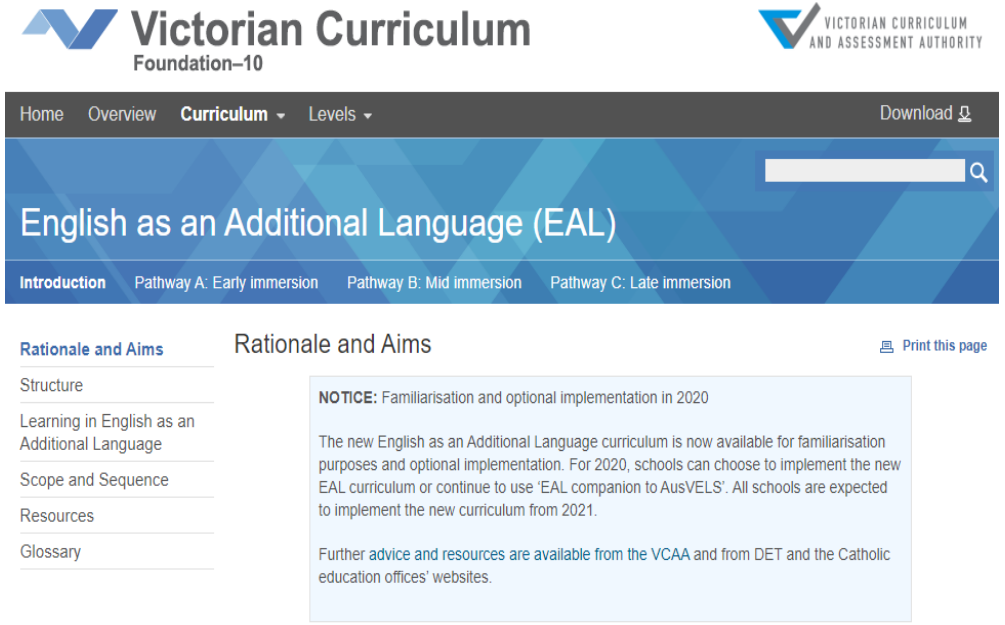
- EAL students usually receive **6 - 12 months** of intensive EAL education before transitioning to a mainstream school.

- Mainstream - students continue to learn English at the same time as content in a range of disciplines in English.

Victorian Curriculum F-10 EAL (2021)

All teachers are responsible for teaching EAL learners in their subject areas, this involves:

- understanding the proficiency levels of their EAL students
- focusing on the content-specific language students need to access the content of their learning areas
- being able to plan for and support the language learning of EAL students in order to support their understanding of different content.



Role of teachers

- Integration of EAL students in mainstream schools necessitates collaboration between EAL specialists and content teachers; responsibility for language as opposed to content learning should be evenly distributed and shared by all content specialists (not only EAL) (Creese, 2010; Edwards, 2014; Hammond 2012; Haworth, 2009; Nguyen & Dang, 2021).
- *But…*Many subject teachers not prepared for supporting language learning, or how to work with EAL specialists (e.g., Gleeson, 2015; Love, Macken-Horarik, & Horarik, 2015; Schall-Leckrone, 2017).
- *Yet…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" (AITSL, n.d.).
- Little is known about what pedagogical practices teachers across the curriculum perceive as being important, and use, in developing EAL students' vocabulary.

Research question

How do the perceptions of and practices of the EAL and science teachers align with the language principles of linguistically responsive instruction related to word knowledge?

Research framework

- ***Linguistically responsive instruction (LRI) :*** pedagogical practices that enhance learning for second-language learners and attend to the importance of diversity and multilingualism (de Jong & Harper, 2005; de Jong et al., 2013; Lucas et al., 2008)

- ***Vocabulary learning***: Beck, McKeown, and Kucan's (2013) concept of three tiers of vocabulary (Tier 1 - everyday, familiar words; Tier 2 - high frequency words encountered in school, that have a range of meanings; Tier 3 - low frequency words, specific to particular content areas).

Examples of content specific language in Science

Content specific vocabulary	Linguistic specific (verbs of instruction)	Language for interaction	Language for clarification
test tube, test tube rack, 10ml measuring cylinder, heat proof mat, rubber hose, matches, wooden tongs	place, measure, pour, set up, hold, point…away, open, move and return	“first you…”, “then…”, “ok now you have to…”.	“sorry, can you repeat that?” or “what was the step again?”

Learning science and language (chemistry)

- Language of science represents a significant barrier to engagement and development of understanding, especially with increased student diversity (Rees, Kind & Newton, 2018)
- Challenges of subject specific vocabulary – specific technical terms, everyday words used in a scientific context, or words with multiple meanings (e.g. salt) (Wellington & Osborne, 2001).
- Specialised language and patterns of use are further complicated for EAL students, in particular chemistry, as these involve graphical and symbolic language (Rees, Kind & Newton, 2018);
- EAL learners learn best when exposed to science concepts in everyday language before being introduced to the scientific terms (Brown & Ryoo, 2008)

“In contrast with foreign language instruction, where students are learning new ways to express familiar ideas, science instruction often involves the presentation of new ideas expressed through language.”

(Brown & Ryoo, 2008, p. 532)

Learning science and language

- 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.).

- “They use appropriate language and representations to communicate science ideas, methods and findings in a range of text types.” (*Australian Curriculum F-10:Science, ACARA, v8.4)*

- Teachers typically not prepared to pay attention to language demands of their subject areas (apart from language teachers).

Research site

- Secondary school in Melbourne
- Offer an extensive EAL program
- Whole school approach to three tiers of vocabulary
- Participants: EAL Teacher (also EAL co-ordinator) & Yr 7 science teacher
- Yr 7 class, included 4 EAL students (C1)
- Collaboration mostly informal and ‘on the fly’

Data Collection

Interviews:

- 2 individual interviews (EAL teacher)
- 2 group interviews (science & EAL teacher)
- Focus:
  - 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.

Video recordings of lessons:

- 2 face-to-face lessons at the beginning of a chemistry unit of work and
- 3 online lessons in the middle of the unit
- Purpose: to observe the teacher's practice in introducing the topic and concepts in chemistry.

Analysis

Interviews and lesson recordings were analysed to identify:

- Teachers' perceptions and practices in five LRI principles within the area of developing EAL students' word knowledge:
  1) understanding the distinction between conversational and academic language,
  2) applying principles of language learning and attending to both language forms and meaning with specific reference to vocabulary knowledge,
  3) responsive teacher talk,
  4) establishing a place for L1 use (plurilingual awareness), &
  5) giving attention to social interaction.
- Teacher confidence and knowledge about these LRI principles.

Example: Principles 1 & 2

T: … the label I'm looking for is about the centre of the *(circle gesture with hands)* atom. Rather than calling it the centre or the middle there's a science word that we need to use. *(casts her eyes over the class)* Jack?

S: Is it like the core?

T: Oh you're so close. Sometimes it's referred to as the core. If you look it up on the internet they might use that word sometimes. The word we use starts with N and it's not neutron *(writes N on the board, Tim raises hand)*. Tim?

S: Is it nucleus?

T: The nucleus, well done. The nucleus. So that's how you say it. Nucleus. *(writes on board)*

(1) understanding the distinction between conversational and academic language,
(2) applying principles of language learning and attending to both language forms and meaning with specific reference to vocabulary knowledge.

T: … the label I'm looking for is about the centre of the *(circle gesture with hands)* atom. Rather than calling it the **centre** *(emphasis)* or the middle, there's a science word that we need to use. *(casts her eyes over the class)* Jack?

S: Is it like the core?

T: Oh you're so close. Sometimes it's referred to as the core. If you look it up on the internet they might use that word sometimes. The word we use starts with N, and it's not neutron *(writes N on the board, Tim raises hand)*. Tim?

S: Is it nucleus?

T: The nucleus, well done. The nucleus. So that's how you say it. Nucleus. *(writes on board)*

(1) understanding the distinction between conversational and academic language,
(2) applying principles of language learning and attending to both language forms and meaning with specific reference to vocabulary knowledge.

Language learning & science

- Teacher discriminates between ‘science words’ (“there’s a science word”) and everyday words (“centre”, “middle”) & aims to replace everyday words with science word (although ‘nucleus’ is used in different science domains: chemistry, biology, astronomy)
- Teacher does not discriminate between different levels – macro, micro, symbolic (associates terms with everyday ideas).
- Teacher mentions later that science words are “difficult” – an intention to support students, but potentially restricts their involvement and creates the association of science with difficulty and as potentially being out of reach.
- How to balance use of everyday language and creating confusion in use of terms to describe chemistry?

Example Principle 3: Responsive teacher talk

"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."

(Science Teacher, Interview 4)

Example Principle 4: Establishing a place for L1 use

"So … 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 vocabulary, the new language, and then bringing it into an English kind of forum if you like."

(EAL teacher, Interview 1)

- Both teachers expressed a lack of confidence in using L1 as a strategy, e.g., How much L1? When to use it?

Example Principle 5: Understanding the importance of peer social interaction

"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."

(Science teacher, Interview 4)

Teacher confidence and knowledge

- Both EAL and science teacher used some LRI principles to inform their vocabulary teaching.
- Science teacher expressed a lack of familiarity with the Victorian Curriculum F-10: EAL, also unaware that strategies she used aligned with LRI principles.
- Both teachers unsure about adopting plurilingual strategies (use of L1 in classroom).
- Shift to online learning led to a more transmissive, teacher-centered approach to teaching vocabulary as opposed to an interactive collaborative approach.
- Few opportunities for formal, collaborative planning, limited development of teacher knowledge and confidence.

Recommendations

- All disciplines need to include a focus on language so that it is not just relevant to the English curriculum.
- EAL teachers need to meet regularly (even if briefly) with content teachers and plan lessons jointly in order to achieve a more language informed pedagogy that connects with content teacher expertise, and increase familiarity with EAL curriculum.
- Shift to online learning provides opportunities to consider how this space may be productively used to support EAL learning, bringing together language, content, technology and pedagogy.
- All teachers need to learn about the pivotal role of language in their discipline's curriculum through targeted PD or accessible resources.
- Schools need to 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".

Dr Anna Filipi
A/Prof. in TESOL & Applied Linguistics
Faculty of Education, Monash University

Prof Amanda Berry
Professor of STEM Education
Faculty of Education, Monash University

Thank you

minh.hue.nguyen@monash.edu

MONASH University

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Notes