The potential influence of word structure and vocabulary knowledge on understanding science texts by linguistically diverse adolescents

What this research was about and why it is important
Although much research has focused on reading comprehension in content areas, there is a need to understand how specialized language skills are important for supporting adolescent learners’ comprehension in particular disciplines. This is the case in the discipline of science, a linguistically and cognitively demanding subject area. Working with linguistically diverse adolescents aged between 12 and 14 years old, we examined contributions of domain-general (morphosyntactic) and domain-specific (science vocabulary) language skills needed for reading in science. Our findings provide evidence that domain-specific vocabulary is essential for reading comprehension in middle school science. Morphosyntactic awareness also contributed to reading comprehension in science, but did so through science vocabulary knowledge by providing additional cues to word meanings. English learner (EL) status also showed an effect on reading comprehension in science, but this effect was fully mediated by linguistic knowledge.

What the researchers did
- We used statistical modeling techniques to analyze data collected at the end of a 10-week physical sciences unit. We explored contributions to science reading comprehension of two sets of language skills, namely:
  1) Domain-general morphosyntactic skills, operationalized as knowledge of derivational morphology (focusing on derivational suffixes such as ‘-ize,’ ‘-ance’) and knowledge of connectives (such as ‘therefore,’ ‘because’); and
  2) Domain-specific skills, operationalized as depth and breadth of science vocabulary knowledge (such as ‘exothermic,’ ‘solubility’) and measured, respectively, by picture- and definition-match tasks.
- Participants were 241 Grade 8 students with an average age of 12. Of them, 64 were emergent English speakers (currently designated ELs). Proficient English speakers included 31 monolingual English speakers and 118 English learners who tested out of language support services (formerly designated ELs; more details in the full article).
- We used statistical modeling to investigate three types of effects: 1) direct effects, one variable’s direct impacts on another; 2) indirect effects, one variable’s indirect impacts on another via a third “intervening” variable; and 3) mediated effects, the effects of the third, “intervening,” variable on the relationship between two variables of interest.

What the researchers found
- Domain-specific vocabulary knowledge in science emerged as the strongest (and the only direct) predictor of science reading comprehension. This finding is consistent with the knowledge hypothesis, which holds that vocabulary relates to reading comprehension, as networks of word knowledge indicate prior disciplinary understanding (Nagy, 2005).
- Domain-specific morphosyntactic skills in science 1) also contributed to reading comprehension in science, but did so only indirectly, through domain-specific science vocabulary knowledge; and 2) emerged as the strongest predictor of science vocabulary knowledge. This finding is partially consistent with the aptitude hypothesis, which holds that the relationship between word knowledge and comprehension is explained by metalinguistic awareness, which influences both vocabulary and comprehension (Nagy, 2005).
- Combined, domain-specific vocabulary knowledge and morphosyntactic skills fully mediated the EL status effect.

Things to consider
- For all students, challenges associated with academic language may relate to differences in texts across subject areas, as the forms and functions of academic language reflect ways of knowing, thinking and providing evidence that are discipline-specific ( Shanahan & Shanahan, 2012).
- From a theoretical perspective, this study contributes to a limited body of work focusing on contributions of specialized language needed for science reading comprehension.
- From a practical perspective, this study provides empirical support for targeted science vocabulary, connectives, and morphology instruction to support student comprehension of science texts.
- From a measurement perspective, the substantially larger vocabulary effect than that reported in other science reading comprehension studies suggests that science vocabulary knowledge may be better captured by measures that are purely domain-specific (physical sciences vocabulary in our study), gauged by both depth and breadth dimensions of vocabulary knowledge, rather than by measures combining general academic and science-specific words.

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