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CAMBRIDGE Mathematics

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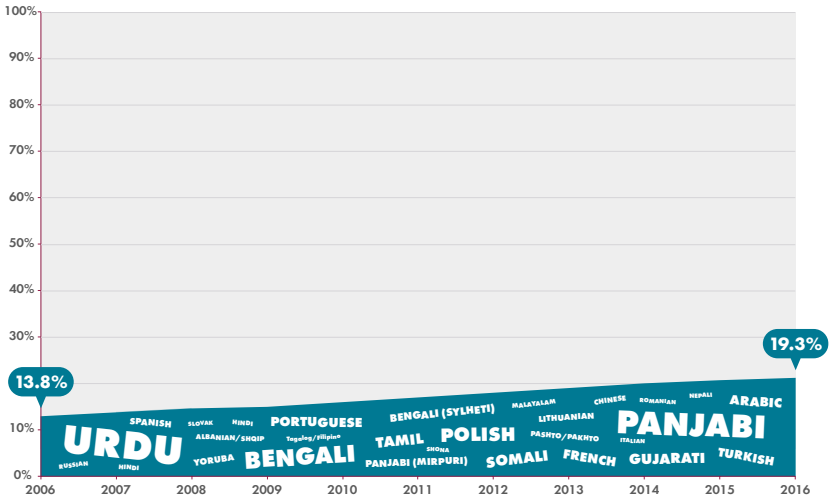
TALKING POINT:

WHAT DOES RESEARCH TELL US ABOUT SUPPORTING EAL STUDENTS IN MATHEMATICS CLASSROOMS?

IN SUMMARY

- Institutions recognising the heterogeneity of EAL learners will understand the impact this may have on their needs
- Language development in mathematics may take several years to develop from proficiency in conversational English
- EAL students may have difficulties with word problems at text, sentence and word level, symbols representing multiple concepts, and mathematical terms with meanings different from their everyday use
- Measuring and assessing EAL students' mathematical ability may be confounded by their ability to speak, read and understand the language in which the mathematics is presented
- Assessments that avoid culture-specific language and minimise complex details that are irrelevant to questions test knowledge of mathematics, rather than informal language
- EAL students in maths may benefit from: glossaries and diagrams; consistent vocabulary when introducing new concepts; focus on their mathematical practices rather than inaccuracies in words
- It is suggested that teachers consider students' home and informal language as assets in moving towards more formal mathematical language

Proportion of students in state-funded schools in England exposed to a language other than English over time, and what the most frequent of those languages were in 2012



1

Students can be considered as having English as an additional language (EAL) if they speak a language other than English at home. This includes British citizens who speak another language at home, migrants and refugees[1]. The proportion of EAL students in England has steadily increased over the last decade[2]. EAL students are extremely heterogeneous, having different language proficiency, first language, life and/or educational experiences[1] (see infographic). Research suggests that mathematical language proficiency may not develop until later school years[3] and that even when EAL learners appear to have mastered conversational English, they may need several more years to achieve native-like proficiency in mathematical English[4].

IMPLICATIONS: Teachers and school leaders who recognise the differences between EAL students will understand what effects these might have on learners' needs

EAL students may appear to have mastered the use of English before they achieve native-like use of mathematical language; teachers should be mindful of the difference between conversational and subject-specific language proficiency

'...despite widespread agreement that language is crucial to mathematical achievement, mathematics textbooks and curricula do not make the language demands of their tasks evident to mathematics teachers'

Lucero, 2012, as cited in Adoniou & Qing, 2014

'Fluency in interpersonal conversation does not equate to fluency in concepts and the discipline-specific language of mathematics'

Galvan Carlan, n. d. as cited in Adoniou & Qing, 2014

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Mathematical word problems can pose a range of difficulties for EAL students[5]. At text level, they are often placed in real-life contexts which may be a distraction for students who may have issues in drawing out mathematical information. At sentence level, the meaning is often embedded within symbols, which can represent several complex words[6]: for example the *greater than or equal to* symbol (≥) simultaneously communicates the idea of relative numerical value and equality[6]. Mathematical words can be context-specific: for example 'positive' and 'negative' may refer to integers, but in science they can refer to electrical charges and in history to attitudes[6]. They may also hold meanings that differ from everyday use, for example *odd number* may be assumed to be a synonym for unusual or incorrect[6]. EAL learners may find it challenging to learn the English language and mathematical language simultaneously and to move between informal and formal language[7].

IMPLICATIONS: EAL learners may find the shift from conversational to mathematical language more difficult than native speakers and may require more time to develop mathematical language proficiency compared to peers

EAL students may have difficulties with word problems at text, sentence and word level, symbols representing multiple concepts and mathematical terms with meanings different from their everyday uses

3

Measuring students' mathematical knowledge is difficult when confounded by their ability to speak, read and understand the language in which the mathematics is presented[7]. Word problems present EAL students with additional cognitive demands as they spend time processing the syntax, semantics and vocabulary, as well as context, to get to the mathematics[7,8]. Research has found that EAL students perform worse on mathematics word problems written with dense, complex sentences compared with those written in simpler sentences[9].

IMPLICATIONS: Measuring and assessing EAL students' mathematical ability may be confounded by their ability to speak, read and understand the language in which the mathematics is presented

Complex sentences and contexts may impair students' ability to unpick and comprehend assessment items irrespective of their mathematical 'ability'

Assessments that aim only to test students' knowledge of mathematics should avoid culture-specific language and minimise complex details that are irrelevant to questions

4

Teachers who focus on EAL students' mathematical practices (reasoning, justifying) rather than inaccuracies in vocabulary notice when students make connections, encourage learners to explain their reasoning and allow them to use different resources (symbols, languages or registers) to show mathematical thinking[10]. Probing students' thinking and developing formal language is more effective when teachers know the extent of students' informal language use[10] and see home language and everyday language as resources when explaining mathematical concepts[11]. It may be useful to keep language simple and consistent during early learning of new concepts, and to build a class glossary of definitions and accompanying diagrams[5] or to encourage students to keep bilingual glossaries with mathematical phrases[12]. Creating diagrams to represent word problems has been shown to support EAL students in problem solving[8]. Collaboration with other EAL students and learners with good language skills and mathematical knowledge can help EAL students clarify and share their own ideas, deepen reasoning and consider alternative ways of thinking and problem solving[10].

IMPLICATIONS: EAL students may benefit from bilingual glossaries of key terms and definitions accompanied by student-drawn diagrams

When introducing concepts, it is important to keep language as simple and consistent as possible initially and use new phrases once students are confident

It is important to view students' home and everyday languages as assets in building their formal language skills

It is beneficial to encourage EAL learners to express their own ideas and deepen their own reasoning by collaborating with other learners with a range of language proficiency skills

Dominika Majewska, 2019

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