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READING COMPREHENSION OF SUBJECT-SPECIFIC TEXTS IN A FOREIGN LANGUAGE: THE ROLE OF BACKGROUND KNOWLEDGE

ABSTRACT

This study investigates the patterns used by economics and business students in reading comprehension (RC) of subject-specific texts in a foreign language (FL), particularly in relation to their use of background knowledge (BK). The think-aloud (TA) method was used and the data were derived from readers' verbal protocols. The coding of protocols yielded seventeen coding categories. The results were analysed and compared between two groups: one with high and one with low knowledge as determined by a prior BK assessment. The coding data were linked to the reading comprehension test results and typical patterns were established. Readers with high BK used more correct paraphrasing, inferencing, elaboration, and evaluation. In contrast, readers with low BK took more of a local approach to reading by focusing more on individual words. They frequently used English in their Slovene think-alouds, produced wrong and approximate paraphrases, and signalled lack of understanding. The article closes by examining implications for FL reading instruction and developing disciplinary literacy.

Keywords: *reading comprehension, foreign language, background knowledge, think-aloud method, subject-specific texts, disciplinary literacy*

BRALNO RAZUMEVANJE STROKOVNIH BESEDIL V TUJEM JEZIKU: VLOGA STROKOVNEGA PREDZNANJA – POVZETEK

Študija obravnava vzorce, ki jih študenti ekonomskih in poslovnih ved uporabljajo v procesu bralnega razumevanja strokovnih besedil v tujem jeziku, zlasti v povezavi z rabo strokovnega predznanja. Uporabili smo metodo glasnega razmišljanja ob branju. Bralne protokole smo kodirali in določili 17 kodirnih kategorij. Rezultate smo primerjali med dvema skupinama bralcev z različnim predznanjem, ki smo ju določili s testom strokovnega predznanja. Podatke smo povezali z rezultati testa bralnega razumevanja in poiskali ključne vzorce. Bralci z boljšim strokovnim predznanjem so pogosteje uporabili pravilno parafraziranje, sklepanje, pojasnjevanje in vrednotenje. Na drugi strani pa so bralci s šibkejšim strokovnim predznanjem pogosteje uporabili lokalni pristop k branju, s tem da so se bolj osredinili na posamezne besede. Pri tem so med rabo slovenskega jezika vključevali angleške izraze ter nepravilne ali približne

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parafraze. Pogosteje so tudi opozorili, da prebranega ne razumejo. Na podlagi izsledkov sklenemo štu-dijo z nekaj napotki za poučevanje bralnega razumevanja v tujem jeziku in razvijanje disciplinarne pismenosti.

Ključne besede: *bralno razumevanje, tuji jezik, predznanje, metoda glasnega razmišljanja, strokovna besedila, disciplinarna/strokovna pismenost*

INTRODUCTION

Tertiary education settings typically require disciplinary literacy in foreign languages, in particular English as a foreign language (EFL). Efficient FL reading is strongly linked to students' academic performance and has attracted attention both theoretically and empirically. On the theoretical front, a number of reading models have been proposed. Process models define and explore reading with respect to the cognitive processing it entails, either bottom-up (Gough, 1972), top-down (Goodman, 1967), or interactive (Just & Carpenter, 1987; Rayner & Pollatsek, 1989). On the other hand, componential models focus on the components of reading performance or the skills that reading requires on the part of the reader (Coady, 1979; Bernhardt, 1991). Componential models of FL reading have turned out to be especially conducive to subsequent empirical research.

The design of empirical reading studies stems from the fact that reading is an invisible cognitive process that can only be approached in an indirect way by observing the way readers read or examining what readers have gained through reading. In other words, the focus is on either the process or the product of reading. Outcomes or products of reading have been typically investigated with quantitative studies that tend to operationally define reading comprehension as a score on a reading comprehension test. Process approaches to reading investigate observable features of reading, such as the readers' eye-fixations or pauses, assuming that these indicate various aspects of the reading process taking place. Nevertheless, there are clearly limitations to what one can infer about reading processes on the basis of observable features of silent reading. Introspective (think-aloud) methodology has been developed and refined (Ericsson & Simon, 1993; Pressley & Afflerbach, 1995; Israel, 2015; Bowles, 2010) to deal with the "unobservable" elements of reading comprehension, especially higher-level processes.

Reading comprehension results from a combination of three sets of factors: a) text input, b) readers' cognitive processes, and c) readers' background knowledge (Grabe, 2009; Grabe & Stoller, 2013). In FL reading, the knowledge factor also involves linguistic knowledge. According to Koda (2005, p. 4), "comprehension occurs when the reader extracts and integrates various information from the text and combines it with what is already known." When reading a text, readers build their own mental model of the text, which contains the most important propositions of the text that readers integrate with their background knowledge. This model has been referred to as the situation model of interpretation (Kintsch, 1998).

Background knowledge

To the texts they read, readers bring various sources of knowledge, linguistic and non-linguistic, both of which affect the processes and products of their reading comprehension. Grabe (2009, p. 74) divides non-linguistic knowledge, also referred to as background knowledge, into four subcategories: a) general knowledge of the world, b) cultural knowledge, c) topical knowledge, and d) specialist expertise. Shanahan (2017) refers to *specific domain knowledge* or *discipline knowledge* as crucial in disciplinary reading, despite interacting with other concepts and skills. A number of empirical studies to date have focused on the contribution of knowledge to FL reading comprehension. Nassaji (2007) observed that they largely focused on the quantitative aspects of knowledge-based processes rather than on the qualitative exploration of how these processes operate. Yamashita (2002) spelled out the need for more process-oriented studies and mixed studies.

The results of empirical studies exploring background knowledge are affected by how BK is operationalized, and it is worth noting that the majority of studies so far have used indirect BK measures. More specifically, BK has been measured through: a) readers' self-assessment of content familiarity (Brantmeier, 2003; Pulido, 2007; Leeser, 2007; McNeil, 2010; Eidswick, 2010; Lahuerta Martinez, 2013; Horiba & Fukaya, 2015), b) readers' study discipline, (Lee, 2007; Hill & Liu, 2012), c) a combination of familiarity assessment, study discipline and some other indirect factor (Clapham, 1996; Krekeler, 2006) or d) free introspection on a given topic (Bernhardt, 1991). Only a handful of studies to date have used direct measures of BK by testing it (Uso-Juan, 2006; Kelly, 2014; Erçetin, 2019). It is worth noting that readers' self-assessment of either their topic familiarity or disciplinary knowledge is a subjective, imprecise measure of BK. The assessment of BK should be objective, matched to the specific text. According to Clapham (1996, p. 199), the RC texts should be evaluated for specificity by subject experts.

The insights into the potential limitations arising from the operationalization of BK and text-specificity assessment motivated the research design of this study in several ways. First, BK was measured directly through a test of BK designed by subject experts targeting specific BK related to the texts; second, RC texts were assessed for specificity and selected by subject experts; third, the TA methodology was selected to get a better picture of how readers with different levels of background knowledge read discipline-specific texts and what strategic patterns readers use.

THINK-ALOUD METHODOLOGY

The think-aloud methodology was developed to provide insights into the cognitive processes involved in problem-solving and reading. Pressley and Afflerbach (1995) describe it as a methodology for "examining thought in action." Ericsson and Simon (1993) find data obtained from verbal protocol analysis to be a particularly good source for studying the cognitive processes and strategies involved in reading comprehension. They make

a distinction between concurrent reports, and retrospective verbal reports. *Concurrent reports,* also referred to as *TA protocols*, reveal the subject's verbalization taking place simultaneously as they are processing textual information. In contrast, *retrospective verbal reports* involve reporting with a time lapse after the task completion. This implies that retrospective reports rely on accurate memory, which may affect the subject's processing (Bowles, 2010). For this reason Ericsson and Simon (1993) find concurrent protocols to have superior validity compared to the retrospective ones.

Despite acknowledging the benefits of the TA methodology, questions have been raised regarding its validity, especially with respect to *veridicality* and *reactivity* (Bowles, 2010). *Veridicality* refers to the degree to which TA protocols truly and accurately reflect the subjects' processing due to the delay between reading and verbalizing. *Reactivity* relates to the effect of additional tasks (i.e. verbalizing) on readers' processing. In other words, does reading while verbalizing differ from silent reading? If yes, to what extent do readers' verbalizations differ from the actual process of silent reading? Lower-level processes, such as letter and word recognition, are fully automatized in skilled readers, and so they are consciously inaccessible to subjects' conscious reporting. Ericsson and Simon (1993) pointed out that this may be different for higher-level processes if reading speed is slowed down by techniques that allow for concurrent verbalization, such as presenting texts sentence by sentence, or prompting the reader to stop and report at certain points. In addition to this concern, subjects' thinking aloud may depend on subjects' verbal skill. To minimize this effect, Ericsson and Simon (1993) suggested that subjects should be allowed to think aloud in their first language. These concerns have been scrutinized and tested in a number of studies that have found support for the validity of the TA method (Bowles, 2010; Leow & Morgan-Shrot, 2004). Theoretical and empirical investigations of TAs as a research tool have generated a series of guidelines for using TAs. Pressley and Afflerbach (1995) emphasised three factors: maintaining the concurrency, encouraging reporting rather than interpreting or justifying, and neutral instructions without prompting particular cognitive behaviours. These guidelines have been taken on board in the research design of this study.

RESEARCH DESIGN

Participants

The study was designed to include three groups of participants: students, subject experts, and language experts. Forty-six students from the School of Economics and Business, University of Ljubljana (Slovenia) took part in the study, of which 24 took part in the main TA study (16 females and 8 males) in 2011, and the rest in the preliminary studies aimed at trialling instruments used in the study. Students were 21 to 22 years of age and the sample was homogeneous with regard to their first language, FL, and study discipline. Their level of proficiency in English could be assessed as level B2 of the Common European Framework of Reference for Languages (Council of Europe, 2001).

The focus on highly specialized BK and the aim of maintaining ecological validity necessitated the involvement of subject experts at all stages. More precisely, five subject experts were involved in: a) the text selection, b) the reading test design and item-writing, c) the coding, assessment, and validation of answers as part of the analysis of the results, and d) the interpretation of findings. All five subject experts held PhDs in finance. Seven language experts were involved in the validation procedure of the grammar test. All of them held PhD or MA degrees.

Key variables and instruments

Reading Comprehension (RC) was operationalized as a score on a RC test of three subject-specific texts selected by subject experts consisting of 17 short-answer questions. The RC test was developed and piloted in several steps. The main subject expert selected 11 articles taken from the *Journal of Finance*, the *Journal of Financial Economics*, the *Financial Management*, the *RAND Journal of Economics* and *The Economist*. They were evaluated by the expert panel, which made the selection according to five criteria: text specificity, appropriateness, familiarity, provision of new knowledge, and explanation of concepts. Because the specificity of articles critically influences the effect of BK on RC (Clapham, 1996), it was decided that "specificity" would be the primary selection criterion. The texts were tested for their readability by calculating two readability indices: the Flesch Reading Ease and the Gunning Fog Index. Test specifications and RC items were written jointly by financial experts. After piloting the test and carrying out item and test statistical analyses, the number of texts was reduced to three.

Background knowledge (BK) was operationalized as a score on a test of knowledge of finance. A test consisting of 14 short-answer questions was developed in conjunction with financial experts according to test specifications and the results of the preliminary trial. The test taps into students' knowledge of specific financial concepts deemed by subject experts to be of key importance for in-depth RC of the selected texts. Care was taken not to confound the variables by including items that would overlap with items from the RC test.

Grammar knowledge (GK) was operationalized as a score on a test of grammar knowledge consisting of 30 multiple-choice questions. The test was based on a modified and validated version of the TEEP test battery (*Test of English for Educational Purposes*), also referred to as the *Test of English for Academic Purposes* (TEAP).

The test battery had to be controlled for the number of items and the length of administration in order to avoid the effect of fatigue on the participants. The disciplinary vocabulary test was not included in the test battery to refrain from an overlap with items from the BK test.

DATA COLLECTION AND PROCEDURE

After preliminary studies aimed at piloting the instruments used in the study, the test battery was administered separately to each of the 24 students involved in the main TA study. Students were told the general aim of the study. First they were asked to do the GK test, followed by the BK test. Then they were given a short training session in the TA procedure and they proceeded to reading texts while thinking aloud, which was completed by doing the RC test after reading each text. The sequence of the three texts used for RC was randomly varied among students to eliminate the sequence effect. Verbalizations were obtained through *prompted (pause) protocols* (Cavalcanti, 1987), which require subjects to verbalize at points marked in the text. This type of thinking aloud ensures that subjects regularly report their thoughts, thus allowing for the concurrency of reporting. Neutral instructions were used without prompting that could elicit data of a particular kind. The aim was for verbalization representative of natural unbiased processing.

ANALYSIS

The TA protocols of three texts produced by 24 readers were transcribed verbatim and were coded by two coders: the key financial expert involved in the study and the author. Coding was applied as "a method that enables researchers to organize and group similarly coded data into categories because they share some characteristic – the beginning of a pattern" (Saldaña, 2013, p. 9). The coding scheme was devised directly from the TA protocols and was data-driven. Several TA coding taxonomies were consulted (Haarstrup, 1991; Pressley & Afflerbach, 1995; Yamashita, 2002; Nassaji, 2003; Bråten & Strømsø, 2003). The TA coding scheme was refined after a coding pilot and subsequent discussion with the finance expert. All protocols were coded with modified categories and 10% were also coded by the finance expert. The two sets of coded protocols were compared to test the reliability of the TA coding scheme. All differences were discussed on a case-by-case basis in three joint sessions by the main coder and finance expert, and a 100% agreement was reached.

RESULTS

The following 17 categories emerged in the pilot study and comprise *the TA coding scheme* that was used in the main study.

Code 1: Correct paraphrase (CP)

This coding category refers to instances when readers correctly understand a phrase, clause, sentence, or section of the text. They paraphrase it, use synonyms or translate it correctly. Readers activate the correct linguistic and background knowledge from their long-term memory.

Text: […] the first movie to issue shares which will be tradeable […]

Think-aloud: *It will be the first film 'to issue shares,' they will launch shares that will be 'tradeable,' yeah, they will be listed on the market.* (TA4, BRR)

Code 2: Approximate paraphrase (AP)

Readers fail to grasp the full meaning of a phrase, clause, sentence, or section of the text, but they show partial understanding. This suggests that when reading, they retrieve some relevant linguistic or background knowledge from their long-term memory, yet fail to fully comprehend the phrase, clause, sentence, or section of the text.

Text: Equity based pay […]

Think-aloud: *Pay which is based on the ownership of managers.* (TA2, TS)

Code 3: Wrong paraphrase (WP)

Readers produce a wrong paraphrase of the phrase, clause, sentence, or section of the text when thinking aloud. This category could also be labelled *wrong schema activation* or *distortion* because readers come up with a paraphrase that is based on either their lack of background knowledge or incorrect background knowledge.

Text: From cinema to parking fines, almost everything is being securitized.

Think-aloud: *From cinema, aaaam, tickets to parking, almost all things are insured.* (TA4, BRR)

Code 4: Correct translation (CT)

Readers focus only on one word and give the correct translation of the word into Slovene.

Text: Default on payment.

Think-aloud: *Not paying.* (TA23, BRR)

Code 5: Approximate translation (AT)

Readers focus only on one word and provide a partially correct translation of the word into Slovene.

Text: Stock options.

Think-aloud: *Bonds.* (TA12, TS)

In this case, the reader appears to know that "bonds" and "stocks" are both types of securities. However, because bonds and stocks are securities with distinctly different properties, the reader's translation is coded as approximate.

Code 6: Wrong translation (WT)

Readers focus on one word and translate it incorrectly. This could be related to readers' lack of either linguistic or background knowledge. In other words, readers may either not be familiar with a particular word or the concept it stands for.

> Text: Default.
>
> Think-aloud: *Delay.* (TA17, BRR)

Code 7: Elaboration (ELAB)

This category covers instances when readers build connections between ideas in the text and their personal experience and knowledge by providing an additional explanation of what they have read or by giving examples, associations, and analogies in reaction to the text.

> Text: There may be moral issues of different sort as well. 'What happens if the star is caught molesting kids?' asks Paul Taylor, of Duff & Phelps, a bond-rating agency.
>
> Think-aloud: *Moral issues. I'm thinking about Slovenia, it is the same here – a firm sponsors a celebrity, and then he does something stupid and tarnishes the image of the company. This is something pretty similar.* (TA8, BRR)

Code 8: Evaluation (EVAL)

This category is coded if readers focus on the worth of what has been processed by offering their opinions, feelings, approval, disapproval or criticism. Readers react evaluatively and make a value judgement about the content of the text or its style.

> Text: Investors got an 8% yield on bonds rated on investment grade.
>
> Think-aloud: *Investors got 8% interest on these papers. That's not at all bad.* (TA13, SS)

Code 9: Guessing (GUES)

Readers assign the meaning of the information in the text randomly and do not show the reasoning or logic behind their choice. They build understanding without drawing on knowledge. According to Comer (2012), this category could also be described as "unexplained guessing" and is a differentiating characteristic of guessing vs inferencing. Whereas guessing is random and unexplained by the reader, inferencing is reasoned and explained (Tavakoli & Hayati, 2011).

> Text: We cannot know if boards expect or condone these sales.
>
> Think-aloud: *Well, they expect or find this normal. Condone - keep, probably.* (TA10, TS)

Code 10: Inferencing (INFR)

The category is coded when readers relate information encountered in the text to their knowledge, both linguistic and content. The interpretation they come up with is a result of readers' reasoning and conclusions about the text. This category was defined by Haarstrup (1991, p. 13) as "making informed guesses."

> Text: Mortgage payment […]
>
> Think-aloud: *Mortgage is something to do with loans. You borrow something. So they were more focused on borrowing than actually making money.* (TA4, BRR)

Code 11: Repair (REP)

Readers deliberately return to a particular word, phrase, clause, or sentence in the text in order to restate their think-aloud. With hindsight, they attempt to repair their understanding, and they may be successful or not.

> Text: Prior ownership […]
>
> Think-aloud: *It is about ownership. No, no, it is not present ownership but ownership in the past.* (TA2, TS)

Code 12: Signalling unknown word (SUW)

Readers explicitly point out that they do not understand a particular word. They may also overtly state that the word is new to them or is part of new or unfamiliar information in the text.

> Text: […] ultimately, returns will depend on sales of DVDs, calendars and other paraphernalia.
>
> Think-aloud: *I don't know what 'paraphernalia' is.* (TA3, SS)

Code 13: Signalling lack of understanding (SLU)

Readers say that they do not understand a phrase, sentence, or section of the text because it is either new or difficult in some way. They may refer to problems in comprehension, for instance the fact that they may understand individual words but fail to grasp the meaning of a sentence.

Text: There is barely a cash flow anywhere, it seems, that cannot be reassembled into a bond-like security that the most conservative of investors might buy.

Think-aloud: *There is no money, it cannot be 'reassembled,' collected 'into a bond-like security.' These most conservative investors would buy something. I understand every word but I don't understand everything together.* (TA11, BRR)

Code 14: Skipping (SKIP)

This coding category could also be termed as the lack of clarification. Readers omit thinking aloud about a word, phrase, clause, sentence, or section in the text. The reasons for skipping could be different – readers either do not understand something, or they may understand it but they want to move on.

Text: Bankers hope to bundle *this with other loans to entertainers and fully securitize it*, but this is proving hard to do.

Think-aloud: *Bankers would like to join* this *together, but* this *is difficult.* (TA3, BRR)

Code 15: Generalization (GEN)

Readers use relative or demonstrative pronouns and umbrella terms like "thing" or "matter" to avoid specific reference to a word or phrase in the text either because they do not know it or for some other reason.

Text: Equity investments

Think-aloud: Some *investments.* (TA14, SS)

Code 16: Monitoring comment (MONCOM)

Readers express their perceptions of the reading process and comprehension while making processing decisions. They comment on the text and how they process it. They may comment on how well they comprehend the text or what difficulties they encounter and how they deal with them.

Think-aloud: *I got lost.* (TA18, BRR)

Think-aloud: *So, I'm slowly understanding what 'bond' means.* (TA8, SS)

Code 17: Using English within a Slovene think aloud (EN)

Readers think aloud in Slovene, but they intertwine their Slovene TAs with words, phrases, clauses, or sentences in English.

Text: Moody's, a rating agency is considering downgrading Bowie bonds.

Think-aloud (Slovene): *Ta Moody's, ta* 'rating' *agencija premišljuje, da bo* 'downgrading'*, se prav, degradirala te Bowijeve obveznice.* (TA11, SS)

Think-aloud (English): *This Moody's, this* 'rating' *agency is thinking about* 'downgrading'*; that is degrading Bowie's bonds.* (TA11, SS)

After coding the verbal protocols of all 24 students, the coding frequencies were calculated. They were tabulated next to the students' scores on the RC, GK, and BK tests.

The TA data analysis addressed the following questions:
• How do readers with high or low BK read subject-specific texts?
• What are the differences in patterns/strategies that readers with high or low BK use in the process of RC of subject-specific texts?

In order to answer these questions, two groups of readers were formed (Table 1). The high BK group consisted of four students (TA10, TA16, TA17, and TA23), whose BK test scores were the best of 24, ranging from 31–40%. The low BK group comprised six students (TA3, TA4, TA9, TA14, TA15, and TA22) that had the lowest BK test scores of the 24 students, ranging from 2–7%.

Table 1: BK, RC, and GK test scores of high and low BK groups

	Students	BK test score %	RC test score %	GK test score %
High BK group	TA10	40	78	73
	TA16	33	63	90
	TA17	31	69	36
	TA23	33	41	80
Low BK group	TA3	2	76	53
	TA4	7	45	26
	TA9	5	51	56
	TA14	2	47	56
	TA15	7	47	50
	TA22	7	35	56
	Mean (N 24)	15.7	55.9	61.4

Comparison of processing patterns between high BK and low BK groups

After forming the high and low BK groups, the next step was to calculate and compare the frequencies of TA categories used by students in the two groups. Figure 1 shows the average coding frequencies for both groups in parallel bar charts. The following patterns were observed.
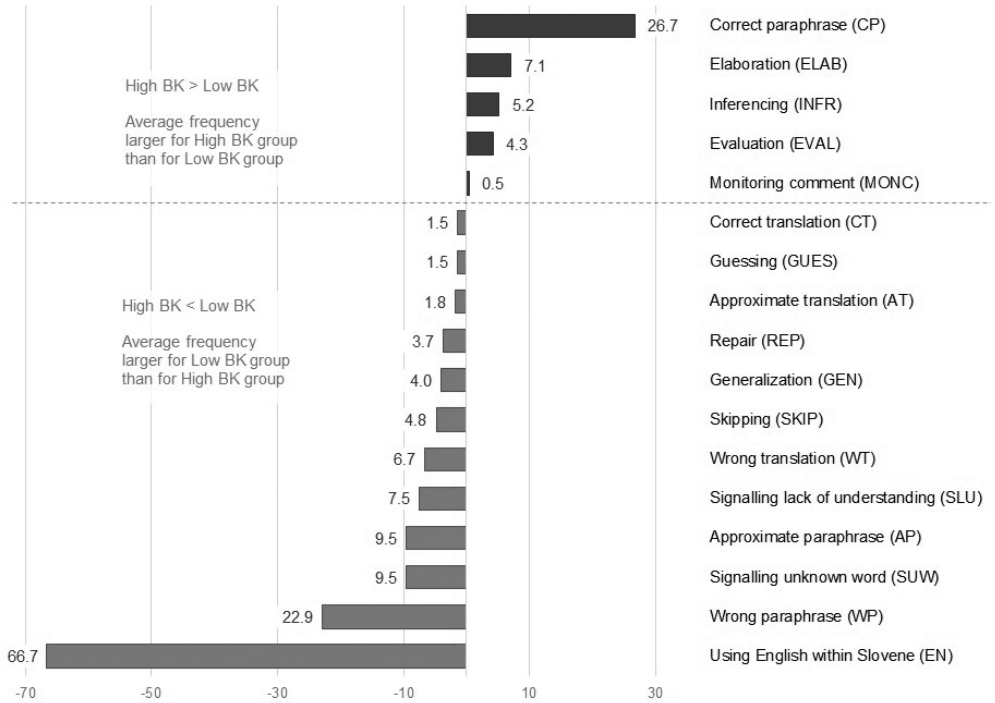
Figure 1: Average frequency of TA coding categories in high BK group and low BK group
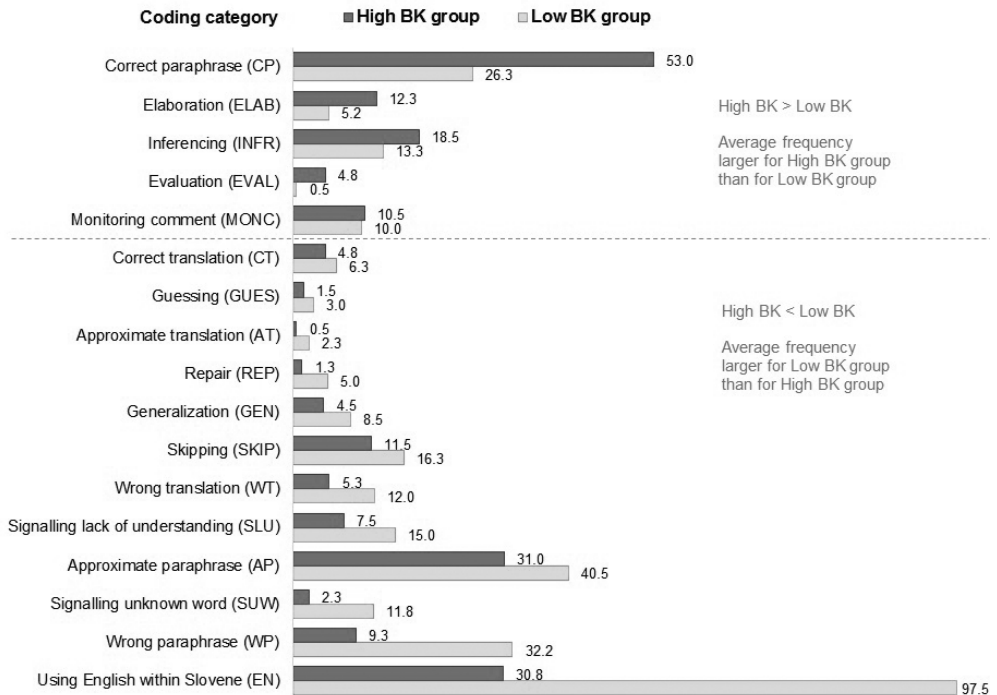
1. More correct paraphrasing and better RC test scores in the high BK group

The high BK group's better RC is shown not only by their better RC test scores compared to the low BK group (means: 62.75 vs 50.16) shown in Table 1, but also by the fact that correct paraphrasing (CP 53) ranks as the most frequently used coding category in the high BK group (Figure 1). CP was used 100% more by the high BK group compared to the low BK group (53 high BK vs 26.3 low BK), which clearly suggests better processing in the high BK group. This evidence corroborates the findings of prior studies that BK correlates with RC and that topic familiarity has a positive effect on comprehension (Chang, 2006; Bengeleil & Paribakht, 2004; Bråten & Strømsø, 2003; Leeser, 2007).

Figure 2: Differences in average frequencies of TA coding categories between high and low BK groups

2. More elaborations, inferences and evaluations in the high BK group

Figure 2 shows differences in average frequencies of the TA coding categories between the two groups with different BK. Five coding categories top right were more frequent in the high BK group, whereas all the remaining twelve categories in the lower left part of graph were more frequent in the low BK group. Apart from CP, high BK readers generated more INFR, ELAB and EVAL than low BK readers. Using these strategies is evidence of readers' use of their background knowledge when creating the situation model of text comprehension.

Inferencing involves "connecting the text with our memory resources that provide our BK" (Grabe, 2009, p. 68). Similarly, other authors have defined inferencing as external evidence of the interaction between the reader and the text, which shows what knowledge the reader brings to the text (Nassaji, 2004). Grabe (2009) distinguishes bridging and elaborating inferences that may be used for several purposes including: a) integrating new information with background knowledge, b) interpreting decontextualized information, c) synthesizing information from multiple sources, d) evaluating information in terms of readers' goals and attitudes, and e) understanding conceptually different information. The success of inferencing was found to depend on two elements: BK and textual clues (Hu & Nassaji, 2014; Cromley & Willis, 2016). Chang (2006) concluded that readers

generated less inferencing if they were reading on an unfamiliar topic and concluded that inferencing is facilitated by topic familiarity. This finding is supported by the results in the present study as the high BK readers produced not only more inferences but also more elaborations and evaluations than the low BK readers.

Inferences are related to *elaborations;* some authors actually list elaborations as a sub-category of inference and refer to them as "elaborating inferences" (Van Dijk & Kintsch, 1983; Grabe, 2009). A closer look at the elaborations used by readers in this study showed a dichotomy in the type of BK readers drew on and the relevance of elaborations in particular context. Some elaborations were clearly relevant to the text and showed that readers relied on the right BK that improved comprehension. If readers retrieved contextually relevant information from their long-term memory, they used it to analyse the text in their working memory and this facilitated their comprehension. Conversely, some elaborations were completely unrelated to the text and they did not appear to affect comprehension. In either case, relevant or not, elaborations show the manner in which readers integrate text information into their existing BK. But it is the congruence between the text base and readers' BK that facilitates better comprehension.

3. More local focus in the low BK group (CT, AT, WT)

The low BK readers focused approximately 100% more on individual words than the high BK readers (20.6 low BK vs 10.6 high BK) as indicated by the total of correct, approximate, and wrong translations. Out of 20.6 word translations in total, the low BK readers produced the majority of wrong translations (12) and these results along with their more pronounced focus on individual words suggest comprehension difficulties compared to the high BK readers. It appears that these problems resulted primarily from a combination of two elements: readers' lack of vocabulary and lack of BK.

4. More signalling unknown words, lack of understanding, skipping, and generalizations in the low BK group

The low BK readers signalled lack of understanding of words or sections of the text 200% more than the high knowledge readers (26.5 low BK vs 9.8 high BK). The low BK readers also skipped parts of the text more (16.5 low BK vs 11.5 high BK) and used more generalizations (8.5 low BK vs 4.5 high BK) than the high BK readers. This shows readers' awareness of their problems in the comprehension process. It is worth noting that the low BK readers kept more focus on the unfamiliar elements than high knowledge readers.

5. More use of English within TA in Slovene and more repair in the low BK group

Although both groups used a substantial amount of English within their think-alouds in Slovene, the low BK readers used English more frequently, actually by far the most frequently of all coding categories, outnumbering the high BK group by 200% (97.5 low BK vs 30.8 high BK). The TA data suggest that readers switched from Slovene to English for a variety of reasons. They may have failed to understand a word or a phrase, they may

have not found the word, phrase or sentence of particular importance for comprehension, or they may have wanted to speed up reading. The use of English within a verbal protocol in Slovene also appears to reflect the jargon of young Slovenes, which abounds in English words. The low BK readers also tried to repair their understanding more often than the high BK readers (5 low BK vs 1.3 high BK).

DISCUSSION

Model of reading comprehension

The results of this study provide evidence that building a coherent model of text comprehension involves the readers' ability to process and integrate information at the sentence, paragraph, and text level with the knowledge they possess. The TA evidence suggests that low BK readers took more of a local approach to reading. They attended to single individual words 100% more often than high BK readers as indicated by the totals of single word translations, either correct, approximate or wrong. Low knowledge readers tended to process the text word by word, they had difficulties in building connections between the parts of the text, they especially had problems to integrate new information or find the main idea. They may have understood parts of the text, but struggled to integrate them into a meaningful whole. Some readers were aware of their inability to see the bigger picture and build a coherent text model, so they expressed their frustration in their monitoring comments: "I understand every word, but I don't understand everything together" (TA11). Overall, these findings corroborate the results of studies that found support for the position that low knowledge readers focus more on the surface code and literal meaning (Chang, 2006, p. 177), they concentrate more on word and sentence level rather than text level (Yamashita, 2002; Nalliveettil, 2014), and they attend to local clues rather than global (Bengeleil & Paribakht, 2004).

Readers' local approach to reading appeared to be linked to their clinging to the text model of interpretation, also referred to as reading close to the text. According to Van Dijk and Kintsch (1983, p. 51), readers produce a text model and situation model of comprehension. The situation model is constructed from the text base and readers' knowledge, with inferences functioning as the links. In this study, high knowledge readers elaborated, inferred and evaluated more than low knowledge readers, thus creating their situation model of comprehension. However, there was a great variation among readers with respect to how much they elaborated, inferred or evaluated, a finding similar to Bråten and Strømsø (2003). This result appears to indicate the differences in depth of readers' BK.

Data analysis provides evidence for the conclusion that readers in this study showed variable level of *flexibility* in the reading comprehension process. Some readers were able to read selectively, go back and forth in the text to check information, and adjust their understanding. They may have skipped parts of the text they found unimportant or too difficult, and they came back to them later and changed their understanding. A flexible approach to reading is considered of central importance for effective processing both in general

reading (Pečjak, 1999) and in disciplinary reading (Brkan, 1997). In this study flexibility appeared to be closely related to readers' ability to tolerate the unknown and accept ambiguity. This means that readers were able to carry on reading with comprehension despite failing to understand every single word or sentence. It is also important to note that low knowledge readers seemed to be more fixated on what they did not know and they more frequently reported on what they did not understand. A key difficulty for readers was *parsing* or working out the grammatical structure of sentences, sentence elements and parts of speech. This was manifest in readers' problems to understand the relationships expressed in sentences and it crucially affected and impaired their comprehension. The parsing problem may have been related to the density of difficult words that some readers have commented on.

Background knowledge and vocabulary

The results in this study provide evidence for the position that readers' depth and breadth of background knowledge and vocabulary impacts their processing of subject-specific texts. Ash and Bauman (2017, p. 379) pointed out that "readers' general conceptual knowledge promotes or causes reading comprehension, not word knowledge per se. Instead, vocabulary knowledge is indicative of a reader's broader knowledge base about a topic and the words used to describe it." This suggests the relationship between vocabulary and reader's knowledge, whereby vocabulary without conceptual knowledge does not facilitate comprehension. This was manifest in a recurring pattern in this study. Readers may have found a word familiar but they did not know the meaning and concept behind the word, which impaired their understanding. An important implication for reading instruction can be drawn here: to facilitate effective comprehension, words in readers' lexicon should be paired up with broader conceptual knowledge in the discipline.

In their semantic processing, readers select content appropriate meaning (Koda, 2005). They match their knowledge to the text base and if there is *congruence* between the two, the comprehension is effective. This is particularly evident in cases when texts are challenging due to lexical, semantic and discourse complexities, as well as the amount of implied information. An expository text can be dense and have a high proportion of content words to function words; it can contain unexplained or new concepts. This challenges the readers and they react strategically. In this study the following patterns were observed.

- *Adjusting understanding*: When faced with a difficult or unknown word or sentence, some readers changed their interpretation as they read further and amended their understanding of the text. For example, readers interpreted "royalty" as "the royal family" but after reading on they realized that this meaning did not fit the context, so they changed the interpretation to "a type of payment", which corresponds to the financial context.
- *Clinging to wrong understanding*: Some readers clung to incorrect understanding even if a particular expression was explained in the subsequent text. For example, "security" was interpreted incorrectly to the context as "insurance" or "guarding" although the meaning did not make much sense in the context. Nevertheless, the readers stuck to this distortion.

- *Inconsistencies in understanding*: Some readers were inconsistent in their think-alouds. They randomly changed and switched their translations of the same expression as the text progressed.

To interpret the results related to vocabulary, I used Nation's (2001, pp. 198–199) classification of specialized vocabulary into three categories. *Category 1 technical words* or *terminological words* appear rarely if at all outside of the field (examples in this study: "equity", "exogeneous", "endogeneous", "imprimatur"). Nation links category 1 technical words to one's knowledge of disciplines by stressing that if you know a discipline, you know its terminology. The findings of this study provide evidence to support Nation's claim. Low knowledge readers found terminological words difficult and because terminological words are taken as an integral part of disciplinary knowledge, the low knowledge readers are disadvantaged in their reading comprehension.

The majority of readers in this study had considerable difficulties with *category 2 technical words* (Nation, 2001). These words are formally similar to high-frequency words but they also have specialised meanings and are used in and out of the field with a different meaning (examples in this study: "bond", "security", "default", "royalty", "options"). These words proved to be especially challenging for low BK students, as they would tend to use the non-specialized meaning of the word despite realizing that it was not quite appropriate in the context. For example, when thinking aloud about "bonds", they talked about "connections between people" rather than "special types of securities" in finance; to refer to "default", they used the meaning from IT rather than "non-payment" from financial context.

Category 3 technical words (Nation, 2001) seemed to be slightly less of a challenge for the readers. These words are used both inside and outside of the field and their specialized meaning can be accessed through non-specialized meaning (examples in this study: "downgrade", "share"). For instance, readers correctly drew a conclusion that if a share was "downgraded", this means that it was worth less. Similarly, "shares" were correctly interpreted as parts of ownership.

Implications for FL reading instruction

The findings of this study, particularly the patterns of RC used by high and low knowledge readers, have the following implications for FL reading instruction.

1. Although BK, including disciplinary knowledge, is not expected to be explicitly taught in FL reading instruction, it is beneficial for RC if readers' BK is activated by using advance organizers in pre-reading activities and by an appropriate training of strategies, especially lexical inferencing.
2. FL reading instruction should expose readers to ample quantities of discipline-specific print to provide opportunities for the readers to see how specialist knowledge is communicated through vocabulary, structure, and structural patterns of expository texts. Readers should be trained to use specialized reading skills and practices required for disciplinary reading. The goal is to develop disciplinary literacy and reader identity

that corresponds to the discipline so that readers approach texts as practitioners in the discipline.

3. Given the inextricable link between disciplinary knowledge and vocabulary, special attention in FL instruction should be paid to three categories of technical vocabulary (Nation, 2001). The results of the study indicated that especially category 2 technical words pose a major problem because of their multiple meaning in different contexts. With respect to these words, Nation (2008) suggests vocabulary-focused activities that relate technical uses of a word to its core meaning. Learners should become aware of the areas of overlap and the areas of difference between the technical and non-technical uses of the word. Instructors should present technical words together in organized ways through flow diagrams that stress the distinctions between words and their meanings.

CONCLUSION

This study explored how readers with different levels of BK read subject-specific texts, especially what strategies and patterns they use in the process of comprehension and how they build their model of text interpretation. By using the TA methodology, readers' processing patterns were elicited and analysed in relation to the text and deployment of readers' knowledge. The analysis of verbal protocols indicated how readers are challenged by disciplinary reading and how they fill the lexical or conceptual gaps in texts in order to make a coherent mental model of text comprehension. Readers' BK was found to facilitate RC if it was congruent with the text base, and if it was contextually relevant. The high BK group used more correct paraphrasing, inferencing, elaboration, and evaluation, whereas the low BK group showed more of a local and literal focus. They were less flexible and less successful in building a coherent text model.

The findings of this study refer to the development of disciplinary FL literacy and may have implications for FL reading instruction in academic settings. Efficient FL reading is associated with students' academic performance, but its impact may extend beyond the realm of tertiary education. As part of lifelong learning and language learning, it has potential to influence careers and lives of young adults.

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