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## **Reading Speed and Reading Comprehension in an English-Medium Instruction Context**

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### **Abstract**

The undeniable importance of reading in higher education prompted this investigation into the reading skills of a group often overlooked in previous research: master's level students studying in English-medium instruction (EMI) environments. Participants (148 master's-level students of engineering) completed the Nelson-Denny Reading Test (Form G), a test of reading speed and reading comprehension. The results indicate that, at group level, these students attained levels of comprehension and rates of (silent) reading which are broadly comparable to those found for second-language users of English in better researched settings. However, a great deal of individual variation was observed, suggesting that some students may find it challenging to read for study purposes. The implications of these findings for various stakeholder groups in EMI are discussed.

**Keywords:** reading speed, reading comprehension, English-medium instruction, higher education, reading at university

Reading occupies a central position in higher education, and expectations on students in this regard are high; indeed, the ability to read academic text is often taken for granted by stakeholders in academia (Bahrtutram & Clarence, 2015; Hermida, 2009; Howard et al., 2018). Widely regarded as instrumental for academic success by virtue of its role in enabling students to “acquire and construct knowledge. . . [reading] brings students into discourse within their major . . . enhances composition skills . . . and improves critical thinking” (Howard et al., 2018, p. 190). Academic reading also very clearly presents challenges to students in higher education (Fairbairn & Winch, 2011; Isakson & Isakson, 2017; St. Clair-Thompson et al., 2018), to the extent that many students reportedly avoid academic reading altogether (Gorzycki et al, 2020). Grabe and Stoller (2020, p. 138) highlight the difficulties associated specifically with academic reading, including “heavy reading loads, challenging

texts, and the need to make effective use of textual information for multiple purposes (e.g., writing papers, giving oral presentations, completing projects).”

The drive to internationalize higher education in recent decades has caused increasing numbers of students whose first language is not English to face academic reading tasks in English as they enter tertiary education. For most such students, academic reading in a second or foreign language is likely to present challenges (see Aizawa et al., 2020; Grabe & Stoller, 2020; Tatzl, 2011). One learning context in which the use of English texts is prevalent and insufficient reading ability is frequently flagged as an issue (Shepard & Morrison, 2021) is English-medium instruction (EMI), such as, “the use of the English language to teach academic subjects (other than English itself) in countries or jurisdictions where the first language (L1) of the majority of the population is not English” (Dearden, 2014, p. 2).

In the past 15 years, EMI has become a very prominent feature of internationalized higher education (Agnew & Neghina, 2021), and the need for English reading skills in EMI is widely acknowledged (e.g., Holzknrecht et al., 2022; Kang et al., 2023; Owen et al., 2021). In some contexts of EMI, English is the only language of instruction (and *nominally* the only language of learning), while elsewhere it is used alongside other languages shared by teachers or students (Söderlundh, 2012). However, regardless of how English features as an instructional language in the EMI curriculum, EMI entails students engaging in sustained and extensive reading in English as a second or foreign language. While much concern has been expressed about the academic reading ability of students in EMI, both by students themselves and scholars in EMI, there is still a dearth of research focused on their reading skills, particularly those enrolled at advanced levels of study. Given the importance of better understanding reading skills in the EMI environment, this study explores the reading ability of master's students in an EMI setting, focusing on the speed with which they read and their reading comprehension.

## Background to the Study

### *Reading in EMI Settings*

The existing research on reading in English-medium instruction (EMI) settings is typically framed in a discourse of student challenges, and this is hardly surprising in view of the many known difficulties associated with academic reading in a second language (L2), including “limited reading...proficiency, the challenge of reading long passages, a lack of fluency in reading...limited L2 background knowledge...inferencing” (Grabe & Zhang, 2013, pp. 10–11). The majority of EMI research on reading is based on students’ self-reported challenges around academic reading in English, although a few studies have tested reading ability.

In many EMI contexts, students identify reading in English as a key challenge. For example, when Evans and Morrison (2011) surveyed 3,000 students in Hong Kong and asked them to self-assess their language skills relating to listening, speaking, reading and writing, students reported being challenged the most by writing, closely followed by reading. This finding was recently confirmed in a follow-up study surveying over 600 students carried out by Shepard and Morrison (2021), in which writing in English was again identified as presenting the most significant challenge to the students, followed by reading. The four most challenging aspects of reading were (a) understanding specific vocabulary, (b) working out the meaning of difficult words, (c) reading quickly to find specific information and (d) reading quickly to get

the overall meaning (p. 179). Thus, dimensions of reading comprehension and reading speed were highlighted as particularly difficult.

These findings from Hong Kong are echoed by recent research from Italy. Guarda (2022) surveyed and interviewed students about the differences between learning through the L1 and EMI, reporting that students needed “extra energy and time...to try to decode meanings and ensure understanding in English [which] had the effect of slowing down the entire learning process and of increasing their workload” (2022, p. 96).

Similar reports regarding tertiary students’ English reading skills have come from Scandinavia. Pecorari et al. (2011) surveyed over 1,000 students, the majority of which reported that, compared to reading in their L1, reading in English required more effort, took substantially longer, and resulted in them understanding less of the content. More recently, Eriksson (2023) investigated Swedish students’ perceived reading challenges following the transition from upper-secondary school to tertiary education. Based on questionnaire responses from 206 first-year university students across various social science subjects, Eriksson reported that approximately one third felt unprepared to engage with the significant amount of English reading facing them, and 41% experienced varying degrees of difficulty when trying to comprehend English texts; 89% reported reading more slowly in English than in Swedish.

Studies testing reading ability in EMI settings largely confirm the picture painted above. A proportion, sometimes substantial, of students are challenged by aspects of academic reading in English. Hellekjaer (2009) asked Norwegian students ( $n = 578$ ) to self-assess their English reading ability and measured their reading comprehension using the International English Language Testing System (IELTS) Academic Reading Module, and established that 74% had varying degrees of difficulties reading in English; unknown words and slow reading rate were flagged up as the key problems.

In a rare contrastive study set in Sweden and Nepal, Owen et al. (2021) investigated reading comprehension among 129 EMI students using a research version of the reading section of the TOEFL iBT. The Nepali sample was homogenous, with all participants being Nepali nationals. By contrast, the Swedish sample was diverse, reflecting the highly internationalized nature of the university, with 25 different nationalities represented. The reading test scores (overall mean as well as sub-test scores assessing basic comprehension, inferencing and reading to learn) of the two samples were significantly different; the students in the Swedish cohort (with an overall mean placing them approximately at the top end of the high-intermediate proficiency range) outperformed the Nepali students (whose scores indicated low-intermediate proficiency) on every measure. While the majority of the students--in both samples--claimed to have few comprehension problems when reading the assigned texts, many students--again in both samples--expressed a (sometimes strong) preference for reading in their L1, with a majority of students saying that they actively look for reading in the L1 to complement the English reading.

Aizawa et al. (2020) adopted the questionnaire developed by Evans and Morrison (2011) and administered it to 264 Japanese business students studying through the medium of English. When the students’ survey responses (where reading and speaking were considered most challenging) were correlated with scores on an English proficiency test (the Test of English for International Communication, TOEIC, which includes a reading component), a linear relationship was established between perceived challenges and proficiency such that

“increases in proficiency result in increases in ease of learning [but] there appears to be no discernible threshold at which students have ‘enough’ proficiency to mitigate challenges completely” (2020, p. 855). These findings were subsequently confirmed in a study of similar design (adopting the EMI challenge questionnaire and an English proficiency test) in a Turkish EMI context (Soruç et al., 2021). Thus, there is evidence that linguistically stronger students in EMI are less likely to be challenged by the academic reading assigned to them; however, none – not even the more proficient ones – are entirely immune to language challenges, and the less English proficient students (of which there are many) are likely to be more challenged, for example, in terms of academic reading.

Based on the research reviewed here it is easy to assume that all students learning through English, whether in partial or full EMI, are struggling readers; that is not the case, as evidenced by a series of studies (e.g., McMillion & Shaw, 2016; Shaw & McMillion, 2018). Comprehension and speed of reading tests were administered to first-year university students of biology, 114 in Sweden, with strong skills in L2 English, and 54 in the UK, with English as L1. Many of the Swedish students had reading comprehension scores comparable to those of the UK-based students; however, they generally needed more time to finish the same amount of reading material. Critically, there was greater variability in scores among the Swedish students compared to their counterparts from the UK. For example, while all but one of the UK-based students scored more than half of the points on the comprehension test, fewer than 60% of the students in Sweden did so.

Recent research conducted by Holzknrecht et al. (2022) also suggests a degree of variation. They administered the Aptis Reading Test (O’Sullivan et al., 2020) to three groups of undergraduate and postgraduate students in EMI settings in Egypt, Lithuania and Austria, and used the Lexile Framework for Reading to investigate the “lexical difficulty” of certain key texts which the students were expected to read. At group level the students in all three contexts read at an appropriate level of difficulty, matching their reading comprehension, which was said to be approximately at B2 level on the Common European Framework of Reference (CEFR) (Council of Europe, 2001) for the Egyptian and Lithuanian students and C1 level for the Austrian students. Within and across the cohorts, however, there was substantial variation, meaning that “a considerable number of students would not be able to fully understand many texts, while other students would easily understand even the most complex texts” (Holzknrecht et al, 2022, p. 191).

### *Reading Rate and Reading Comprehension amongst University Students*

The conclusions from within EMI research about reading presented here--that reading in L2 English can present a challenge, at least for some students and in some EMI learning contexts--finds support in research concerned more broadly with reading in a second language. Several of the sources cited above reference low reading speed as a particular difficulty for students in EMI as they engage with English texts. In his meta-analysis of reading rate, Brysbaert (2019, p. 19) notes that “reading speed in second-language (L2) speakers is considerably slower than in first-language (L1) speakers. Indeed, reading rates below 100 wpm are not uncommon.” For context, the figure provided by Brysbaert can be compared to the average silent reading rate for English L1 speakers reported as a result of his meta-analysis: 238 words per minute (wpm) for non-fiction texts.

Few studies measuring reading speed in English L2 speakers are fully comparable, but a small number of studies offer indicative benchmark values. Hirai (1999) investigated the

reading (and listening) ability of 56 Japanese undergraduates in economics, English, and engineering (with different levels of English proficiency); they students read non-academic prose passages at a rate of 139 wpm. When Dirix et al. (2020) studied 80 first-year undergraduate Dutch students of psychology and education, they recorded reading rates of 174 wpm in English (compared to 189 wpm in Dutch) for two expository non-academic texts and two scientific articles (unfortunately the analysis did not differentiate between text types). Unsurprisingly, but highly relevant for understanding the specific complexities of reading academic texts, the reading rate for studying (as opposed to reading for interest)--defined as “memorizing factual information to pass a subsequent recognition test” (p. 371)--was substantially lower, a mere 50 wpm when reading in L2 English. Some studies have tested reading speed as part of an intervention. Tran and Nation (2014) found that their Vietnamese participants read English texts at a mean rate of 117.83 wpm pre-intervention, while in Saudia Arabia, Alarfaj & Alshumaimeri (2012) found a rate of 150.83 wpm.

Other studies have looked at interactions between reading rate and other aspects of reading. Shaw and McMillion (2018) examined the relationship between reading speed and reading comprehension in a group of Swedish postgraduates, and found a mean reading rate in English of 207 wpm. Siegleman et al.'s (2023) large-scale (over 7,000 participants) study of English reading speed, comprehension, and factors underpinning reading performance found some differences between L1 and L2 users of English, while concluding that L1 and L2 reading do not always exhibit differences as striking as may be expected. Table 1 provides an overview of studies providing relevant points of comparison.

Table 1. *Overview of studies of L2 English university students' reading rates*

| Study                         | Population  | English L2 reading rate (full sample mean) (wpm) |
|-------------------------------|---|--|
| Hirai (1999)                  | Japanese undergraduate students<br>( <i>n</i> = 56)                               | 139 wpm  |
| Alarfaj & Alshumaimeri (2012) | Saudi foundation-year students<br>( <i>n</i> = 29)                                | 151 <sup>b</sup>                                 |
| Tran and Nation (2014)        | Vietnamese undergraduate students ( <i>n</i> = 116)                               | 118 wpm <sup>a</sup>                             |
| Shaw and McMillion (2018)     | Swedish postgraduate students<br>( <i>n</i> = 84)                                 | 207 wpm  |
| Dirix et al. (2020)           | Dutch undergraduate students<br>( <i>n</i> = 80)                                  | 174 wpm (casual reading)<br>50 wpm (studying)    |
| Siegleman et al. (2023)       | Varying countries and levels of university study ( <i>n</i> = 3,256) <sup>b</sup> | 207 wpm  |

Note. <sup>a</sup>Prior to the intervention; <sup>b</sup>Based on the available scores for L2 users of English in Siegelman et al.'s (2023) open-source data.

Reading comprehension difficulties are also a widely recognized challenge among users of English as a second language. Many studies of reading comprehension have made use of the Nelson-Denny Reading Test (NDRT) (Brown et al., 1993). Its advantages include the fact that it was designed to be used by both secondary and tertiary students and therefore is less susceptible to floor and ceiling effects. We are not aware of any study with a specific focus on EMI using the NDRT, but the test has commonly been used to measure reading comprehension in second or foreign language users of English in other higher education contexts. As Table 2 shows, mean scores on the NDRT in earlier studies involving L2 English university students which can serve as a relevant reference point range from approximately 19 points (53%) to 30 points (79%). According to the NDRT developers

(Brown et al., 1993), American university students average scores between 24.25 in their first year and 29.53 in their fourth year. By comparison, the students in the L2 English studies cited here read at different levels of sophistication, from a level corresponding to American ninth graders (Nassaji & Geva, 1999) to levels comparable to American university students (Akkakoson, 2013; Henriksen et al., 2004).

Table 2. *Reference scores for L2 English university students on the NDRT*

| Study                     | Population   | Full sample mean NDRT comprehension score (%) | Full sample mean NDRT reading speed |
|---------------------------|--|---|-------------------------------------|
| Nassaji and Geva (1999)   | Iranian postgraduates<br>( <i>n</i> = 60)              | 19.15 (53.19%)                                | 179 wpm                             |
| Henriksen et al. (2004)   | Danish undergraduates <sup>b</sup><br>( <i>n</i> = 30) | 29.20 (76.84%)                                | not available                       |
| Mežek (2013)              | Swedish undergraduates<br>( <i>n</i> = 34)             | 22.21 (58.45%)                                | 188 wpm                             |
| Akkakoson (2013)          | Thai undergraduates <sup>b</sup><br>( <i>n</i> = 164)  | 29.56 (77.80%) <sup>a</sup>                   | not available                       |
| McMillion and Shaw (2016) | Swedish undergraduate students<br>( <i>n</i> = 114)    | 21.40 (56.31%)                                | 183 wpm                             |
| Shaw and McMillion (2018) | Swedish selected informants<br>( <i>n</i> = 84)        | 27.39 (72.08%)                                | not available                       |

Note. <sup>a</sup>pre-intervention scores; <sup>b</sup>allowed extra time

### *The Setting for the Present Study*

Some aspects of EMI are constant across the globe; for example, a relative lack of attention to language, compared with multilingual pedagogies such as immersion, or the fact that most participants in EMI settings have other L1s than English (Pecorari & Malmström, 2018). Other important factors which play into the outcomes of EMI are specific to given settings. This section therefore presents some key aspects of EMI in Sweden, where this study is set.

EMI has been a key tool in Sweden's aggressive approach to internationalising higher education and, consequently, the vast majority of master's-level programmes in Sweden are taught through the medium of English (Malmström & Pecorari, 2022)<sup>1</sup>, making them accessible and attractive to international students. In 2022-2023, 40% of students enrolled on master's programmes in Sweden were international students, coming from 113 different countries, with the largest groups from India, China and Germany (Swedish Higher Education Authority, 2023). The presence of international students makes master's-level education a richly multilingual space, an effect enhanced by the fact that 20% of Sweden's population was born outside the country (Statistics Sweden, 2023). Thus, many of the 60% of master's students classed as local students will have come from homes in which a language other than Swedish was spoken.

As part of the admissions process, all university students must satisfy some form of requirement for English language proficiency. For international students, the ordinary mechanism is a score on an internationally recognized test of English equivalent to a B2 level on the CEFR. For local students, the requirement is to have successfully completed English

instruction in school from at least the age of seven, when the national curriculum first requires it (some schools offer it earlier still) through the penultimate year of upper secondary school (some students choose to continue for another year). Attainment of this minimum level is intended to equate with a CEFR B2 level in English (Skolverket, 2022).

Several aspects of these arrangements for demonstrating English proficiency merit note. First, demonstrated English proficiency is required for all university admissions, regardless of the medium of instruction. An across-the-board English requirement is needed because English is so widely used in Swedish higher education that students inevitably encounter it, for example, in reading assignments, even when the formal language of instruction is Swedish (Eriksson, 2023). In other words, all students must demonstrate the same minimum level of proficiency in English, regardless of how much or little English is used in their education.

Second, these arrangements deliver greatly varied English proficiency; some students surpass the minimum CEFR B2 level and are at C1 or even C2, so that the student body spans fully half of the range of proficiencies represented on the CEFR scale, and in practice it is possible that not all students fully attain the B2 level. For example, an overall IELTS score of 6.5, which equates with the high end of B2 proficiency, could include a sub-score as low as 5.5, which falls at the boundary with B1. Such a student may not be able to bring B2 proficiency to a given task, such as reading a textbook.

A third relevant factor is that English proficiency is exclusively a qualifying criterion in the admissions process, and virtually never a selection criterion. In other words, beyond determining whether students satisfies the minimum standard, the admissions process does not further consider students' English language skills; an applicant at B2 level with strong grades would be admitted in preference to an applicant at C2 level with lower grades.

Taken together, these factors make the Swedish master's-level classroom a highly linguistically diverse ecosystem. Many students have a first language which is neither English nor Swedish. A small number are L1 users of English. Of the remainder, some have English proficiency at C2 level, while for others it may range down to B2 or, in some cases and for some purposes, slightly lower. On each module, these very diverse individuals come together and listen to the same lectures, receive the same reading assignments, and complete the same assessment tasks, through the medium of English.

### *The Objectives of this Study*

Given the structural factors which allow great diversity in students' linguistic preparedness for EMI, the aim of this study is to map out the reality on the ground and provide a snapshot of students' language skills in an EMI setting. Because of a dearth of EMI research into the key skill of reading, that is the focus of our study. Similarly, because existing research has prioritized undergraduate students and tended to neglect postgraduates (where, in Sweden, most programmes are English-medium) (Malmström & Pecorari, 2022) this study examines the reading skills of master's students. The specific research questions (RQs) which guided this investigation were:

1. What is the rate of reading among master's student's in Swedish English-medium instruction (EMI) programmes?
2. What is the level of reading comprehension among this group of students?
3. What is the relationship between reading rate and comprehension?



## Method and Data

### *Participants*

The data presented here were gathered as part of a larger study into language skills in Swedish higher education. Participants were 148 students enrolled on masters' programmes at a prestigious university of science and technology in Sweden who agreed to complete a test of reading speed and reading comprehension.

As part of the study, students completed a brief background questionnaire, which showed that the 71 males and 31 females (the remainder did not answer that question) had a mean age of 23.3. As a group they were broadly representative of the population of master's students in Sweden, as described above. The largest group—72 students, or 48.6%—came from Sweden, making the proportion of home students somewhat lower than the national average. The remainder came from 19 different countries, with India, China and France supplying the largest numbers. 59 reported that their L1 was Swedish, three of whom had an additional L1. Four reported having English as a first language. The questionnaire asked about the language(s) of instruction used in the participants' undergraduate degrees. As noted above, virtually all university students in Sweden encounter English in some form during their education, and the Swedish participants in this study were no exception. Amongst the international students, ten reported that the whole of their undergraduate education was in English, and ten reported that none of their undergraduate education had been delivered or completed in English. The remainder reported that English was used for some limited purposes, e.g., assigned reading.

### *Materials*

The widely used Nelson-Denny Reading Test, and specifically the comprehension sub-test of Form G of the Nelson-Denny was used for this purpose (the NDRT also provides a vocabulary test, which was not administered in the present study). The test consists of seven short reading passages, each followed by multiple-choice questions (eight questions following the first passage, and five per passage thereafter, for a total of 38).

### *Procedure*

The test was administered during class time to five intact groups. Participation was voluntary but high; although not all registered students were present in the testing sessions, at most one to two students in each session declined to participate. Students were informed of the purpose of the study, the procedures, and implications of participating. The prevailing regulations at the time of data collection did not require ethical review or approval.

Test takers are instructed to read each text, answer each question, and then move on to the next passage, not spending excessive time on any single question. Scoring is binary, with one point for correct answers and no points for incorrect answers, i.e., incorrect answers are not penalised. After the first minute, test takers are asked to mark the line they are currently reading, thus permitting the reading speed, expressed as words read per minute, to be calculated.

### *Data Analysis*

Although reading rate and reading comprehension were measured in different ways, the two interact, because the NDRT is timed. An earlier study of reading amongst Swedish postgraduates found that their reading comprehension could approximate that of L1 users of English “with unrestricted time” (Shaw & McMillion, 2018; p. 162). Given that time was *not* unrestricted in this case, it was possible that in some cases test takers failed to score points either because they did not manage to complete all the reading passages and questions, or because in the effort to complete them, they read more quickly than they would have needed in order to achieve good comprehension. To disambiguate (to the extent possible) reading rate from comprehension, adjusted scores were also calculated. The method for adjusting scores was based on the likelihood that lack of time would have less effect on participants’ scores at the beginning, and more effect as they worked through the test. The adjusted scores were calculated based on answers to the first question through to the last question which each test taker answered correctly; subsequent questions were discounted. For example, if the last point-scoring question for a given participant was question 30, the proportion of correct answers would be calculated from a base of 30 rather than 38.

### **Results**

In this section we report our findings in relation to the RQs regarding reading skills in master's students in Swedish EMI programmes.

#### *RQ1: What is the Reading Rate?*

Our first RQ asked about the rate at which students read, as measured by their progress with the first reading passage after one minute had elapsed. Eleven students either did not follow the instruction to mark the line they were reading when the one-minute interval was called, or did so in a manner which could not clearly be interpreted (e.g., some marked the text in multiple places). One student recorded having finished reading the 601-word text by the end of the minute, and this outlying value was excluded. Amongst the remaining 136 students, the mean reading speed was 174 words per minute (wpm), and the median was 164 wpm, as shown in Table 3.

Therefore, as a group their reading rate was considerably below the means identified for L1 users of English in Brysbaert's (2019) meta-analysis (238 wpm), the NDRT standardisation sample, which was 227.77 wpm (see Brown et al., 1993), and the cohort of Swedish postgraduates studied by Shaw and McMillion (2018), which was 207 wpm. However, the mean score matches that found by Dirix et al. (2020) among Dutch undergraduate students. As the high standard deviation in Table 3 indicates, there was a great deal of variability in the scores, which ranged from 56 wpm to 429 wpm. As Table 4 shows, the variance was 4,004.14.

Table 3. *Descriptive statistics for reading rate scores*

| Statistic          | Value    | Standard Error |
|--------------------|----------|----------------|
| Mean               | 174.98   | 5.426          |
| Median             | 164.00   |                |
| Variance           | 4004.140 |                |
| Standard Deviation | 63.278   |                |

|                     |       |      |
|---------------------|-------|------|
| Minimum             | 56    |      |
| Maximum             | 429   |      |
| Range               | 373   |      |
| Interquartile Range | 70    |      |
| Skewness            | 1.055 | .208 |
| Kurtosis            | 2.036 | .413 |

This variation means that measures of central tendency give only a weak reflection of reading abilities amongst students in this EMI setting. As Table 4 shows, the top decile of students exceeds the mean L1-speaker rate of 238 wpm, and the top quartile approach it. The top 50% reach or at least approach the average reading rate from Dirix et al.'s (2020) study of Dutch L1 speakers. However, the bottom quartile fell well below this rate, and the bottom five percent read at a rate of under 100 wpm.

Table 4. *Reading rate scores by percentile*

|                  | Percentiles |        |        |        |        |        |        |
|------------------|-------------|--------|--------|--------|--------|--------|--------|
|                  | 5           | 10     | 25     | 50     | 75     | 90     | 95     |
| Weighted Average | 84.00       | 103.60 | 137.00 | 164.00 | 207.00 | 251.20 | 299.00 |
| Tukey's Hinges   |             |        | 137.00 | 164.00 | 203.00 |        |        |

### *RQ 2: What is the Level of Reading Comprehension?*

The second research question was about the level of reading comprehension demonstrated by the master's students, as indicated by correct answers to the questions about the reading passages on the NDRT. The mean comprehension score was 29.28, and the median was 30, or 77.1% and 78.9% correct, respectively. Here too, a highly relevant comparison is with Shaw and McMillion's (2018) study using the NDRT. Their L1 English users recorded a mean score of 33.33 points (87.1%), while amongst the L2 English users the mean was 27.39 points (72.1%). Therefore, taken as a group the EMI students in the present study did not reach the comprehension of the L1 students in Shaw and McMillion's (2018) study, but they did achieve scores that are comparable to American university students at approximately the same level of study; the mean score of the upper-division university students in the NDRT standardization sample was 29.54.

There was again considerable variation in the scores, though markedly less so in comparison with reading speed. As Table 5 shows, the standard deviation was 5.92, scores ranged from 11 to 38, and variance was 33.84. In other words, in terms of reading comprehension, this group of students does not present a homogeneous profile. Percentile scores can be seen in Table 6. Fully the top performing quartile exceed the median score achieved by the L1 users of English in Shaw and McMillion's (2018) study, but the bottom decile barely scored half of the available points, and the bottom five percent failed to do so.

Table 5. *Descriptive statistics for reading comprehension scores*

| Statistic          | Value          | Standard Error |
|--------------------|----------------|----------------|
| Mean               | 29.28 (77.05%) | .478           |
| Median             | 30.00 (78.95%) |                |
| Variance           | 33.837         |                |
| Standard Deviation | 5.817          |                |
| Minimum            | 11             |                |
| Maximum            | 38             |                |

|                     |       |      |
|---------------------|-------|------|
| Range               | 27    |      |
| Interquartile Range | 8     |      |
| Skewness            | -.989 | .199 |
| Kurtosis            | .598  | .396 |

Table 6. *Reading comprehension scores by percentile*

|                  | Percentiles |       |       |       |       |       |       |
|------------------|-------------|-------|-------|-------|-------|-------|-------|
|                  | 5           | 10    | 25    | 50    | 75    | 90    | 95    |
| Weighted Average | 16.45       | 20.00 | 26.00 | 30.00 | 34.00 | 35.10 | 36.00 |
| Tukey's Hinges   |             |       | 26.00 | 30.00 | 34.00 |       |       |

### *RQ3: What is the Relationship between Reading Rate and Comprehension*

Particularly on a timed test of reading, a relationship would be expected between the rate at which a text can be read and the extent to which it is understood, and the third RQ sought to understand this. As expected, the results showed such a relationship between reading speed and reading comprehension, with weak correlation identified (Pearson's correlation = .407, two-tailed significance < .001). It is possible that the source of this correlation is simply that the slower readers were also less accurate readers. However, an alternative explanation also exists, that the slower readers ran out of time for accurate reading, and either failed to answer some questions, or *became* less accurate readers when time was running out and they were forced to rush through the reading or answering the questions.

As noted above, to disambiguate these two possible explanations, an adjusted score was also calculated, by discounting all answers following the last correct answer. This meant that the base on which the proportion of correct answers was calculated differed from one participant to another, and of course had the effect of increasing the proportion of correct answers; the adjusted mean was 80.92%, and the adjusted median was 82.61%, as shown in Table 7. Only four of the participants failed to answer at least half of the questions correctly. This suggests that for many, and perhaps most of this group, improved reading comprehension can be obtained with the investment of more time spent reading.

Table 7. *Descriptive statistics for adjusted reading comprehension scores*

| Statistic           | Value   | Standard Error |
|---------------------|---------|----------------|
| Mean                | 80.93%  | .0102          |
| Median              | 82.61%  |                |
| Variance            | .015    |                |
| Standard Deviation  | .124    |                |
| Minimum             | 30.56%  |                |
| Maximum             | 100.00% |                |
| Range               | 69.44%  |                |
| Interquartile Range | 15.69%  |                |
| Skewness            | -1.01   | .19            |
| Kurtosis            | 1.44    | .39            |

## Discussion

This study measured the reading rate and reading comprehension of students in an EMI setting to provide a snapshot of one aspect of language proficiency in this environment. A question which inevitably suggests itself is whether the demonstrated rate and level of accuracy are sufficient to enable engagement in academic reading tasks.

Virtually all the postgraduate participants in this study had reading comprehension scores within the range found for the UK-based first-year undergraduates in Shaw and McMillion's (2018) study, all of whom scored more than half of the available points on the NDRT (i.e., at least 20/38). This comparison with L1 users of English is in many ways problematic, but given the prominent discourse of challenges in the EMI literature, it is also highly relevant. Across geographical contexts, subject areas and levels of education, one concern with EMI is possible risks to students' learning attainments, because of the challenges associated with learning through the medium of an L2 (e.g., Bosch et al., 2023). The findings of the present study do not provide any guarantee that students' reading comprehension provides an adequate foundation for doing the reading required on their courses; however, they do suggest at first glance that students are as well equipped (from the reading perspective) for study in English as English L1 university students in the United Kingdom are.

However, the question of reading speed means that the situation is in fact a bit more complex than it may initially seem. Unsurprisingly, these L2 users of English read more slowly in English than their L1 counterparts, and the gap between the raw scores and the adjusted scores reported above demonstrates that a slower rate of reading affected how much information participants took away from the texts, a finding which reinforces those of Akkakoson (2013) and Henriksen et al. (2004), whose participants were given longer timeframes to complete the NDRT and, consequently, had higher scores than comparable groups which were restricted to the usual time limit. In considering how well prepared these students are for EMI, it is therefore important to consider not just how accurately they can read, but how much they can manage to read accurately.

In one study, university students in English L1 settings estimated spending between eight and 17 hours per week reading for academic purposes (St Clair-Thompson et al., 2018). Taking these self-reported figures at face value, they can be used as the basis for a calculation which, while very tentative, may shed some light on this question. At the median reading rate of 174 wpm found for the participants in this study, in eight hours they could read 83,520 words, and in 17 hours they could read 177,480 words. In other words, they could read between 10.5 and 22 research articles the length of this one, or equivalent, per week.

While this is not, on its face, a small amount of text to consume, several caveats are needed. First and most importantly, the texts used in the NDRT are not particularly representative of the types of texts university students (should) read. In addition, the task type is also not particularly representative of reading for study purposes. Dirix et al. (2020) tested the reading speed of Dutch students in two conditions: (a) one in which they were simply asked to read, and (b) one in which they knew that they would be asked questions about their reading and would need to answer them *without reference* to the text. When reading in the anticipation of having to account for the content of the text, the students read approximately three and a half times more slowly (174 wpm for casual reading versus 50 wpm for what the authors termed "studying"). The NDRT falls somewhere between these two conditions, in that test takers are

aware that they will be asked questions about the text, but are able to refer to it when answering questions. This raises the possibility that when reading for some purposes, such as high-stakes, closed-book exams, the participants in the present study would read at a rate closer to 24,000 words per week (based on eight hours of reading) or 51,000 words (based on 17 hours of reading), equivalent to three to six research articles.

Naturally, that calculation holds true only if students decide not to increase the amount of time they spend reading, and that and other aspects of decision-making and behaviour are critical to understanding whether and to what extent students in EMI settings can secure educational attainments by reading. It seems feasible that students who read at the low end of the self-reported range could increase their reading time. Those at the high end, 17 hours, may find it difficult to do so, assuming that they must also attend classes, spend time producing essays, lab reports and other assessed work, and engaging in other academic activities. In other words, not every L2 reader has the scope to compensate for a slower reading rate by spending more time to cover the same ground; some will spend the same time on reading and cover less ground.

### *Can Choose or Will Choose to Read More?*

Beyond the question of whether they *can* choose to spend more time reading is the question of whether they *will*. Students who experience frustration with L2 reading report a range of behaviours which most educators would regard as undesirable. In a study, 9% of participants reported that "they gave up and stopped reading if they did not understand a sentence or a paragraph in their assigned reading" (Eriksson, 2023; p. 7). In another study, respondents said that when assigned reading was in English, they sought alternative sources of information, such as a textbook on the same subject in their L1, or indeed a Wikipedia article (Pecorari et al., 2011). These are choices which have the potential to jeopardise students' learning attainments, not only in terms of understanding the subject matter, but also in terms of another intended outcome of EMI: the incidental development of English-language skills. The benefits of reading in terms of language development are numerous (e.g., Green, 2022; Shimono, 2023), and any factors which reduce students' engagement with academic texts commensurately reduce the likelihood that EMI will promote the development of English proficiency.

This discussion so far has suggested that the average participant in the present study may find reading challenging but, in all likelihood, not an insuperable barrier to academic success; consistent with various reports around students' perceived challenges of studying in EMI (e.g., Shephard & Morrison, 2021). It is however important to remember that the participants in this study were greatly varied in their reading ability, and that variation limits the extent to which it is meaningful to speak about an "average" student. Despite the fact that all had been admitted to their degree programmes via a mechanism designed to ensure sufficient proficiency in English, and were all expected to accomplish essentially the same tasks, at the same level, in English, some were clearly better prepared than others.

All of this adds support to Shaw and McMillion's (2018) conclusion that "English-language reading plays different roles in an English L1 environment and an English L2 one" (p. 162). Although EMI settings come in many different shapes and sizes, Swedish master's-level programmes are not unique in attracting diverse student cohorts. One reason for this is likely to be the rather minimal role which English plays in the selection process for EMI (in our setting and in others). An attempt is made to exclude students who do *not* have good

preconditions for success in EMI, but English proficiency plays no other role; it is not used, for example, to group students according to their ability level, or to plan accommodations for students who might benefit from them. As a result, students must find their own pathways. When it comes to reading, one implication of the findings of the present study is that these pathways are likely to be as diverse as the study body. Very proficient readers in English may be able to engage with their English-language course materials in a manner similar to the way they read in their L1, and similar to the way L1 English students read. Less proficient readers may need to find alternatives, such as spending more time reading or finding alternative texts.

### *Implications, Multiple Stakeholders*

The findings of this study have implications for three groups. Prospective or current students in EMI would benefit from an understanding of the challenges. Many of the students in Eriksson's (2023) study reported frustration with reading in English, but not having anticipated them, nor indeed that reading would be a prominent part of their academic lives. A realistic awareness of this reality may motivate students to seek functional solutions, such as approaching a study skills centre, or asking the teacher to recommend materials in the L1, rather than less desirable responses, such as avoiding reading.

For teachers, an awareness that learning through a second language is different from learning through a first language is important. Providing opportunities for individualised learning--for example, by offering extra resources suitable for students who need more scaffolding, and for those who wish to challenge themselves further--is good pedagogy in every context. It is possible that the demands of EMI, and in particular the variation in the language abilities of many EMI cohorts, makes this good pedagogical practice even more valuable.

University management at all levels should also bring into their decisions--about curriculum, about admissions, and much more--this awareness that EMI is, in many ways, different. Options which are missing in our setting and many others, but which may be beneficial for students and for learning, include: (a) more stringent admissions requirements for English proficiency on EMI programmes, (b) streaming groups according to English proficiency and tailoring support accordingly, (c) offering EMI programmes in parallel with programmes in the L1, so that students have a choice and are not forced into EMI because it is the only language in which their desired programme is offered, and (d) introducing more active language support within EMI programmes; in other words, making EMI a bit more like other multilingual pedagogies, such as content and language integrated learning.

EMI is often viewed by stakeholders as a language-neutral activity: what used to be done in the L1 is now still done, just in English. The evidence from this study provides additional evidence that this is not the case. EMI is different, because the participants are different, and those who participate in it need to recognise that.

### **Notes**

1. Noteworthy exceptions are programmes which confer locally recognised professional qualifications, such as law and accounting.

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