THE UNIVERSITY of EDINBURGH

Edinburgh Research Explorer

Learning subject-specific L2 terminology

OPEN ACCESS

Learning subject-specific L2 terminology: The effect of medium and order of exposure

Abstract

In the globalised university environment, many university students are expected to learn subject-specific terminology in both the local language and the L2 (English) by learning from two media in two different languages: lectures in the local language and reading in L2 English. These students' bilingual learning is greatly affected by the learning strategies they employ. An experiment was designed to investigate the effects of student choice of learning media and the order of media on their learning and perception of learning of terminology in English. The results confirm that added exposure to terminology in different media, even in different languages, contributes to learning and show that, in some circumstances, learning terminology from reading may be more effective than learning it from a lecture. The results also show that students do not correctly judge their knowledge of terms learnt from different media in different languages and that they underestimate knowledge gained from reading in L2. Implications for teaching are discussed.

1. Introduction

In the last 20 years, universities have adopted a rhetoric of internationalisation, as part of the general discourse of globalisation. Due to factors including market pressures, universities have felt the need to establish international profiles, to attract international students and researchers, and to give domestic students the skills to be able to compete in the global market (Ammon & McConnell, 2002; Wächter & Maiworm, 2008). In many cases this has meant an increasing use of English in tertiary education in non-English speaking countries, not always as a result of careful planning. A number of different practices are subsumed under this increased use. Many universities have courses and programmes which are given completely in English, and the number of these types of courses has been growing in recent years (e.g. Wächter & Maiworm, 2008). An even larger number of students now also attend what are called 'parallel-language' courses and programmes (Josephson, 2005) where they are required to learn from textbooks in English, which have originally been designed for students in the UK or the US (Graddol, 2006). As the rest of the course is given in the local language, the students in parallel-language courses are often expected to learn from different media in different languages: they listen to lectures in their local language (L1) and read in English (L2).

Several pedagogical reasons have been given for the use of English textbooks in higher education courses and programmes. In addition to increasing their proficiency in English (Chang, 2006; Pecorari, Shaw, Irvine, & Malmström, 2011a), students are also said to gain the ability to read research in English and to learn disciplinary discourse in English (Chia, Johnson, Chia, & Olive, 1999; Pecorari et al., 2011a; Taillefer, 2007). This will benefit the students in their future careers, as they will have the skills to be able to access information in English and to participate in the global market. However, while some institutional language

policy documents state that the aim is for students at the undergraduate level to gain this type of passive competence in the language (Mežek, 2013a), they rarely address how such a policy can be implemented (Björkman, 2014). In addition, a survey of Swedish lecturers' objectives and practices has shown that while they expect students to develop English competence and learn disciplinary discourse in English, in particular subject-specific terminology, they do not make these aims explicit to the students (Pecorari et al., 2011a). Instead, these course aims remain implicit and apart from the assigned English textbook, students are often not supported in other parts of the course. For example, it has been found that teachers draw students' attention to assigned reading only infrequently in their lectures (Shaw, Irvine, Malmström, & Pecorari, 2010). Furthermore, an investigation of teacher practices at a Swedish university with many parallel-language courses has shown that the learning of disciplinary discourse in English, in this case the learning of English terminology, is not supported in lectures in Swedish (Malmström, Mežek, Pecorari, Shaw, & Irvine, submitted). Thus, learning subject-specific terminology in English, for example, is something that students in the parallel-language courses achieve only through reading and usually without support in lectures.

These students' bilingual learning experience is, therefore, greatly affected by lecturers' management of medium and language issues. Pedagogical decisions in this parallel-language context are often based on the mere assumption that learning in this type of context is largely unproblematic and even beneficial; however, the efficacy of this type of teaching practice does not appear to have been tested by research. In fact, the effects of learning from media in different languages have largely been unexplored. For example, while it has been shown that one effect of learning from two media in different languages is that, in order to adapt to this situation, students have adopted different learning strategies (e.g. Pecorari, Shaw, Irvine, Malmström, & Mežek, 2012; Ward, 2001), the effectiveness of these strategies has not yet

been established. Thus the aim of this article is to investigate the effectiveness of student learning strategies in educational parallel-language environments and make suggestions as to how teachers could effectively manage and balance learning from different media in different languages in order to improve student learning.

2. Background to the study

2.1 Student strategies

The strategies the students have adopted depend in particular on how they view assigned reading. Research has shown that students in general do not do all of their assigned reading (Burchfield & Sappington, 2010; Pecorari et al., 2012; Sappington, Kinsey, & Munsayac, 2002; Ward, 2001). They have problems understanding the purpose of different learning contexts, such as reading, lectures, and seminars (White et al., 1995), and they tend to underestimate the importance of reading (Lei, Bartlett, Gorney, & Herschbach, 2010). Many students thus have negative attitudes towards reading textbooks in general. Moreover, in the parallel-language context, students have reported time management problems and reading difficulties when reading in English (Hellekjær, 2009; Pecorari, Shaw, Malmström, & Irvine, 2011b; Mežek, 2013c; Ward, 2001), which results in them being even more negative towards textbooks when they are in English. This situation of students not doing their assigned reading is particularly problematic in parallel-language courses, as the students are usually exposed to disciplinary discourse and terminology in English in their textbooks only.

Because of time management issues, reading difficulties, and their negative attitudes towards reading, students have adapted to their learning situation by adopting particular strategies: depending on the lecture for content and minimising their reading load. Engineering students in Thailand, for example, focus only on certain parts of the English-language textbooks, such as examples, instead of doing all of their assigned reading (Ward, 2001). In a survey of study reading habits of Swedish university students (Pecorari et al., 2012), many students reported that they prefer lectures to reading, and that they believe that reading is an alternative to attending lectures. They also reported reading only certain parts of their textbooks and doing the reading after the lectures, even when their teachers expect them to do the reading beforehand. In short, these students restrict their learning to one medium (L1 lecture only instead of L2 English reading) and sequence their learning in a different way than instructed (reading after instead of before the lecture). These students' bilingual learning experience is thus affected significantly by lecturers' management of these medium and order issues. However, while surveys have revealed the types of strategies the students have adopted, and in part even their reasoning behind them, less is known about the measurable effects of the practices described. This article reports the results of an experimental study where we investigated what effects the medium and the order of exposure to media have on student learning and self-assessment of knowledge of subject-specific terminology in English when the media are in different languages.

2.2 The effect of order of exposure

Most investigations of the effect of the order of items on retention have been carried out within memory studies. In those studies researchers have investigated the effect of order by

asking participants to recall a list of words or numbers. They found two effects of order: the primacy effect and the recency effect. In the primacy effect the participants more accurately recall the items from the beginning of the list, whereas in the recency effect they better recall items from the end of the list (Anderson, 2000). The items from the middle of the list, on the other hand, are usually recalled the least well. In addition, these two order effects affect retention differently. It has been claimed that items encountered first have a higher chance of being stored in long-term memory, unlike items from the end of the list which are more likely to affect short-term memory (Anderson, 2000). In addition, while recent items tend to be recalled first, they are also more likely to be forgotten (Benjamin, 2007). This means that items which are affected by the primacy effect have a higher probability of being retained in memory than items affected by the recency effect.

Although primacy and recency effects have mainly been investigated in memory studies, a small body of literature has discussed them in the context of learning. Since items encountered first are more likely to be remembered longer, one piece of advice to students has been that they should avoid massing, or, in other words, learning everything at once (Benjamin, 2007, p. 183). Instead the suggestion has been that they should use self-spacing: shortening their individual study events in length, but increasing them in frequency (Benjamin, 2007). In this manner the time spent studying is equal to when massing, but used more effectively. The concepts of spacing and massing have also been used in vocabulary learning literature in discussions of the effectiveness of spaced and massed repetitions (e.g. Hulstijn, 2001; Nation, 2001). When learning new vocabulary, using the strategy of spaced repetition has been said to be the most effective use of time (Nation, 2001). The implications of this are that vocabulary learning is also affected by the primacy and recency effects. However, the issue of the order of exposure in different media has not yet been investigated.

2.3 The effect of medium

Memory studies have also examined the effect of medium. Research has shown that recall of items in an auditory/verbal presentation is better than recall of items in a visual presentation (Beaman & Morton, 2000; Harvey & Beaman, 2007). This modality effect is especially true of final items, the recall of which benefits from verbal presentation (Gardiner, 1983), although this effect often depends on the testing method as well (Gibbons, Velkey, & Partin, 2008). Consequently, experts in teaching methodologies advise that hearing is more effective than reading (Biggs & Tang, 2011, p. 63).

Medium has thus been shown to have an effect on remembering in memory studies. However, when it comes to learning in practice, the media commonly used to transmit knowledge at universities, reading and lectures, have not been shown to differ from one another in the transmission of information. Costin (1972) conducted a survey of studies comparing different learning and teaching methods, among them reading and attending lectures. He found that reading and lectures are equally effective. Bligh (2000) came to the same conclusion based on his survey of studies. However, students with different abilities might benefit more from lectures than reading. Students with poor reading ability, for example, would benefit more from lectures (Costin, 1972), and, in the parallel-language situation described above, most students are at a disadvantage in reading, since it is in the L2.

When students learn the same subject matter from several types of media, however, they learn more. Thus students who, for example, read and attend lectures, or read lecture handouts and attend lectures, do better than students who only read textbooks or lecture handouts (Costin, 1972). Chevins (2005), as well, found that replacing some lectures with reading results in students devoting more time to studying and increased performance in

exams. Similarly, students who read in addition to going to lectures perform better on tests (Sappington et al., 2002) and students who read more of the textbook perform better on the course (Landrum, Gurung, & Spann, 2012). In vocabulary learning, as well, meeting words in different contexts, such as reading and listening, has been said to positively affect the learning of words (Huckin & Coady, 1999; Nation, 2001). Learning from several media, or in different contexts, can, therefore, promote learning.

In the developing multilingual academic world, it is increasingly likely that a third factor is coming into play, and that is the language through which content is 'delivered'. It is the aim of this study to examine the effect of the medium of delivery (either written L2 English or spoken L1 Swedish) in an 'internationalised' university environment. Only these two medium-language combinations are considered because in practice only these two commonly occur.

2.4 Experimental method

To test the effect of medium and order of exposure in learning subject-specific terminology, it is appropriate to employ an experimental method. While a quantitative experimental method is not naturalistic and does not necessarily resemble the exact learning process of students in the parallel-language courses, it has the advantage of being able to test the intended variables and to control for those not tested (Brown, 2004), and thus to provide baseline data for analysing the multitude of factors present in a naturalistic study. Some of these variables could be, for example, the amount and type of information transmitted through the medium, complexity of the text, language difficulty, etc. In this manner, a carefully designed experiment can reveal the effects of different strategies and also minimise

the interference of other factors which might affect the results. Furthermore, the experiment can be replicated and used to test different variables, which can then be compared to results of earlier experiments and naturalistic studies.

In our study we designed a quantitative experiment to test the effects of the different learning strategies students have reported using in the parallel-language context: learning from a specific medium (reading in L2 English, lecture in L1 Swedish, or both) and learning from two media in a specific order (reading before or reading after the lecture). The results of this experiment will reveal whether the students are correct in their beliefs about the relative efficacy of reading and listening to lectures. In addition, they will also reveal whether the student strategy of reading after the lecture is effective, and whether students are capable of correctly self-assessing their own learning. The results of this study will thus have implications for how content teachers could design their courses and the type of advice they could give their students to maximise their learning of subject-specific terminology in English.

3. Research questions

This study is an investigation of the effectiveness of strategies adopted by students who are learning in the parallel-language context where they learn English-language subject-specific terminology from two media in two languages: they read in L2 (English) and listen to lectures in L1 (Swedish). The investigation was guided by the following questions:

1) What is the effect of medium (reading L2 English, lecture in L1) on the learning of subject-specific terminology in English?

2) What is the effect of order of media exposure on the learning of subject-specific terminology in English?

3) How does learning from different media/languages and in a different order affect the students' perception of their knowledge (as opposed to actual knowledge) of subject-specific terminology in English?

These questions in the light of the existing research literature gave rise to the following hypotheses:

Hypothesis 1: Reading in L2 is more effective than listening to a lecture in L1.

Hypothesis 2: Reading about and hearing a term in a lecture is more effective than reading it only.

Hypothesis 3: Reading about and hearing a term in a lecture is more effective than hearing it only.

Hypothesis 4: Reading about a term before hearing it in a lecture is more effective than first hearing it in a lecture and then reading about it.

Hypothesis 5: Students do not correctly judge their knowledge of terms learnt from different media in different languages.

The hypotheses are formulated on the basis of previous studies of student strategies and learning (Hypotheses 1-3, 5) and psychological studies of memory (Hypothesis 4). Hypotheses 2 and 3 are used to confirm the presumption that additional exposure in another context contributes to the learning of a term even when an additional factor is added: the language of the medium (L2 reading, L1 lecture).

4. Methods

4.1 Participants

The participants were first-term students of undergraduate English studies at a major Swedish university. Their courses included both studies of linguistics and literature. Because of entry requirements, all students were at least at CEFR proficiency level B2 and most were at C1 or even C2. In their courses they were expected to learn academic English vocabulary and literary and linguistic terminology in English. One hundred and thirty students participated in the study. A majority of the participants were new to university studies, as 54% reported having studied at the university one term or less. Almost half (45%) were 21 years or younger, and a large majority of them were women (62%). Over a quarter of the participants (27%) reported being 'bilingual', in the sense of having learnt both Swedish and another language (such as Arabic, Bosnian, Farsi, Finnish, Kurdish, or Spanish) in early childhood. All were fluent in Swedish and had taken secondary education in that language. The sample is representative of students studying this subject at this institution.

Before the experiment, the students were informed that the experiment included reading in English and listening to a lecture in Swedish, and that knowledge of both English and Swedish was needed to participate in the experiment. Students were aware that participation was voluntary.

4.2 Experiment material and procedure

This experiment was a part of a larger study investigating university students'
acquisition of subject-specific terminology in English in parallel-language courses, where the
reading is in English and the lectures are in the local language, Swedish (e.g. Malmström et
al., submitted; Mežek, 2013a, 2013b, 2013c; Pecorari et al., 2011a, 2011b, 2012; Shaw et al.,
2010). This particular experiment was one in a series designed to test the students' learning of
terminology from reading in English and listening to a lecture in Swedish (e.g. Mežek, 2013a,
2013b).

The terminological set used in this experiment consisted of terms from classical
rhetoric. This set of terms was chosen because they were largely unknown to the students and
because the terms were related to the students' subject fields, linguistics and literature, and
could be, therefore, useful to the students in their studies. This set of terms was thus seen as
something the students would be interested in and motivated to learn. The specific terms we
chose for this study were terms which would be classed as technical terms by Nation (2001),
i.e. words that are "recognisably specific to a particular topic, field or discipline" (p. 198). As
the classical rhetoric terms we chose were etymologically Greek, some items were similar in
form to others. This similarity might make these terms more difficult to learn together
(Nation, 2001), as the students were expected to in this experiment. However, this type of
learning condition is quite common in university studies, so the task the students were given
was something they might be expected to do at university. The list of terms is in Table 1.

In this experiment the students were instructed to learn the terms in English by reading
a text in English and by watching a video recording of a lecture in Swedish (which also used
the English form of the term) on the same topic. They read the text and listened to the lecture
for approximately the same amount of time. They were allowed to take notes during these
learning events, but the notes were taken away before testing. The students were tested on
their knowledge of rhetorical terms at three points: before the learning events (pre-test),

immediately after the learning events (post-test), and one week after the learning events (retention test).

The experiment in this study focuses on the effect of medium (reading in L2 English, lecture in L1 Swedish, or both) and the effect of order of media exposure (reading before or after the lecture), so the reading text and lecture were manipulated to test these variables. To test the effect of medium, some of the terms the students were expected to learn were only in the reading (Reading-only terms), some were only in the lecture (Lecture-only terms), and some were in both the reading and the lecture (Reading and Lecture terms). To test the effect of the order of exposure, some students read first and then listened to the lecture (Reading first), and some listened to the lecture first and then read (Lecture first). The learning materials, tests, and procedure are described below.

4.2.1 Reading text

The reading text was in English, textbook-like in nature, and on the subject of rhetoric. The text was 668 words long, and organised into six paragraphs. The first paragraph was an introduction to rhetoric. The following paragraphs introduced ten rhetorical terms. Five of these were Reading-only terms, and five were Reading and Lecture terms. Every paragraph introduced two terms, one Reading-only and one Reading and Lecture term. The terms in these paragraphs had descriptions which were similar in structure and the amount of information they provided. Every paragraph started with a topic sentence describing the general characteristics of the two terms presented in the paragraph. After this, the two terms were each defined and exemplified. Some additional information was also given, for example

13

people famous for using the rhetorical figure. The reading text is in Appendix 1 and the list of terms presented in the text is in Table 1.

Term group	Abbr.	n	In learning material/In tests	Terms[1]
Lecture-only terms	LO	5	Described only in the lecture. Appear in both parts of all of the tests[a].	asyndeton, mempsis, polyptoton, soraismus, synecdoche
Reading-only terms	RO	5	Described only in the reading. Appear in both parts of all of the tests[a].	antimetabole, oxymoron, paramythia, parrhesia, prozeugma
Reading and Lecture terms	RL	5	Described in the reading and in the lecture. Appear in both parts of all of the tests[a].	catachresis, diaphora, litotes, paenismus, polysyndeton
Test-only terms	TO$_1$	5	Appear only in the recognition part of all of the tests.	epicrisis, hendiadys, prolepsis, schematismus, systrophe
	TO$_2$	5	Appear only in the recognition part of the post-test and retention test.	agnominatio, cataphasis, ethopoeia, mesarchia, peristasis

a Only one term from each group (LO, RO, and RL) was tested in the knowledge section of the pre-test, but all of them in the knowledge sections of the post-test and retention test. See Section 4.2.3 for an explanation.

The students had 12 minutes to read the text. They were allowed to take notes on a piece of paper given to them or in the text itself. The text was collected after they finished reading; it was not available to them during the lecture. The notes were collected after the learning events, before the post-test.

4.2.2 Lecture

The students watched a ten-minute pre-recorded lecture in Swedish on the topic of rhetoric which introduced ten rhetorical terms. While the descriptions and explanations of the

---

[1] In another experiment we asked the students to learn all of the terms from reading only. There were no significant differences between the mean scores of term groups in the results of the knowledge section, so the term groups can be considered equally difficult to learn.

terms were in Swedish, the terms themselves were named in English. Five of the terms were Lecture-only terms, and five were Reading and Lecture terms. The list of these terms can be found in Table 1.

The lecture began with a short introduction to rhetoric. After the introduction, the terms were presented. Every Lecture-only term was described with the help of an anecdote, or an explanation of an example, and a definition. Each one of these five terms was named in English once and then written on the board. Every Lecture-only term was thus described with a similar amount of information and was the focus of the lecture for a similar amount of time.

The Reading and Lecture terms were not the focus of the lecture. They were introduced in conjunction with the Lecture-only terms; after the in-depth description of a Lecture-only term, one Reading and Lecture term was mentioned as, for example, being similar in conceptual structure. These terms were also named in English at two points in the lecture: once after the description of a Lecture-only term, and once at the end of the lecture as terms the students should revise. The Reading and Lecture terms were not written on the board. These terms thus received a minimal amount of attention in the lecture.

The students watched the pre-recorded lecture on a projected screen. During the lecture, the students were allowed to take notes on a piece of paper given to them. Their notes were collected before the post-test.

4.2.3 Tests

The students were tested three times: with a pre-test, a post-test, and a retention test. All three tests were completely in Swedish, with the exception of term names. All three of the tests also consisted of two parts: recognition and knowledge.

The recognition part of the test was of the type introduced by Paribakht and Wesche (1993), a Vocabulary Knowledge Scale (VKS), which has been shown to have good reliability (.89; Paribakht & Wesche, 1997). The students were asked to self-assess their knowledge of rhetorical terms by reading a list of alphabetically-arranged rhetorical terms in English, and marking one of the following options for each term (in Swedish): (i) "I've never seen this word"; (ii) "I recognise this word, but I don't know what it means"; or (iii) "I know this word". The students were given no points for marking that they had never seen the term, one point for marking that they recognise it, and two for marking that they know it. The final scores for this part of the test were the means of the different term groups. To control for the different levels of perceived pre-knowledge of different students, the means which were compared were mean recognition gains from the pre-test to post-test (post-test gain), and the pre-test to retention test (retention test gain). Recognition scores were used in comparisons of the students' perception and actual knowledge (Research question 3).

The knowledge part of the test was multiple-choice and completely in Swedish as well, except for the names of terms. The students were given a definition in Swedish, which they then had to match with one of the four given terms in English. They also had the option to mark "I don't know", and in the post-test and retention test also "I recognise the definition, but I don't remember the term". As an "I don't know" option has been shown to prevent guessing in vocabulary tests (Zhang, 2013), the inclusion of these two options could prevent the students from guessing the correct answer because they are more familiar with the term due to the repetition of the tests. The students were given a point for every definition matched with the correct term. The knowledge scores were used to measure the students' actual knowledge of terminology.

A description of the three tests can be found in Table 2: when the tests were given, which terms were tested in the recognition and the knowledge sections, what score the students could achieve, and how long the students had to complete the test.

Table 2
Information about tests.

		Pre-test	Post-test	Retention test
Sequence		Before learning events	Immediately after learning events	One week after learning events
Recognition	Terms tested[a]	20: 5 TO_1, 5 LO, 5 RO, 5 RL	25: 5 TO_1, 5 TO_2, 5 LO, 5 RO, 5 RL	25: 5 TO_1, 5 TO_2, 5 LO, 5 RO, 5 RL
	Scores (means)	*M of TO_1, LO, RO, RL*	*M of TO_1, TO_2, LO, RO, RL*	*M of TO_1, TO_2, LO, RO, RL*
Knowledge	Terms tested[a]	3: 1 LO, 1 RO, 1 RL	15: 5 LO, 5 RO, 5 RL	15: 5 LO, 5 RO, 5 RL
	Max. score (points)	*3: 1 LO, 1 RO, 1 RL*	*15: 5 LO, 5 RO, 5 RL*	*15: 5 LO, 5 RO, 5 RL*
Time limit		10 min	15 min	15 min

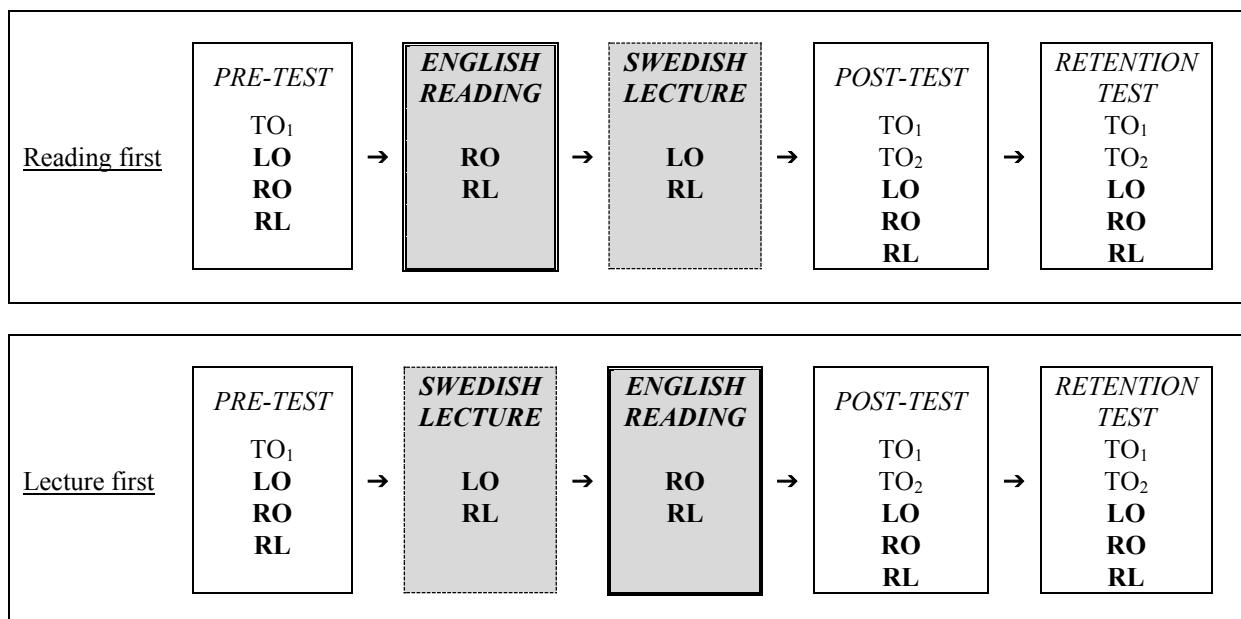a Detailed information about the terms is in Table 1.

As can be seen in Table 2, the retention test was identical to the post-test. However, the pre-test and the post-test differed. In the recognition part of the pre-test, the students were asked to evaluate five terms which were only in the tests (TO_1), but in the post-test and retention test they were also asked to evaluate five additional terms (TO_2). These terms were introduced in order to be able to prevent or identify the random marking of options and to allow for possible recognition due to the test only respectively. The knowledge portion of the pre-test was also different from the post-test and retention test: it consisted of only three items. This part was used to estimate the students' pre-knowledge of the terms. Only three items were tested here because we expected that the students' knowledge of these terms was minimal or non-existent; the results confirmed that their pre-knowledge was very small indeed.

17

4.2.4 Experiment procedure

All students took the pre-test before the learning events, the post-test immediately after the learning events, and the retention test one week later. However, the order of exposure to the media (L2 reading and L1 lecture) differed. At the beginning of the experiment, the students were randomly divided into two groups:

(1) The Reading first group read first, and then listened to the lecture second. This group consisted of 69 participants.

(2) The Lecture first group listened to the lecture first, and then read second. This group consisted of 61 participants.

Figure 1 provides an illustration of the experimental design: where the students learnt the different groups of terms, and in what order they were exposed to them.

Detailed information about the terms is in Table 1 and the tests in Table 2.

Fig. 1. Experiment design.

All data were tested statistically with SPSS (Version 19). The comparisons were made between groups of terms (LO, RO, and RL) and student groups (Reading first and Lecture first). The tests used for statistical analyses were analysis of variance (ANOVA), *t*-test, and test of correlation (Pearson coefficient, two-tailed), where appropriate. Results were considered significant at $p < .05$.

5. Results

The results are presented in three subsections: (i) Subsection 5.1 deals with the first research question, the effect of medium, and Hypotheses 1-3; (ii) Subsection 5.2 with the second research question, the effect of order of media exposure, and Hypothesis 4; and (iii) Subsection 5.3 with the third research question, students' perception of learning, and Hypothesis 5.

5.1 The effect of medium

This section explores whether the medium from which students learn terminology affects their learning. The students were tested on their knowledge of L2 terminology in the post-test and in the retention test. Knowledge test scores of all students for these two tests, and the differences between the post-test and retention test (knowledge loss), are presented in Table 3.

Table 3
Mean knowledge scores of Total students (n=130), by term group.

	RO		LO		RL	
	M	(SD)	M	(SD)	M	(SD)
Post-test	2.42	(1.46)	2.45	(1.49)	2.52	(1.64)
Retention test	1.79	(1.51)	1.59	(1.37)	2.03	(1.53)
Knowledge loss	-.63	(1.21)	-.87	(1.32)	-.49	(1.37)

RO = Reading-only terms; LO = Lecture-only terms; RL = Reading and Lecture terms

The table shows that on average the students learnt only about a half of the terms as tested by the post-test (M = 2.42-2.52). A two-way mixed ANOVA showed that the differences in mean test scores among the different term groups on the post-test were not significant, $F(2, 256) = .308$, $p = .735$. The different term groups had, therefore, been learnt approximately equally well at the time of the post-test. However, there was a significant difference between term groups on the retention test, $F(2, 256) = 8.99$, $p = .000$. This was between terms learnt in the Lecture-only (LO) and Reading and Lecture (RL) terms ($p = .000$), which confirms that reading about and hearing a term in a lecture is more effective than hearing it only (Hypothesis 3). The difference between terms which were learnt in the Reading-only (RO) and RL terms was almost significant as well ($p = .058$); thus Hypothesis 2, reading about and hearing a term in a lecture is more effective than just reading, is not confirmed, although it was close to being so. This closeness suggests that further tests could be beneficial. There was also no significant difference between the retention mean scores for RO and LO ($p = .214$), so Hypothesis 1 which stated that reading in L2 is more effective than listening in L1 is not confirmed either. In other words, the students learnt terms which they both read and then heard in the lecture better than those which were only in the lecture and perhaps also those only in the reading. Added exposure in different media therefore contributed to the learning of L2 terms. However, this effect of added exposure can only be observed in the scores on the retention test, and not on the immediate post-test.

The difference between the retention test and post-test scores (knowledge loss) in different term groups was also significant, $F(2, 256) = 3.10$, $p = .047$. As can be seen in Table 3, knowledge loss was the highest for the LO terms, and the lowest for the RL terms. The terms for which there was the least knowledge loss between the post-test and retention test were, therefore, those which were in the reading and the lecture. As the difference between the retention mean scores for RO and RL was not significant, significant differences in knowledge loss are not enough to confirm Hypothesis 2. However, these results do imply that knowledge gained from reading is somehow more permanent.

Knowledge scores of terms learnt from different media (RO and LO) were also compared between order groups in order to exclude the possible effects of order. The results by order group are shown in Figure 2. An independent-samples t-test analysis showed that there were no significant differences between the knowledge scores of terms learnt from different media, whether they were learnt first ($p = .917$) or second ($p = .758$). Differences in means on the retention test were also not significant. In short, Hypothesis 1 cannot be confirmed even when controlling for the effect of order.
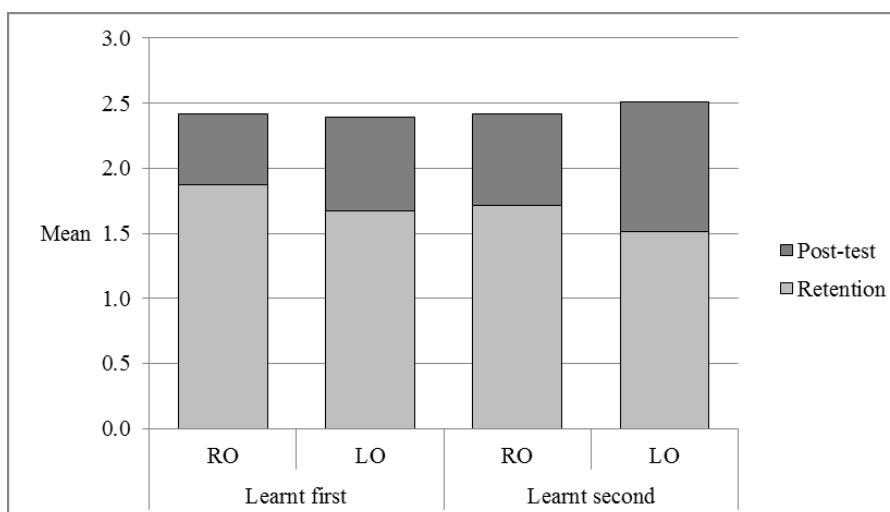
RO = Reading-only terms; LO = Lecture-only terms

Fig. 2. Mean knowledge scores of RO and LO term groups, by medium order.

5.2 The effect of order of media exposure

The second research question asked whether the order of media exposure affects student learning of L2 terminology. This question was investigated by describing some terms in detail in the L2 reading, and mentioning them briefly in L2 in the L1 lecture (RL terms). The mean knowledge scores of RL terms are shown in Table 4.

Table 4
Mean knowledge scores of Reading and Lecture (RL) terms, by order group.

	Reading first		Lecture first	
	M	*(SD)*	M	*(SD)*
Post-test	2.58	*(1.64)*	2.46	*(1.65)*
Retention test	1.91	*(1.57)*	2.16	*(1.50)*
Knowledge loss	-.67	*(1.17)*	-.30	*(1.54)*

Independent samples *t*-tests showed no significant difference between order groups on the post-test ($t(128) = .42$, $p = .677$), nor was there a significant difference between order groups on the retention test ($t(128) = .93$, $p = .354$), or in knowledge loss ($t(128) = 1.53$, $p = .129$). Thus while, for example, the RL mean scores of the Lecture first group are slightly higher on the retention test, this difference is not significant. Consequently, Hypothesis 4, which posited that reading before the lecture is more effective than reading after the lecture, cannot be confirmed.

5.3 Students' perception of learning

The third research question asked whether students were able to self-assess their knowledge of terminology (recognition scores) learnt from different media which were in different languages. We did this by comparing their recognition test scores with their knowledge scores. The means and standard deviations of recognition scores for all students are given in Table 5.

Table 5
Mean recognition scores of Total students (n=130), by term group.

	RO		LO		RL	
	M	(SD)	M	(SD)	M	(SD)
Pre-test	.32	(.27)	.20	(.19)	.29	(.23)
Post-test gain	.93	(.48)	.87	(.46)	1.01	(.42)
Retention test gain	.71	(.38)	.74	(.42)	.74	(.40)

RO = Reading-only terms; LO = Lecture-only terms; RL = Reading and Lecture terms

As can be seen in Table 5, after the learning events, the students' mean recognition for the different term groups was just over one point, which means that their perception of the terms went from not knowing the term to recognising the term; however, a portion of this score could be attributed to the repetition of the test. The differences in recognition gains between the term groups were not very large. However, a two-way mixed ANOVA of the post-test gains was significant, $F(1.84, 235.90) = 4.93$, $p = .010$. The pairwise comparison showed that the only significant difference was between RL and LO terms, where the perceived post-test gains were significantly larger for RL ($p = .004$), a result not in conformity with the knowledge test scores (Table 3, Section 5.1). On the other hand, the comparison of gains in retention test scores was not significant, $F(1.77, 226.61) = .97$, $p = .374$, which means that there was no significant difference between the recognition means in gains on the retention test when comparing the different term groups.

Immediately after the learning events then, the students perceived that they knew terms which they were exposed to in two media (RL) more than those in only one medium (LO).

However, after one week, their self-assessed knowledge of all three term groups was similar, which means that perceived higher knowledge of terms learnt through two media was only temporary. Conversely, the actual learning as measured by our tests followed the opposite pattern (see Section 5.1). In the post-test, the knowledge scores of all three term groups (RO, LO, and RL) were similar, whereas in the retention test the RL mean score was significantly higher than the LO scores and on the border of being significantly higher than the RO scores. In short, when analysing the knowledge and recognition scores of all students, students were not correct in their perception of their RL knowledge, and thus it is confirmed that students do not correctly judge their knowledge of terms learnt from different media in different languages (Hypothesis 5). On the other hand, their perception that RL was in some sense the most effective type of exposure was accurate.

Tests of correlation between recognition and knowledge scores on the post-test and retention test show that it is the terms learnt from reading only which the students are the least capable of assessing correctly. While all correlations were highly significant ($p = .000$) and moderate, the correlation coefficient was the lowest for RO ($r = .442$), intermediate for LO (.536), and the highest for RL (.550). The results followed the same pattern on the retention test: RO ($r = .410$), LO (.454), and RL (.477). Therefore, the students' self-assessed knowledge corresponded the least well with their actual knowledge when it came to terminology learnt from reading only. These results show that students underestimate the learning achieved through reading.

It is possible that the order of learning (L2 reading before or after the L1 lecture) affects the accuracy of knowledge perceptions. A comparison of the recognition and knowledge scores of different order groups can reveal whether the accuracy of students' perception of their knowledge is so affected.

In the post-test results, a two-way mixed ANOVA of recognition scores ($F(1.84, 235.90) = .46$, $p = .618$) and paired samples t-tests[2] on the knowledge scores ($p > .05$ between all term groups within the order groups) showed that the results for each order group follow the same pattern as total student scores. In the retention results, however, there were some differences. A two-way mixed ANOVA was significant for the effect of order in the recognition retention gains, $F(1.77, 225.61) = 4.26$, $p = .019$. In Figure 3 it can be seen that when Reading-only (RO) terms are learnt first, there is no significant difference in recognition gains between RO, LO, and RL terms. However, when RO terms are learnt second, the mean retention test recognition gain for RO terms is lower than for LO and RL terms, and about the same for LO and RL terms.
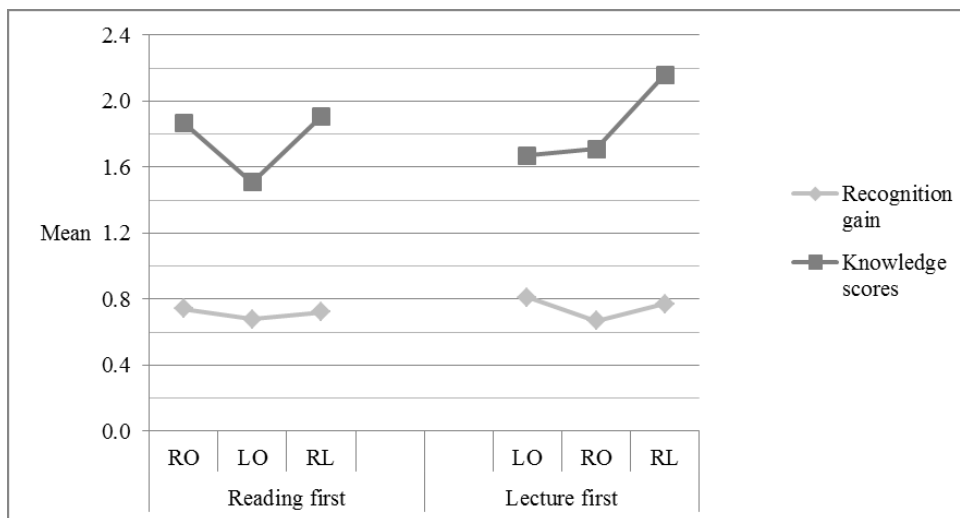
RO = Reading-only terms; LO = Lecture-only terms; RL = Reading & Lecture terms

Fig. 3. Mean recognition gains and knowledge scores on the retention test, by medium order.

Again, these students' self-assessment of their knowledge does not follow the pattern of their knowledge scores. As can be seen in Figure 3, in Reading first, means of RO and RL were higher than LO ($t(68)=2.25$, $p = .028$; $t(68)=2.62$, $p = .011$), whereas RL and RO did

---

[2] Levene's test of equality of error variance showed that variances were significantly different in different order groups for the RO scores on the post-test ($p = .046$), and LO scores in the retention test ($p = .012$), which means that it would be difficult to compare the effect of order in a two-way mixed ANOVA. For this reason, comparisons of term groups between and within order groups were done with t-tests.

not have significantly different means ($p = .321$). In Lecture first, on the other hand, RL was significantly higher than RO ($t(60)=3.16$, $p = .002$) and LO ($t(60)=3.68$, $p = .000$).

Students who read first thus seemed to overestimate their knowledge of LO terms, and students who read second seemed to underestimate their knowledge of RO terms. This result, again, confirms Hypothesis 5 which stated that students cannot correctly judge their learning of L2 terminology from different media in different languages and, specifically, tend to undervalue the benefits of reading. Thus whether different order of learning is taken into account or not, the same conclusion can be made about students' perception of their knowledge in relation to their actual knowledge: their judgement of their knowledge is incorrect.

6. Discussion

The first research question concerned the effect of medium on the learning of subject-specific terminology in English. We tested three hypotheses: (1) reading in L2 promotes learning better than a lecture in L1; (2) exposure to a term in two media is more effective than reading only; and (3) exposure to a term in two media is more effective than a lecture only. We were only able to confirm Hypothesis 3, with Hypothesis 2 falling just short of confirmation. These results are striking because the number of exposures that the students received to the terms in additional media was not big. In fact, although literature on vocabulary learning does not preclude the learning of words which learners have not received a great amount of exposure to, the literature does suggest that a larger number of exposures is needed to learn a word (e.g. Huckin & Coady, 1999; Nation, 2001). It is possible that more exposure to terms in the experiment would have resulted in students learning more terms. The

differences between learning terms from reading and from a lecture could also be made clearer. This issue of the amount of exposure in the learning material is therefore something which should be addressed in future research. In addition, what should also be explored is the effect of exposure to terms due to test repetition, although the inclusion of terms in the pre- and post-test of items not taught showed that this is small.

Another interesting finding is that there were no differences in the learning of the terms from different media in the post-test; instead, the differences appeared in the retention test. Thus different media affect how much of the knowledge learnt is retained. This result has implications for teaching, as it implies that the different effects of media do not show immediately, but that their effect is delayed. Terms which were only in the lecture were retained the least, as the difference between the post-test and retention test scores was the largest, whereas the terms in two media were retained the most, and the terms from the reading were somewhere in the middle. Therefore it could be claimed that more is retained from reading than from listening to a lecture even when the media are in different languages.

These results suggest that the medium affects the learning of subject-specific terminology in English. The terms presented in two media were on average learnt more than those in only one medium, despite them being only mentioned in the lecture and research on vocabulary learning suggesting that a greater amount of exposure is needed to learn a word (e.g. Nation, 2001). Added exposure to terminology in different contexts, even when brief, thus contributes to learning. Previous studies have suggested that learning the same content from different media is more effective than learning from one medium (Costin, 1972; Sappington et al., 2002), and this finding confirms that this remains applicable in an environment where the media are associated with different languages.

Despite what might be assumed to be the greater cognitive load of L2 reading, there appear to be no great differences between the learning of terms from L2 reading or from a

lecture in L1. This is in conformity with results as found for single-language environments (cf. Bligh, 2000). However, it is necessary to point out that the reading text described ten terms in detail, while the lecture only focused on five. As the reading and lecture listening time were similar, students needed to learn more terms in-depth from the reading in the same amount of time. This reason, in connection with the finding that students forgot more of what they learnt from a lecture than from reading, provides potential support for a claim that reading, even though it was in English, was more effective than listening to a lecture in Swedish. This result is impressive and goes against the assumptions of students that L1 lectures are more effective than L2 reading (Pecorari et al., 2012) and the presumption that hearing is better than reading (Biggs & Tang, 2011). These findings suggest that Hypothesis 1, which stated that reading in L2 is more effective than a lecture in L1, might in fact be correct as well; however, this claim needs to be tested more thoroughly.

The second research question was whether the order of media exposure affects the learning of subject-specific terminology in English. The hypothesis we tested was that reading in detail about a term and then hearing the term mentioned in a lecture is more effective that hearing a term first, and then reading about it (Hypothesis 4). In other words, we hypothesised that recalling terms in a lecture promotes learning of English terms more than priming the students for the reading. The results of the two orders were not significantly different, so there was no effect of primacy or recency (Anderson, 2000). Students in the two order groups learnt the terms equally well, whether they had an in-depth exposure to them first (reading before the lecture) or second (reading after the lecture). These results thus did not confirm Hypothesis 4.

However, it is possible that there was no significant difference because the text and the lecture were fairly short. If the reading text were longer and included many more terms, students who listened to the lecture first might possibly be affected by the mention of the

terms in the lecture, so they would prioritise the learning of those terms, and not others. The students who read first, on the other hand, would perhaps put the same amount of focus on all terms in the reading. In addition, reading before the lecture could also affect how they learn the terms in the lecture. This possibility of the lecture defining the content of the students' learning agenda (cf. Pecorari et al., 2012) and pre-reading affecting the learning of terms in the lecture could be the focus of a future experiment.

An interesting finding of this study concerns the student perception of learning in relation to their actual learning (Research question 3). The results of the recognition and knowledge sections of the post-test and retention test clearly show that the students incorrectly judged their knowledge of terms learnt from different media in different languages (Hypothesis 5). In the post-test, the students perceived their knowledge of terms which were in the reading and the lecture as higher than that of the other terms, even though their demonstrated knowledge of all three term groups was equal. The exact opposite happened in the retention test: the students assessed their knowledge of different term groups as equal, even though their demonstrated knowledge was higher for the terms appearing in both of the media. This finding has great implications for teaching and learning, as it implies that students are not aware that the effects of different media are delayed. If students make learning strategy choices based on their immediate perceptions of knowledge gained from learning activities, their choices might in fact not be beneficial to their learning, which is problematic and should be addressed by teachers.

In addition, tests of correlation show that it is the knowledge learnt from L2 reading which the students were the least correct in assessing. Looking at the different order groups also reveals that students perceive learning from the two media (L2 reading and L1 lecture) as differently effective. Not only were they not able to correctly evaluate their knowledge of terminology, they also seemed to underestimate knowledge gained from L2 reading, and

overestimate knowledge gained from L1 lectures. This result is in line with studies of student evaluations of learning materials, where the results clearly show that students believe lectures to be equally effective or more effective than reading (Lei et al., 2010; Pecorari et al., 2011b, 2012). Further study of this phenomenon is suggested, however, in order to verify these findings. In particular, future studies of this issue might benefit from extending the knowledge test to include all of the recognition items, in order to more clearly connect the students' self-assessment to their demonstrated knowledge of individual items. This type of test might also contribute to investigating what types of effect repetition of tests might have.

7. Conclusion and implications for teaching

In short, this study has shown that, in the parallel-language courses, learning subject-specific terminology in L2 English is affected by the medium. Students learn more terms which are both in the L2 reading and in the L1 lecture, even if the lecturer only mentions the term. This effect is independent of order of presentation, so that presentation in reading and recall in the lecture is neither less nor more effective than priming in the lecture followed by full presentation in the reading. Furthermore, while no strong proof was found that students learn more terms from L2 reading than listening to a lecture in L1, some results do suggest that this might be the case. Thus in this environment reading in L2 can be more effective than a lecture in L1 Swedish, even though the reading is in English and students in parallel-language contexts report difficulties with it (Mežek, 2013c; Ward, 2001). In addition, the data suggest that students are poor at assessing how much they learn from different media; as has been suggested in previous research (e.g. Pecorari et al., 2011b, 2012), they tend to underestimate reading. The strategies students in parallel-language courses have adopted,

such as depending on lectures for content and minimising their reading load (e.g. Pecorari et al., 2012; Ward, 2001), are therefore not very effective at promoting subject-specific terminology learning. The teachers' role is thus to structure their courses in such a way that students are motivated to read the assigned reading.

Our findings have significant implications for teaching and learning in the parallel-language environments, where teachers lecture in the local language but expect students to learn from texts in English (L2). Content lecturers who expect students to not only learn terminology in the local language, but also in English, can support student terminology learning by merely mentioning the English terms in the lectures. For example, when discussing content, the lecturer could name the central concepts in both the L1 and English, either by saying the term in L1 and English or by writing them on the board or the slides, and in this way establishing a clear link between the reading and the lecture. This teaching strategy would also increase the exposure to terms which would positively affect term learning.

In addition, teachers should be aware that students tend to underestimate learning from reading and do not understand the differences between learning from different media (White et al., 1995). Teachers should thus explicitly explain how different types of knowledge are learnt in different contexts (Biggs & Tang, 2011; Bligh, 2000) and that the benefits of different learning activities are not always immediately apparent. They should also stress the relevance and benefits of learning from reading and encourage students to read. Perhaps a simple solution for this could be to refer more frequently to assigned reading in their lectures, which is something lecturers do little of (Shaw et al., 2010). The lecturer could, for example, explicitly refer to a section in the textbook where a particular concept is discussed, or use particular passages, graphs, or examples from the textbook to discuss the content in the lecture. Simply naming the textbook as a source of knowledge for the subject might make it

more relevant to the students and motivate them to read it. However, the lecturers should also avoid using lectures as mere summaries of the reading, as this teaching strategy is not conductive to student reading. In what order reading and attending the lecture is done, however, can depend on the lecturer and the purpose of the lecture. If the lecture's effectiveness depends on the students reading beforehand, then students should, of course, be encouraged to do the reading before the lecture.

All in all, university students attending parallel-language courses would benefit from explicit explanations of goals and benefits of different learning activities and from more connections between different contexts of learning.

References

Ammon, U., & McConell, G. (2002). *English as an academic language in Europe: A survey of its use in teaching*. Frankfurt am Main: Peter Lang.

Anderson, J. R. (2000). *Learning and memory: An integrated approach* (2nd ed.). New York: John Wiley & Sons, Inc.

Beaman, C. P., & Morton, J. (2000). The separate but related origins of the recency effect and the modality effect in free recall. *Cognition, 77*, B59–B65.

Benjamin, A. S. (2007). Memory is more than just remembering: Strategic control of

encoding, accessing memory, and making decisions. *The Psychology of Learning and

Motivation*, *48*, 175–223.

Biggs, J., & Tang, C. (2011). *Teaching for quality learning at university: What the student

does* (4th ed.). Maidenhead: Open University Press.

Björkman, B. (2014). Language ideology or language practice? An analysis of language

policy documents at Swedish universities. *Multilingua*, *33*, 335–365.

Bligh, D. A. (2000). *What's the use of lectures?* San Francisco: Jossey-Bass.

Brown, J. D. (2004). Research methods for applied linguistics: Scope, characteristics, and

standards. In A. Davies & C. Elder (Eds.), *The handbook of applied linguistics* (pp. 476–

500). Oxford: Blackwell Publishing.

Burchfield, C. M., & Sappington, J. (2000). Compliance with required reading assignments.

Teaching of Psychology, *27*, 58–60.

Chang, J. (2006). Globalization and English in Chinese higher education. *World Englishes*,

25, 513–525.

Chevins, P. F. D. (2005). Lectures replaced by prescribed reading with frequent assessment:

Enhanced student performance in Animal Physiology. *Bioscience Education E-journal

(BEE-j)*, *5*.

Chia, H.-U., Johnson, R., Chia, H.-L., & Olive, F. (1999). English for college students in

Taiwan: A study of perceptions of English needs in a medical context. *English for

Specific Purposes*, *18*, 107–119.

Costin, F. (1972). Lecturing versus other methods of teaching: A review of research. *British

Journal of Educational Technology*, *3*, 4–31.

Gardiner, J. M. (1983). On recency and echoic memory. *Philosophical Transactions of the Royal Society of London*, *Series B*, *Biological Sciences*, *302*(1110), *Functional Aspects of Human Memory*, 267–282.

Gibbons, J. A., Velkey, A. K., & Partin, K. T. (2008). Influence of recall procedures on the modality effect with numbers and enumerated stimuli. *The Journal of General Psychology*, *135*, 84–104.

Graddol, D. (2006). *English next*. London: British Council.

Harvey, A. J., & Beaman, C. P. (2007). Input and output modality effects in immediate serial recall. *Memory*, *15*, 693–700.

Hellekjær, G. O. (2009). Academic English reading proficiency at the university level: A Norwegian case study. *Reading in a Foreign Language*, *21*, 198–222.

Huckin, T., & Coady, J. (1999). Incidental vocabulary acquisition in a second language. *Studies in Second Language Acquisition*, *21*, 181–193.

Hustijn, J. H. (2001). Intentional and incidental second language vocabulary learning: A reappraisal of elaboration, rehearsal and automaticity. In P. Robinson (Ed.), *Cognition and second language instruction* (pp. 258–286). Cambridge: Cambridge University Press.

Josephson, O. (2005). Parallellspråkighet [Parallel-language use]. *Språkvård*, *1*, 3.

Landrum, R. E., Gurung, R. A. R, & Spann, N. (2012). Assessments of textbook usage and the relationship to student course performance. *College Teaching*, *60*, 17–24.

Lei, S. A., Bartlett, K. A., Gorney, S. E., & Herschbach, T. R. (2010). Resistance to reading compliance among college students: Instructors' perspectives. *College Student Journal*, *44*(2), 219–229.

Malmström, H., Mežek, Š., Pecorari, D., Shaw, P., & Irvine, A. (submitted). Pathways to acquiring second-language academic and disciplinary discourse: Exposure to technical terminology in the parallel-language classroom.

Mežek, Š. (2013a). *Advanced second-language reading and vocabulary learning in the parallel-language university* (Doctoral dissertation). Stockholm, Sweden: Department of English, Stockholm University. Available at http://urn.kb.se/resolve?urn=urn:nbn:se:su:diva-94766

Mežek, Š. (2013b). Learning terminology from reading texts in English: The effects of note-taking strategies. *Nordic Journal of English Studies*, *13*(1), 133-161.

Mežek, Š. (2013c). Multilingual reading proficiency in an emerging parallel-language environment. *Journal of English for Academic Purposes*, *12*, 166-179.

Nation, I. S. P. (2001). *Learning vocabulary in another language*. Cambridge: Cambridge University Press.

Paribakht, T. S., & Wesche, M. B. (1993). Reading comprehension and second language development in a comprehension-based ESL program. *TESL Canada Journal*, *11*(1), 9–29.

Paribakht, T. S., & Wesche, M. (1997). Vocabulary enhancement activities and reading for meaning in second language vocabulary acquisition. In J. Coady & T. Huckin (Eds.), *Second language vocabulary acquisition: A rationale for pedagogy* (pp. 174–200). Cambridge: Cambridge University Press.

Pecorari, D., Shaw, P., Irvine, A., & Malmström, H. (2011a). English for Academic Purposes at Swedish universities: Teachers' objectives and practices. *Ibérica*, *22*, 55-78.

Pecorari, D., Shaw, P., Malmström, H., & Irvine, A. (2011b). English textbooks in parallel-language tertiary education. *TESOL Quarterly*, *45*(2), 313-333.

Pecorari, D., Shaw, P., Irvine, A., Malmström, H., & Mežek, Š. (2012). Reading in tertiary

    education: Undergraduate student practices and attitudes. *Quality in Higher Education*,

    18(2), 235-256.

Sappington, J., Kinsey, K., & Munsayac, K. (2002). Two studies of reading compliance

    among college students. *Teaching of Psychology*, *29*, 272–274.

Shaw, P., Irvine, A., Malmström, H., & Pecorari, D. (2010). Intertextual episodes in lectures:

    A classification from the perspective of incidental learning from reading. *Hermes –*

    Journal of Language and Communication Studies, *45*, 115-128.

SPSS Inc. (2010). IBM SPSS Statistics, Version 19. Chicago: SPSS Inc.

Taillefer, G. F. (2007). The professional language needs of Economics graduates: Assessment

    and perspectives in the French context. *English for Specific Purposes*, *26*, 135–155.

Wächter, B., & Maiworm, F. (2008). *English-taught programmes in European higher*

    education: The picture in 2007. Bonn: Lemmens.

Ward, J. (2001). EST: Evading scientific text. *English for Specific Purposes*, *20*, 141–152.

White, R., Gunstone, R., Ekerman, E., Macdonald, I., McKittrick, B., Mills, D., & Mulhall, P.

    (1995). Students' perceptions of teaching and learning in first-year university physics.

    Research in Science Education, *25*, 465–478.

Zhang, X. (2013). The *I don't know* option in the Vocabulary Size Test. *TESOL Quarterly*,

    47, 790–811.