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Science-specific technical vocabulary in science fiction-fantasy texts: A case for ‘language through literature’

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ABSTRACT

This study investigated the lexical coverage and frequency of occurrence of 318 common science-specific technical word families in a corpus of science fiction-fantasy texts in order to determine the potential for science fiction-fantasy literature to be a resource for incidental technical vocabulary acquisition. Coverage of the word list in the science fiction-fantasy corpus was found to be 0.50%, which was 46% higher than coverage of the same list in a corpus of fiction texts (0.27%), and 70% lower than coverage of the same list in a corpus of academic science journals (1.68%). These findings suggest that, in terms of exposure to technical vocabulary, science fiction-fantasy could serve as a bridge resource for second-language learners studying or prespecializing in the Sciences. A frequency analysis revealed that the highest potential for lexical learning occurs at the 500,000-word reading level, at which 21% of science words occurred 10+ times and 83% occurred 1+ times. Potential lexical gains, as well as both practical and theoretical implications, are discussed.

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1. Introduction

Acquiring English as a second or foreign language for the purposes of pursuing a career in the Sciences is a daunting task. Much of this has to do with the learning burden associated with comprehending lexically demanding discipline-specific texts, which have high densities of technical vocabulary—that is, mid- to low-frequency words particular to a specific subject. Given the resultant high lexical threshold necessary for comprehension, a mastery of a sizeable vocabulary beyond high-frequency and academic words is necessary. Intentional learning, essential for acquiring a large vocabulary, is key for such an undertaking; however, because there are limits to how much vocabulary can be taught explicitly in the classroom, incidental learning through extensive reading outside the classroom is an invaluable supplementary aid to vocabulary learning (Nagy & Herman, 1987; Schmitt, 2008).

Literary texts in particular are ideal resources, as they offer a wealth of potentially comprehensible input and can be accessed relatively easily. Nevertheless, in many second- and foreign-language classrooms, where “learning is fundamentally an exercise with utilitarian (i.e., career) goals” (Shanahan, 1997: 165), literary texts are considered irrelevant, carrying instead a ‘humanist agenda’ that fails to prepare second-language (L2) learners for the academic and professional careers ahead of them (Horowitz, 1990). In short, some of the primary doubts surrounding the efficacy of learning language through

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literature seem to be rooted in notions of insufficient learner payoff. Proponents maintain, however, that learner payoff includes greater learner autonomy; enhanced critical thinking and interpretive skills; more communicative confidence; greater language, text, and cultural awareness; more learner motivation and interest; and better retention, among other benefits. Moreover, literary materials have been shown to be an important resource in ESL acquisition, retention, and proficiency, offering learners improvement in productive and receptive language skills, as well as the language areas of grammar and vocabulary.¹

Nevertheless, English for Specific Purposes (ESP) in particular has generally rejected literature, due in part to the genre's insufficient coverage of discipline-specific vocabulary. The literary subgenre of science fiction-fantasy (SFF), however, likely comprises higher levels of technical vocabulary relevant to the Sciences than does general fiction, and therefore could serve as a resource for developing language skills in science-related ESP programs (Boiero de Angelo, Jure, Fernandez, & Remondino, 2008; Díaz-Santos, 2000; Hirvela, 1990; Kelly & Krishnan, 1995; Zoreda, 1996, 2002). To date, though, no research has been undertaken to determine quantitatively how well SFF, or any literary subgenre, covers scientific technical vocabulary.

To address the gap in research, this study aims to investigate the extent to which SFF can contribute to L2 scientific literacy by examining the frequency and lexical coverage of science-specific technical vocabulary in SFF texts, as compared to that found in general fiction texts and science texts. In doing so, this research could better inform practitioners and researchers regarding the potential that specific literary genres have as resources for incidental learning of L2 discipline-specific vocabulary.

1.1. Incidental L2 vocabulary acquisition through extensive reading

Incidental vocabulary acquisition occurs when new or partially known words are acquired through untargeted exposure to input (Huckin & Coady, 1999). Research into adult L2 incidental vocabulary acquisition suggests that this is particularly so when the input is written as opposed to spoken (Brown, Waring, & Donkaewbua, 2008; Vidal, 2011), and when the input is wide ranging and sizeable (Huckin & Coady, 1999; Krashen, 1985). Extensive reading, or reading widely for pleasure and meaning with some component of accountability (Krashen, 2003), meets both of these conditions, making it ideal for incidental vocabulary learning. Indeed, over the past several decades, numerous researchers have recognized the positive effects it can have on vocabulary acquisition, retention, and usage in both the L1 (Nagy & Herman, 1987; Nagy, Herman, & Anderson, 1985) and the L2 (Brown et al., 2008; Day, Omura, & Hiramatsu, 1991; Horst, Cobb, & Meara, 1998; Huckin & Coady, 1999; Pellicer-Sánchez & Schmitt, 2010; Pigada & Schmitt, 2006; Pitts, White, & Krashen, 1989; Saragi, Nation, & Meister, 1978; Waring & Nation, 2004).

1.1.1. What kind of input is required for incidental learning to occur?

One key to incidental vocabulary acquisition through extensive reading is that L2 learners be exposed to texts that are appropriate to the learners (Waring & Nation, 2004). According to Krashen (1985), this includes texts that are slightly more difficult than the learner's comprehension level. This concept, which underlies his Input Hypothesis (IH), is represented as 'i+1,' where 'i' is the learner's current level of competence, and '+1' is the next level of language acquisition. Krashen argues that as long as there is sufficient comprehensible input, i+1 exists for all L2 learners in much the same way i+1 exists for young children learning their native language through caretaker input. That is, even though the input is not finely tuned to a learner's competence level, instead comprising utterances both more and less advanced, L2 learners can select aspects of the input that are relevant to their particular level, in much the same way children do (Krashen, 2013). Several studies carried out in ESL contexts have investigated the hypothesis using fiction texts as the input, with results indicating development of new and partially learned vocabulary (Cho & Krashen, 1994; Constantino, 1995; Kim, 2006; Lao & Krashen, 2000; Renandya, Rajan, & Jacobs, 1999).

For incidental learning to occur when the input is written, it is thought that an L2 learner must know approximately 98% of the running words in a given text, the equivalent of roughly one unknown word in fifty (Hirsh & Nation, 1992; Hu & Nation, 2000; Nation, 2006; Schmitt, Jiang, & Grabe, 2011), and that otherwise, learners are less likely to be able to guess new vocabulary from context (Waring & Takaki, 2003). While this equates to a required vocabulary size of between 8,000 and 9,000 word families for general fiction texts (Nation, 2006), the threshold increases significantly in academic texts (Waring & Nation, 2004). Hazenberg and Hulstijn (1996), for example, established in their study of Dutch college students reading first-year university materials that to understand just 95% of an academic text, knowledge of approximately 11,000 word families (including proper nouns) is likely necessary. This suggests that reaching the 98% lexical coverage threshold required for incidental learning to occur in post-secondary academic texts likely requires knowledge of well over 11,000 word families. Indeed, Coxhead, Stevens, and Tinkle (2010) found that reaching 98% coverage in high-school science textbooks alone could require learners to know between 11,000 and 20,000 words (plus proper nouns).

The higher lexical threshold necessary for understanding specialized texts is partly due to the larger proportion of technical vocabulary, which Nation (2016) defines as words or phrases that are closely related to a particular subject, field, or

¹ These and other merits are discussed at varying lengths in Bredella and Delanoy (1996), Lazar (1990, 1996), McKay (1982), Mishan (2005), and Widdowson (1984). See also Paran (2008), who provides an extensive survey of existing research and evidence that supports the benefits offered by incorporating literature in the ESL classroom.

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