Applying Neurocognitive Research in the Language Classroom: Potential Benefits of Using Metaphors in ESP Vocabulary Instruction[1]

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Abstract: *Conceptual metaphors (CMs) have been widely researched in the context of foreign language vocabulary organisation since Lakoff and Johnson introduced them in 1980. Since then, extensive research has been conducted in major European languages such as French, Dutch and German, including a focus on various applications of CMs in language teaching. Bilingual studies on CMs have mostly explored metaphors from the perspective of language universality, focusing on CMs that are found in both the target and source language. The results of these studies have shown that learners tend to benefit from raised metaphoric awareness, as evidenced by the effectiveness of vocabulary retention. However, when it comes to CM studies from the neurocognitive perspective, such studies are relatively scarce and further research into metaphor application is required. The aim of this article is to address this research gap and delineate the neurocognitive studies on CMs, with the end goal of proposing potential methods of implementing metaphors in ESP vocabulary instruction.*

Keywords*: ESP vocabulary; metaphor in language instruction; language teaching; neurocognitive approach; LSP teaching*

Introduction

Teaching and learning vocabulary, and the related challenges, have been the focal points of numerous research in teaching English as a foreign language, be it for general or specific purposes. One of the reasons for this, as stated by Yang and Dai (61), lies in "that second/foreign language learners rely heavily on vocabulary knowledge, and that a lack of vocabulary knowledge is the largest obstacle for second/foreign language learners to overcome". This is pronounced in "specialized English (where) the lexis focus is almost entirely on terminology" (Goranova 24), 'terms' denoting "word(s) with a specific meaning, within a specific field of knowledge and expertise" (Vrapi 24). As Coxhead (116) writes, "…a specialized word would have a narrow range of use within a particular subject area", therefore the "… everyday words with specialized meanings could present some difficulties for teachers as learners struggle to learn new meanings and concepts for words that are already

[1] This paper was funded under the project line ZIP UNIRI of the University of Rijeka, for the project UNIRI-ZIP-2103-18-22.

established in their lexicon in a particular way" (Coxhead 127). In addition to specialized vocabulary knowledge, the ability to display the general, 'everyday' communicative skills, alongside academic ones, plays a vital role in successful communication in a specific context (Goranova, 2023; Fălăuş, 2017; Gatehouse, 2001). Another issue arising from this are strategies for successful vocabulary teaching and learning, stemming from principles of language acquisition and conscious language learning (Krashen, 1981), which can be presented as implicit and explicit vocabulary teaching, the first being indirect, unconscious and contextual (Dakhi & Fitria 19) and the latter conscious and systematic (Dakhi & Fitria 20). A common form of explicit vocabulary teaching, rote memorization, "fails to provide language learners with any means of deeper understanding of the source material, which inevitably leads to eventual loss of (metaphoric) vocabulary" (Jelčić Čolakovac 146). Moreover, by reviewing relevant literature (Stevick (1976); Stevick (1982); Craik and Lockhart (1972); Baddeley (1990), Tumolo (482) concludes that "vocabulary instruction requires… systematization". According to Craik and Lockhart (677), memorization is related to the "depth of processing", meaning that "deeper analysis leads to a more persistent trace". Thus, Badr and Abu-Ayyash (165) mention "the superiority of semantic mapping over rote memorization". Another form of conceptualizing new lexis is presented through a widely discussed topic of metaphors. Jelčić Čolakovac (147) states that conceptualizing vocabulary through metaphors can help not only with learning new lexis, but also with memorizing the learnt one. Contemporary metaphor theories stem from Lakoff's (1993) proposition that metaphors are cross-domain mappings in the conceptual system, thus being seen as a matter of thought, rather than language, which was the case in classical theories of language, where metaphors were seen as linguistic expressions (Lakoff 1). With metaphors being a part of our conceptual, as well as linguistic systems, the need for raising metaphoric awareness and ensuring metaphoric competence in language learners is of great importance. As stated by Boers (553), learners are "bound to be confronted with figurative discourse at various stages of the learning process". Numerous researchers (Deignan, Gabryś & Solska, 1997; Vasiljevic, 2011; Cameron, 2003; Littlemore et al., 2011) have emphasised the need for raising metaphorical awareness and developing metaphoric competence, with Goranova (27) suggesting that "not only metaphoric competence in general should be developed, but that the educational effort should be aimed at developing metaphoric competence both at the level of lexis and thought".

This paper is concerned with the pedagogical implications of the neurocognitive findings on conceptual metaphors. Firstly, it provides a theoretical overview of the current neurocognitive research on metaphor.

Secondly, the findings of these studies are discussed from a pedagogical perspective. Finally, the paper provides a look at figurative language and conceptual metaphors in a Maritime English text, with the end goal of proposing a methodological frame for potential inclusion of neurocognitive findings on metaphor in an ESP vocabulary lesson.

Metaphor & language instruction

Numerous researchers (Jelčić Čolakovac, 2023; Boers, 2000; Deignan, Gabryś, Solska, 1997; Vasiljevic, 2011; Cameron, 2003; Littlemore et al., 2011; Goranova, 2023) have emphasized the importance of metaphoric awareness in language teaching and learning. As stated by Shao (134), the past decade has shown a "deep integration trend (of) cognitive linguistics and second language acquisition", claiming "it is of great practical value… to use cognitive linguistics knowledge to explore… strategies of metaphor in second language learning" (134). Despite the indications of advantages of metaphor-based approach to language teaching, Boussaid's survey found the majority of 255 teachers in question to be either unaware of the advantages of such approach or passively approving (98). Similarly, Veliz and Smith report comparable results for Chilean teachers of EFL, calling primarily for changes in their pre-service training (151). Conversely, in a study of university students' attitudes towards the metaphor-based approach to teaching and learning idioms, Pham Thai Bao describes them as "highly favorable" (122). Using (conceptual) metaphors in language teaching and learning has been widely researched, with generally positive feedback. Li (2017) presents "… better results in learners' short-term and long-term retention of English vocabulary…" when instructed via conceptual metaphor approach, as opposed to the traditional ones (659). Howe discusses both positive and negative effects of metaphors in L2 vocabulary acquisition, claiming that the awareness and knowledge of conceptual metaphors aid vocabulary comprehension and retention, but noting the possible interference of the first language "due to dissimilarities in the metaphors at conceptual level", as well as a "limited vocabulary size and depth" (4). Many studies (Yang, Hsieh, 2010, Lee, 2012, 2016; Kartal, Uner, 2017; Kalay, Keçik, 2023) have been conducted on the topic of cognitive or metaphor-based approach to phrasal verbs teaching. The studies report an overall positive effect of said approach to phrasal verbs memorization and retention, apart from Yang and Hsieh, who state "the positive effect of applying conceptual metaphor to teaching phrasal verbs by CS awareness method" (9), but find the "negative effect on phrasal verbs' memory retention" (1), due to "participants' learning experience, who only rely on memorization and are only taught… by memorization…" (1). Alongside the research on phrasal verbs, numerous studies have been conducted on using (conceptual) metaphors in teaching

idiomatic expressions. Since idioms "can be viewed as instances of conceptual metaphors… which are grounded in physical and social experience" (Vasiljevic 135), and "most English (and Chinese) idioms are motivated by conceptual metaphor in a systematic way" (Li 209), researchers (Vasiljevic, 2011; Samani and Hashemian, 2012; Pan, 2019) present an overall positive effect of using conceptual metaphors in teaching and learning idioms, with Shan stating that "…most students show great enthusiasm for the conceptual metaphorical approach and (are) eager to learn idioms without rote memory" (63) and Vasiljevic pointing out the positive effect of students' first language in presenting the "underlying concepts", which makes them "more likely to benefit from CM-motivated instruction…" (135). Moreover, and relating to ESP context, in their study of Iranian economics majors, Heidari, Dabaghi and Barati emphasize the advantage of "an explicit focus on source domains underlying conceptual metaphors, (which) can lead to more effective acquisition of vocabulary in ESP contexts" (101). Jelčić Čolakovac draws attention to "the prevailing absence of metaphoric language in the studied textbooks (… with special focus being placed on Maritime English textbooks…) (which points) to the need of ML [metaphoric language] inclusion in ESP materials" (153). Accordingly, Velasco Sacristán, alongside Silaški and Đurović, advocate raising metaphor awareness and integrating metaphor instruction into ESP teaching, proposing appropriate exercises for Business English learners and business and economics students respectively.

Metaphor in neurocognitive research

As Lakoff (2016) states, "the division between concrete and abstract thought is based on what can be observed from the outside" (134), 'concrete' being physical, visible entities, and 'abstract' invisible (134). He continues to claim that when it comes to the brain, all entities are 'physical', "because all thought and understanding is physical, carried out by neural circuitry" (134), hence "(the brain) is structured by thousands of embodied metaphor mapping circuits that create an extraordinary richness within the human conceptual system" (134). In recent years, neurocognitive research has provided insight into the "relationship" between our brain and how we comprehend and produce metaphoric instances of language. J.B. van Heuven and Dijkstra (2010) mention the positive aspects of the development of "noninvasive neuroimaging techniques", such as magnetic-encephalography (MEG), functional magnetic resonance imaging (fMRI), positron-emission tomography (PET), and event-related potentials (ERPs), alongside behavioural approach, especially in the bilingual context (105). The authors conclude that neurolinguistic approach offers "a completely new and promising dimension to bilingual research" (118). Siyanova-Chanturia, Canal and Heredia (2019) put focus on the ERPs method in non-literal language

context, stating that it is "(still relatively little known) about the electrophysiological markers involved in non-literal language processing", especially "in bilingual populations" (508). This method, as the authors discuss, can "inform us about the nature of the cognitive processes involved in a linguistic task, such as lexical/semantic, syntactic, or pragmatic processing difficulty" (513). Research based on the above-mentioned methods is presented below.

Several studies have been conducted on the topic of the difference between hemispheres in metaphor processing. Bottini et al. (1994) used positron emission tomography (PET) to study whether the right hemisphere has a pronounced role in metaphor processing, using metaphorical and literal sentences and lexical-decision tasks, inferring that "metaphor appreciation selectively activates the right hemisphere" (1250). In their fMRI study, Lai et al. (2016) propose that the right hemisphere (RH) does show a greater contribution to metaphoric language processing, but only because "relative to its contribution for processing literals, the LH [left hemisphere] contributes less" (31). Faust and Kenett (2016) study "impairments in semantic processing" in cases of Asperger syndrome and schizophrenia, where RH involvement is "reduced" or "excessive", respectively (41), concluding that "a delicate balance between the more rigid and the more chaotic aspects of semantic processing…" is necessary, leading to "semantic integration… (which) is achieved by hemispheric communication and structural and functional neurocognitive connectivity" (47).

Kazmerski, Blasko and Dessalegn (2003) study individual differences in metaphor processing using ERPs, surmising "…metaphors were more difficult to reject as literally untrue than were the scrambled controls consisting of the same topic and vehicle terms" (685), as well as IQ playing an evident role, where "(for higher IQ subjects) the metaphorical meaning appeared to be automatically activated", whereas "(lower IQ subjects) acted as if both metaphors and scrambled sentences were equally untrue" (686). Additionally, Lai, Curran and Menn (2009) study the neurological representation of conventional and novel conceptual metaphor processing using ERPs, stating that "(ERPs) can be effective in measuring processing effort from conceptual mappings" (146). The results point to more effort needed in conventional metaphors processing, despite being deemed "familiar and interpretable" (151), than in literal sentences processing, and additional effort in processing novel metaphors, rated similarly to anomalous sentences, "… unfamiliar and least interpretable" (151). In a later study (2013), the authors used ERPs to determine the role of conceptual mappings in the comprehension of metaphorical instances, alongside the meaning of said process. Using sentence and simile-priming and discussing the differences in the effect on metaphor comprehension, they describe mapping

as "…a process in which comparison plays a critical role, and (…) conventionality modulates the ease of this processing" (495). An additional perspective on the topic was provided by Park and Chung (2013), where the authors, using ERPs and adopting Lai et. al's (2009) "experimental materials" (611), discuss the potential differences in conventional and novel metaphor processing between L1 and L2 speakers (in the present study Korean learners of English language), deducing that:

> … the following scale of efforts held: literal < conventional metaphoric < novel metaphoric < anomalous… (where) Korean learners of English failed to make a meaningful resolution of the last three conditions, unlike L1 speakers who managed to resolve conventional metaphors meaningfully. (Park and Chung 624)

Similarly, Chen, Peng and Zhao (2013) provide a bilingual perspective on metaphor processing, showing that "… for Chinese-English bilinguals, the ERP effects elicited by English metaphors were different from those elicited by Chinese metaphors" (or literal sentences) (514). Siyanova-Chanturia (2013) proposes the method of ERPs, alongside eye-tracking method, as "…invaluable techniques in the study of the role that phrasal frequency and predictability play in natural language processing" (262), considering multi-word expressions, such as collocations and idioms, presented as "… highly familiar phrases that exhibit a certain degree of fixedness and are recognised as conventional by a native speaker" (246). Molinaro and Carreiras (2010) in their study of collocations use ERPs to determine the difference between expected and less expected endings in the linguistic strings, as well as contrast in their semantic (literal vs. figurative) aspects. Furthermore, Lai, Howerton and Desai in their ERP study on action metaphors (2019) discuss that metaphor processing is based in concrete semantics. Neurolinguistic approach has been applied in idiom processing, with Canal et al. (2017) studying "basic semantic composition" and "enriched meaning integration (in the sentential representation)" (28) in the processing of idioms, with results pointing to "sentence revision mechanisms… (being) involved in idiom meaning integration,… and (…) the literal semantic composition of the idiomatic constituents, (…) not (being) carried out after idiom recognition" (2). Laurent et al. (2006) used ERPs to study the salience of idiomatic expressions, showing that "… salient meanings are accessed automatically, regardless of figurativity" (151). Furthermore, Kessler, Weber and Friedrich (2021) use both ERPs and eye-tracking method to study idiom processing "by measuring their possible decomposition by means of semantic activation of individual idiom

components" (614), with participants "(building) up an expectation of the idiom-final word" (615).

Additional perspective on the eye-tracking method is provided by Carrol and Conklin (2017) in their study of idiom priming in an L1 and L2 context. The researchers have concluded that "the 'compositional by default' approach for non-native speakers may negate any possible idiom advantage in the L2 until much higher levels of proficiency are reached" (315), thus differentiating between the processing of form and meaning in non-native speakers. The eye-tracking method is further advocated by Köder and Falkum (2020) in their study on children's metonymy processing, proclaiming that "the gaze data indicated an early sensitivity to metonymy already from the age of 3 and a general improvement with age" (203). Filik et al. (2014) use the eye-tracking method, as well as ERPs, to study irony processing, summarizing their results as presenting "(an) on-going conflict between the literal and ironic meanings of the utterance component" (42) and being "most compatible with the graded salience hypothesis, which predicts differences between the processing of familiar and unfamiliar ironies" (42).

Vocabulary studies

As stated by numerous researchers (Vasiljevic, 2011; Lee, 2012, 2016; Samani and Hashemian, 2012; Kartal, Uner, 2017; Pan, 2019; Kalay, Keçik, 2023; etc.), raising metaphoric awareness in language teaching and learning, with an emphasis on vocabulary teaching and learning, aids to the comprehension and retention of linguistic units. When observed from the neurocognitive perspective, many studies (Molinaro and Carreiras, 2010; Siyanova-Chanturia, 2013; Lai et al., 2016; Faust and Kenett, 2016; Lai, Howerton and Desai, 2019, etc.) have applied a neurolinguistic approach to metaphor processing, with Lai, Curran and Menn (2009; 2013) discussing the difference in the processing of conventional and novel conceptual metaphors, while Park and Chung (2013), similar to Chen, Peng and Zhao (2013), provide a bilingual perspective. Similarly, Jankowiak, Rataj and Naskręcki (2017) shed light on the overlooked perspective on the topic. Using the ERP method, their study presents results on differences between N400 and late positive complex (LPC) responses in L1 and L2 unbalanced bilinguals, who completed a semantic decision task on literal, conventional, novel and anomalous verb-noun dyads in speakers' both L1 (Polish) and L2 (English). The language-specific contrast was observed in the reduced LPC responses initiated by conventional metaphors in L2, while the responses evoked by novel metaphors were reduced in both L1 and L2 (26). Furthermore, the differences were shown in the P200 and the early N400 time windows, denoting "… lower subjective frequency of L2 lexical items…" and "… less automatic lexical access, extended lexical search, as well as reduced

interconnectivity for L2 words" (26). Alongside studying the language-specific contrast, another aim was to examine the cognitive processes underlying the comprehension of metaphorical word sets, specifically related to the dyads' level of conventionality or novelty. The results indicate that more resource intensive lexico-semantic operations are involved in the processing of novel metaphors when they are compared to conventional ones in both languages (26). This finding brings forward the differences in processing of contrasting utterance types, regarding their conventionality (or novelty). As mentioned above, researchers (Lai, Curran and Menn, 2009; Park and Chung, 2013) have emphasized this matter, with overall results pointing to more cognitive effort needed in processing of conventional metaphors than literal utterances, and additional effort necessary in processing of novel metaphors than conventional metaphorical linguistic units. As Jankowiak, Rataj and Naskręcki (2017) observe, "… research into figurative language processing has repeatedly shown that metaphor processing is modulated by the level of conventionality…" (2), primarily due to the fact that novel metaphors "… require meaning construction…" and conventional metaphors "… meaning retrieval…" (25). A similar issue was brought up in Jankowiak, Naranowicz and Rataj's study (2021) on the processing of novel metaphorical instances in English-Polish bilinguals, with an emphasis on their presentation as novel nominal metaphors and novel similes (672). Using the similar methodology of ERPs and semantic decision task, the aim was to determine if "… novel meaning processing is facilitated by the comparison structure" (680). Even though novel metaphor processing "requires a more extended activation of long-term memory during the stage of lexico-semantic access… in L2…" (683), such meaning construction "… might rely on comparison mechanisms between the source and target domains (which) might be independent of language nativeness" (682), the role of (comparison mechanisms) which is "… more profound at the stage of meaning integration (in the case of L2)" (683)", similar to the effect observed by Lai and Curran (2013), where conceptual mapping is presented as "…a process in which comparison plays a critical role…" (495).

Regardless of the complexity of novel metaphorical language, when observed from the L2 perspective, conventional metaphorical language and difficulties in its processing in non-native speakers present implications for vocabulary teaching and learning. As stated by Werkmann Horvat, Bolognesi and Kohl (2021), most research has been conducted on the topic of idiom processing (447); however, the authors state that a literature review (Cameron, 2003; Holme, 2004; Steen et al., 2010; Bort-Mir et al., 2020) shows that"… the most common type of metaphorical expressions in everyday speech of L1 speakers are conventional metaphorical expressions…" (447). In their study of L1 Croatian speakers of English, they

used a semantic priming task in order to determine the differences in conventional metaphor processing between L1 and L2 and the existence of "… primacy of the literal meaning, compared to the metaphorical one, for L2 speakers" (452). The results indicate there are differences between conventional metaphors and literal language in the L2 lexicon (463), where the metaphorical semantic ties are weaker in advanced L2 learners when compared to native speakers (463). Similar to the conclusions from various research (Boussaid, 2023; Veliz and Smith, 2021), which show neglect of metaphor-based approach to language teaching, the results of the study in question "… confirm the importance of addressing this tendency identified in the classroom…" (462, 463), because metaphorical meanings have a different status in the L2 lexicon even when compared to context-dominant literal meanings (463). The authors thus propose "… the need for explicit teaching of metaphorical meanings of words that are extensions of literal meanings…" (463), placing an emphasis on the importance of type of linguistic instances presented in vocabulary teaching and learning. The effect of such explicit teaching methods has also been discussed in the ESP context, with Heidari, Dabaghi and Barati (2015) proposing a conceptual metaphor-based approach to vocabulary teaching.

Alongside the research questions discussed above, Werkmann Horvat, Bolognesi and Kohl shed light on the role of proficiency in metaphorical language processing. The participants were divided into an intermediate and advanced level of proficiency groups (454), with results showing that"… speakers of (the intermediate) level of proficiency are not proficient enough to be sensitive to subtle semantic cues that can produce a priming effect" (459), even though the advanced level group also showed differences in conventional metaphorical and literal language processing(463). The role of proficiency is additionally discussed in Carrol and Conklin's (2015) study of idiom priming in L1 and L2, pointing to higher levels of proficiency necessary for idiomatic language processing in L2. Accordingly, neurocognitive research methods might also be affected by the participants' level of proficiency and age, with Jankowiak, Rataj and Naskręcki (2017) proposing "… that brain mechanisms engaged when processing the non-native tongue may be less automatic when the foreign language was acquired later than the native tongue" (25), and Köder and Falkum (2019) discussing the role of age in metonymy processing from the eye-tracking method perspective.

ESP context: The Maritime English case

Nowadays learning vocabulary is seen as a stepping stone towards building a more proficient language learner. Boers and Lindstromberg state that "currently, a significant proportion of FLT theoreticians see learning

vocabulary, in the expanded sense of words and phrases, as being the key to attaining a high level of proficiency" (6). We argue in favour of raising general reading comprehension through a more effective vocabulary instruction, i.e. we propose the two are inevitably linked as suggested by the *aptitude* and *knowledge hypotheses* described by Anderson and Freebody (77, 81) where one's knowledge of the vocabulary unit must also involve some knowledge of the general context in which the unit is used (for example, if someone is familiar with the expression *to batten down the hatches*, then they should probably also know something about seamanship in general). According to Wright and Cervetti, who offered us a systematic review of the research on vocabulary instruction that impacts text comprehension, there are two possible approaches to supporting comprehension: (1) direct teaching of a set of word meanings, or (2) teaching strategies for making sense of unknown words during reading (205). When it comes to utilising conceptual metaphors in teaching ESP vocabulary and bearing in mind the findings of relevant neurocognitive studies, we believe explicit vocabulary teaching methods instead of mere communicative, meaning-centred instruction would yield better retention in learners. As mentioned earlier, in the case of figurative multiword expressions, the background motivation of a phrase is of particular relevance and directly impacts the chances of its later retention (Boers, Demecheleer, and Eyckmans 53).

Procedure

An article from *The Maritime Executive*, an online publication source featured on the list as one of the 15 most popular maritime magazines according to *Feedspot.com*, was chosen as an example of authentic text. *The Maritime Executive* encompasses a magazine, a website, a newsletter, and social media platforms to form the largest audience in the maritime industry. They also offer audio tapings for their articles, which provides opportunities for listening activities to be included in the lesson plans. No modifications have been done to the selected article apart from some visual adjustments (e.g. removal of in-text advertisements). The article was chosen for its topic (maritime-related), appropriate length (in case of real-life teaching scenarios the text would not need to be significantly abridged), and inclusion of different vocabulary (phrasal verbs, idioms, prepositions, etc.) that should lend itself easily to instruction from the neurocognitive perspective.

The selected text was analysed using the PIMS (*Procedure for the Identification of Metaphorical Scenes*) procedure proposed by Johansson Falck and Okonski (295). Unlike the earlier proposed methods of metaphor identification like MIP (*The Metaphor Identification Procedure*, Pragglejaz Group) or its extended version MIPVU (Steen et al., 2010) that, unlike MIP, differentiates between direct, indirect, and implicit metaphors, PIMS attempts

to also include metaphorically understood concepts expressed by single words. Johansson Falck and Okonski argue in favour of including the cognitive linguistic premise "that linguistic meaning is grounded in embodied experience, equal to complex conceptualizations (i.e., cognitive processing), and dynamic, encyclopaedic, and contextual in nature" (295). The PIMS procedure includes the following steps of metaphor identification (*adapted from* Johansson Falck and Okonski 303):

(1) Establishing the scenes and elements to be included (determining the type of scenes and concepts that are potentially involved);
(2) Establishing an understanding of the context (in case of written materials, read the text for understanding the analysed scenes);
(3) Establishing if the elements of a scene(s) only rely on direct understanding (for each scene/ element of a scene we determine if they can either a) be only directly understood or b) be understood by means of another, usually more basic, type of experience);
(4) Establishing scene or its element as metaphorical or non-metaphorical (based on results of Step 3, all a) cases will be categorised as non-metaphorical and all b) cases as metaphorical);
(5) Establishing ambiguous cases (cases where both a) and b) explanations are possible).

Keeping in mind our aim to provide a description of a practical application of neurocognitive findings on metaphor in an ESP vocabulary instruction lesson, we adapted the PIMS steps to fit into our research objective. We focused our efforts on different examples of vocabulary units that are frequently the central point of vocabulary lessons in EFL/ ESP contexts and then analysed them for the presence of conceptual metaphors. We then proposed methods of vocabulary instruction for different vocabulary units that underwent the PIMS analysis.

Results and analysis

The article we chose for our analysis is titled *Something Is Starting to Smell Fishy About the Global Seafood Supply Chain.* It is authored by Ian Urbina, the director of The Outlaw Ocean Project organisation that focuses on environmental and human rights concerns at sea. The article originally appeared in *Time* magazine and deals with the topic of human rights abuses in industrial fishing. In 873 words, it focuses on the working conditions of the labour force in seafood plants in Thailand, India and China and the problem with audits that have limited capacity in making sure the working conditions are kept up to their legal standards. In the PIMS analysis focus was placed on metaphorical cases while the non-metaphorical and ambiguous cases were omitted. In the following paragraphs we offer analyses of several

examples of vocabulary from the text that can, in our opinion, benefit from including conceptual metaphors in the instruction lesson.
Let us now take a look at our first example from the text:

(a) *The past half year has seen a steady stream of disturbing reports about serious human rights abuses tied to industrial fishing*. (Ian Urbina, *The Maritime Executive*)[2]

The article's introductory sentence showcases several metaphorical uses, the most evident one being the collocation *steady stream* ('a continuous flow of things or people', *Cambridge Dictionary Online*) and the phrasal verb *(to) tie someone to something/someone* ('to force someone to stay in a place', *Cambridge Dictionary Online*). A more in-depth analysis would also reveal the metaphorical use of the verb *see* or the noun *abuse*, but it is our belief that vocabulary instruction lessons should focus rather on what we label first-level metaphoric appearances (those likely to be identified by proficient L2 learners when asked to do so). In the case of the *steady stream* collocation, the first step in the instruction would be to make sure the learners are familiar with the literal meanings of each constituent (*steady* 'happening in a smooth, gradual, and regular way', *stream* 'any current of water or liquid', *Cambridge Dictionary Online*). Then, the instructor might find it facilitating to discuss the actual physical properties of water and its movement, since "real-world physical relations (…) can typically be directly understood by means of our body-world knowledge" (Johansson Falck & Okonski 305) and "abstract scenes, on the other hand, are typically understood by means of another type of experience" (306). Finally, the underlying metaphor will be introduced (FLOW OF EVENTS IS FLOW OF WATER). We presuppose here that the class has already been introduced to the concept of conceptual metaphors and the general role they play in motivating L1 and L2 vocabulary. At this point, the language instructor may opt to present other figurative vocabulary motivated by the same metaphor (for example, expressions like *go with the flow* 'to do what other people are doing or to agree with other people' or *against the current* 'different to the opinion or feeling that a group of people have', *Cambridge Dictionary Online*), and, in the case of EFL/ ESP scenario, relate the instructed L2 vocabulary to similar examples from the learners' L1 (for example, *(ići) protiv struje* 'go against the current' in Croatian). Let us now examine another example from the text:

(b) *Labor researchers, unions, academics and industry consultants have warned that these concerns will keep popping up until major buyers — in particular the restaurant and supermarket companies — decide*

[2] Retrieved from: https://maritime-executive.com/editorials/something-is-starting-to-smell-fishy-about-the-global-seafood-supply-chain Accessed Apr 1, 2024.

> *to fix their supply chains so that they know what is happening at every step along the way, from bait to plate.* (Ian Urbina, *The Maritime Executive*)[3]

In example (b), several instances of metaphorical use can be found. We will focus on the phrasal verb *(to) pop up* 'to appear or happen, especially suddenly or unexpectedly', the collocation *supply chain* 'the system of people and organisations that are involved in getting a product from the place where it is made to customers', and the expression *from bait to plate* 'a progression of seafood product traceability'. The phrasal verb *(to) pop up* can be explained through the metaphor EXISTENCE IS LOCATION UP HERE. In the text, concerns are the abstract concept that exists only if seen. The preposition 'up' suggests movement from a horizontal into a vertical, upright position. The instructor might also opt to introduce a wider context in which the vocabulary unit is used, for example *pop-up children's books*, to further illustrate the relationship between the verb and the preposition. The phrasal verbs are usually notoriously difficult for language learners because of the variety of prepositions they entail. By introducing orientational metaphors in a wider sense (such as the difference between the prepositions 'up' and 'down'), the learners would perhaps gain awareness of the fact that upward orientation is usually associated with positive evaluation and downward orientation with a negative one.

The collocation *supply chain* was interpreted through PIMS as being metaphorical since one collocational constituent ('chain') is not used in the literal sense of the word ('(a length of) rings usually made of metal that are connected together and used for fastening, pulling, supporting, or limiting freedom', *Cambridge Dictionary Online*). In this metaphorical case, the instructor can utilise the literal, non-metaphorical interpretations to help them establish a mental picture of what an actual chain might look like, and then start a discussion on which physical properties of a chain (e.g. strength, interlocked units, etc.) are potentially being used in creating the image of how the supply process in seafood industry works. At this point the underlying metaphor CAUSES AND EFFECTS ARE LINKED OBJECTS is introduced. The same metaphor could have been used in the case of the phrasal verb *(to) tie someone to something/someone* from Example (a).

The expression *from bait to plate* is especially interesting since it is an example of a novel phrase that requires the learners to be familiar with literal meanings of the noun constituents ('bait' – 'a small amount of food on a hook used to catch a fish' and 'plate' – 'a flat, usually round dish that you eat

[3] Retrieved from: https://maritime-executive.com/editorials/something-is-starting-to-smell-fishy-about-the-global-seafood-supply-chain Accessed Apr 1, 2024.

from', *Cambridge Dictionary Online*). Here, 'bait' is the starting position and 'plate' is the final one. The motion happens between these two locations and based on the wider context presented in the article, we can conclude that the traveller is the seafood. Hence, the expression is motivated by the CHANGE IS MOTION metaphor, i.e. CHANGE OF STATE IS CHANGE OF LOCATION metaphor. This example also shows that not only can metaphor be used in neurocognitive approach to vocabulary instruction, but other vehicles as well, such as metonymy (a figure in which a single word or property is used to refer to an entire group or collection which it describes). In our case, 'bait' is used to refer to the initial stage of fishing and catching seafood and 'dish' is used to refer to the final stage of food preparation and serving it to the end consumers of the product.

The success of the proposed approach to vocabulary instruction will primarily depend on the will of the instructor to surpass the traditional perspective on language instruction and to invest time in educating themselves on the recent findings from cognitive linguistics and neurolinguistics. It will also depend on the availability of appropriate teaching resource tools that are based on the neuroeducational perspective on teaching. What we have attempted here was to describe some of the possible ways of including metaphors in vocabulary instruction and, hopefully, we have shown that the neurocognitive approach to language instruction is indeed sustainable and may even result in more proficient language users, since, as Boers and Lindstromberg put it, "genuine form-focused teaching has the potential to speed up the elaboration of knowledge about, among other things, denotations, connotations, paradigmatic and syntagmatic relations, range, and register" and "this is important because the more elaborated one's knowledge of a lexical item becomes, the more likely it is that one will achieve command of it" (6).

Conclusion

The aim of the paper was to present the neurocognitive findings on metaphor and to investigate their potential application in a language classroom. After providing a theoretical overview of the current neurocognitive research on metaphor and vocabulary in general, an analysis of examples of metaphoric language in a Maritime English text was provided, with the end goal of proposing a methodological frame for potential inclusion of neurocognitive findings on metaphor in an ESP vocabulary lesson. The selected text was analysed using the PIMS procedure proposed by Johansson Falck and Okonski (295) and chosen vocabulary examples were evaluated through the lens of the underlying conceptual metaphors. The scanned units included vocabulary such as phrasal verbs and collocations that are examples of multi-word expressions whose familiarity and fixedness have been recognised in

previous neurocognitive research. The provided analysis rests upon the belief that raising metaphoric awareness in language teaching and learning, with an emphasis on vocabulary teaching and learning, facilitates the comprehension and retention of linguistic units. This belief has been supported by studies into metaphor processing from the neurocognitive perspective and it bears importance for second/foreign language learners who rely heavily on vocabulary knowledge. We hope our results provide an additional argument in favour of moving away from the traditional approaches to vocabulary instruction (e.g. rote memorization) and towards a neuroeducational perspective on language teaching. By making learners aware of the underlying vehicles that motivate much of what we label metaphoric language, we not only provide a deeper understanding of the instructed lexis, but also ensure better chances of its retention. Further investigations would need to focus on providing sound theoretical support to teacher-training programmes and neuroeducational material design, since the success of any novel classroom pedagogy will primarily rest upon the person or people executing it.

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