9 Promoting and Assessing Knowledge Building in the Writing of English-medium Instruction Students

Nashwa Nashaat-Sobhy

Introduction

The academic and professional success of tertiary students hinges on their access to disciplinary literacy and the opportunities they have for knowledge building. *Disciplinary literacy* is all manners of communication for academic, social, and professional purposes (see Airey, 2011; Fang & Coatoam, 2013), and *knowledge building* refers to the transformation of subject content into conceptual artefacts and knowledge objects (Bereiter, 2002, pp. 480–482) that can be improved through supportive discourse (Bereiter & Scardamalia, 2014, p. 36) and the integration of new and prior knowledge through inferring, reasoning, discussing, and monitoring understanding (Roscoe & Chi, 2007). Making meaning with words, thus, aids the complex linguistic and cognitive processes of understanding disciplinary knowledge and building on it, which implies that insufficient experience in using the language of instruction may limit students' ability to engage optimally in these processes.

More universities and students in non-Anglophone countries are adopting English as a medium of instruction (EMI) for its wide reach in academia (Galloway et al., 2017; McKay, 2018). Engaging in learning through an additional foreign language is undeniably an added challenge, whether in Transnational Education (TNE), at international branch campuses and offshore host universities (Wilkins & Juusola, 2018), or in English Medium Education (EME) programs that are established in national universities to fulfill mainly an internationalization agenda (Dafouz & Smit, 2016). Similar concerns regarding the quality of education in TNE and EME settings are raised; for example, the comparability of the quality of learning between onshore and offshore institutions in TNE (e.g., Connelly et al., 2006) and between mainstream non-EMI and EMI programs in EME (e.g., Del Campo et al., 2015). Another concern is students' modest language levels in English in both settings, reported to affect student engagement in disciplinary discourses (e.g., Aguilar & Rodríguez, 2012; Carroll-Boegh, 2006; Dearden & Macaro, 2016; Feast & Bretag, 2005), raising calls in these settings for additional literacy support in academic English (e.g., Dafouz, 2020; Palmer et al., 2019; Pecorari, 2010).

The serious implications this has for the provision of sustainable development for a more inclusive and equitable quality education (World Educators Forum, 2015)

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warrants revisiting assessment practices from a knowledge building perspective in EMI (*EMI*, henceforth, refers indistinctly to TNE and EME contexts and students) with the aim to address limitations that have been particularly observed in the writing of L2 students in higher education that affect their academic achievement. A commonly observed phenomenon in L2 writing is students' overdependence on source material (e.g., Keck, 2006; Pecorari, 2006; Shi, 2004), considered *plagiarism*, which implies an intent to deceive, or patchwriting, which is "copying from a source text and then deleting some words, altering grammatical structures, or plugging in one-for-one synonym substitutes" (Howard, 1993, p. 233). There is, however, more literature on the nature of the problem than on the solution (Wette, 2010), and the offered solutions seem to center on familiarizing the students with the concept of plagiarism, its undesired effects (i.e., the stigma of academic misconduct), and providing the students with technical strategies for adequate source-use (e.g., paraphrasing, citing, and referencing) (see Pecorari & Petric, 2014). These interventions are pedagogically valid and needed, but source-use is a single achievement criterion, valued in some disciplines, and by some educators, over others (Julliard, 1994; Pecorari, 2012; Pecorari & Petric, 2014). To understand how EMI-students operate and evolve, other assessment tools that have at the core these students' meaning-making practices is needed (see Hélot et al., 2018, pp. 1–3) as not only do they have different language thresholds, but these learners also continue to develop as academic writers throughout their studies.

The aim of the study in this chapter was to promote and assess knowledge building among a group of EMI students. After an account of shortcomings that motivate students to resort to patchwriting, assessment task design is revisited to explain how it was employed to engage the participants in discerning and integrating parts of a text in manners that they individually considered necessary to construct their own explanations of a conceptual artefact, i.e., self-explanations (Chi, 2000). To assess the level of students' engagement in knowledge construction, two analytical frameworks were combined: Seidlhofer's (1991) work on summarization from the domain of Applied Linguistics and language pedagogy and Maton and Doran's (2017a, 2017b) semantic codes from Legitimation Code Theory (LCT) (Maton, 2013; Maton & Doran, 2017a, 2017b), which integrates views from Sociology, Education, and Linguistics to offer different lenses (e.g., semantic devices) for analyzing and shaping social practices (Doran et al., 2021, p. 8). The final contribution of this study is an assessment tool drawn from the results of the study that makes explicit the stages students go through as they use a source to construe concepts, which is transferable to any TNE or EME setting.

Shortcomings that Motivate Inadequate Use of Source Material

In an attempt to fulfill course requirements, some EMI students center on the text around relevant keywords when they study, learning the wording, verbatim at times, without sufficient analysis of the content. Consequently, they may lift chunks of information from the source when writing, sometimes including irrelevant data (i.e., text dumping), then depending on the lecturer, students' work will be regarded as either "plagiarism" or "patchwriting" (Howard, 1995; Pecorari, 2016, p. 538). Hull and Rose (1989, p. 151) suggest that patchwriting should be regarded as a stage in academic literacy development that students resort to as a point of entry to disciplinary language and a way of belonging to the academic community. This view is particularly warranted when the students have not been trained in their previous study cultures to incorporate their voice into their writing (e.g., Barnawi, 2011; Pennycook, 1996), and thus have difficulties controlling the way they present ideas from sources[1] (e.g., Howard, 1995; Pecorari, 2016, p. 539; Pennycook, 1996; Perkins et al., 2018).

To avoid dealing with these issues in their assessment, and for fearing that students' inability to express ideas clearly in English may prevent them from showing their knowledge of the content, some lecturers prefer to use discrete items, like multiple-choice questions (Denyer & Hancock, 2012). Though these forms of assessments may seem more practical, they minimize the space for "languaging" knowledge—"making meaning through language to shape knowledge" (Swain, 2006, p. 98)—and mediating cognitive processes (Swain & Watanabe, 2021).

Also, certain task designs can promote patchwriting. When apprenticeship is geared toward 'doing' science, specifically in the case of Chemistry, the context of this study, many written assignments are directed toward lab practice for which protocol logs and result predictions need only be lifted from the lab manuals, motivating both patchwriting and information dumping. Gallant et al. (2019) and Moskovitz and Kellogg (2011) found this "technical parroting" to occur with descriptions of lab equipment, chemical ingredients, experiment procedures and expected results. Because Chemistry is traditionally taught as a body of conclusions as well (Taber & Watts, 2000; Villalta-Cerdas & Sandi-Urena, 2013), students may complete assignments without relating or explaining formerly learned concepts. For this reason, Blackie (2014) warrants the importance of training students to use language to "talk their way through" the content, i.e., to unpack, technical terms and symbols.

The Role of Task Design in Languaging Knowledge

This background serves to argue that task design and assessment practices elicit types of performances that either create or stifle the opportunity to practice meaning-making. The promotion of knowledge building thus starts with task design, which is the focus of this section.

Self-explanations as Biased Summaries

A type of task that promotes knowledge activation and construction rather than reproduction is "self-explanations" (see Chi, 2000)—summarizing to explain. Self-explanation is a strategy teachers use with students so they may explain concepts from a source, infer relations, and create new gist as they seek answers for knowledge gaps that they encounter when making meaning. The purpose of self-explanation is not to recite others' words, or recall textbook answers, but to invest in thinking to make the object of learning more meaningful for themselves (Chi, 2000). Though summarizing source texts is not the aim of self-explanation, self-explanation involves processes that are seen in summarization. When students are prompted to focus on an object of inquiry in the text (e.g., a technical term) to clarify its relationships to other phenomena or processes, they create, by default, summary types that define and/or explicate (see Dalton-Puffer, 2013), and the product may be regarded as a biased summary.[2]

Tracking Processes in Self-explanations

Self-explanation based on a source text, like summarization, starts with text comprehension. This is a multi-layered construct of attention, consciousness, decisions, and memory (Kintsch & Van Dijk, 1978, p. 364) as well as a prerequisite for languaging meaning, which, in turn, requires other linguistic (e.g., lexical substitutions) and cognitive operations (e.g., sequencing ideas and expressing relations). To analyze and assess students' self-explanations, Seidlhofer's (1991) work on summarization processes is drawn on. These processes, represented in a diagram in "Data Analysis" (see Figure 9.3), include: (1) *selection/extraction* of propositions, which subsumes the (2) *deletion* of others, and vice versa; deletion can involve (3) *pruning* or trimming phrases for more selective data extractions. These three processes may require less effort than (4) *restructuring* propositions from the text and presenting them in a different order, which at times result in interpretations that deviate from the original sense; (5) *inferring* or making explicit possible intended inferences, which requires a certain amount of risk as new elements are introduced, some of which may not be correct, which often deters novice writers. Throughout these processes, lexical substitutions are made, using synonyms and alternative expressions, but there are lexical changes that are *taxonomical* (Seidlhofer, 1991, p. 233): these are (6) *generalization* (e.g., instead of "she played with a doll", she played with "a toy") and (7) *integration/construction* (instead of "they dug a foundation" and "built walls", "they built a house").

While engaging in these processes can indicate the level of students' involvement in the task, there are other tools as shall be explained next that can, moreover, reveal if students make sense of abstract knowledge, as using semantic codes from LCT (Maton & Doran, 2017a, 2017b), among other knowledge building practices.

Tools for Tracing Levels of Complexity in Knowledge Building

LCT (Maton, 2013) proposes that different contexts (e.g., subject areas, classroom cultures, educational approaches) legitimate different forms and codes of knowledge (Maton, 2013), hence its suitability for exploring students' language use in the EMI context at hand. LCT comprises a set of semantic devices recently applied to analyze the construction and unpacking of knowledge. Here I present the three tools applied in this study: *semantic gravity (SG)* and *semantic density (SD)* that together make up *semantic waves* (Maton & Doran, 2017a) and *sequencing* (Maton & Doran, 2017b).

Semantic Gravity and Semantic Density

SG refers to the extent to which meaning is fixed irrespective of the situation (context-independent); for example, healthcare personnel would agree that the term "drug metabolism" refers to "a metabolic process that occurs in the body through enzymes to breakdown and eliminate drugs" irrespective of the situation in which the term is used. When the meaning of the terms is fixed (not embedded in a context), they gravitate less to a context, and thus are said to have a weak semantic gravity (SG–). SD is concerned with meaning condensation; the term "drug metabolism" packs/condenses a number of processes, which renders it semantically dense (SD+). The symbol "H_2O" (water in the periodic table) similarly has low semantic gravity (SG–) because the symbol's meaning remains the same in any context and high semantic density (SD+) since it includes a lot of information: water molecules contain one oxygen and two hydrogen atoms. The strength of SG/SD is best visualized as a gradation of semantic strengths on a cline determined by the relation of utterances to others in its constellation (Maton, 2013; Maton & Doran, 2017a). Thus, when students self-explain a technical term (a priori SG–/SD+), they unpack information, revealing the meanings it contains, and so weakening its SD. The more content the term contains, the more unpacking into specifying features (details) and expansions there is likely to be (see Llinares & Nashaat-Sobhy, 2021). In the process of unpacking (moving down from SG–/SD+ to SG+/SD–), writers can also introduce other terms that, in turn, may need clarifying or explaining (i.e., unpacking), but they may also repack information and condense knowledge. In the following example (1), "other forms" is part of the definitional clause (underlined) of "drug metabolism" (both terms in bold), and though "other forms" is not a technical word, it is semantically dense (SD+) as it requires specification from the chemical field.

> *Example 1 (semantic wave)*: **Drug metabolism [SG–/SD+]** <u>is the process through which the body converts (alters or modifies) drugs</u> **[SG+/SD–]** <u>into other forms</u> **[SG+/SD+]** that are <u>easier for the body to eliminate</u> **[SG+/SD–]** through the kidneys. (Example adapted from the data of this study).

These shifts from SG–/SD+ to SG+/SD– to clarify meaning create semantic waves; the downward shifts represent unpacking meaning and the upward shifts repacking meaning into technicisms (see the example in Figure 9.1).

Maton and Doran (2017a) also refer to taxonomic use of language—discussed earlier in reference to the summarization processes by Seidlhofer (1991)—which depending on the wording can contribute to strengthening epistemological

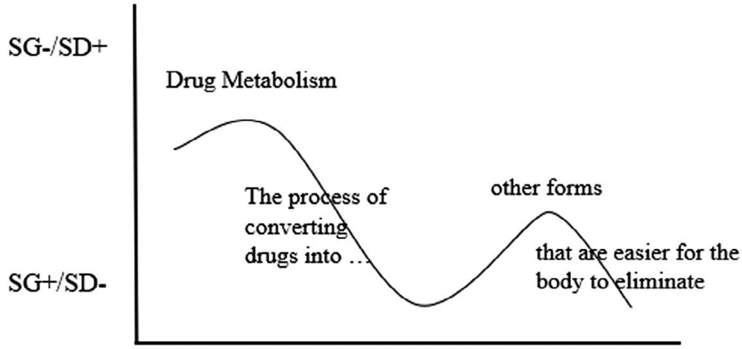

Figure 9.1 Semantic wave with downward shifts to unpack meaning (SD–) and upward shift to repack information (SD+).

semantic density (ESD) (knowledge condensation). For example, when categorically modifying "enzyme" to "digestive enzyme" or "analysis" to "source analysis", the categorization becomes taxonomic as it contributes to identifying subtypes of words/processes/concepts, strengthening the ESD of the word in the process.

Sequencing

While summarizing, students typically pull gist from different parts of a text and condense them in shorter stretches to compact more meaning in fewer words. One way of achieving epistemological condensation is through "sequencing", another LCT tool (Maton & Doran, 2017b) to explore how students construct knowledge. In "sequencing", Maton and Doran (2017b) move from the condensation of meaning at the word level (SD) to the condensation of meaning at the discourse level (in a clause or a passage) by combining meaning (through adding information) into progressively shorter stretches of discourse (epistemological condensation).

Sequencing has several levels of delicacy (subtypes and sub-subtypes) that are non-hierarchical, to be used separately or together as needed. Students may sequence information in the form of isolated segments—i.e., segmental sequencing (e.g., "They don't have windows. They have very small slits"), or they may explicitly link terms, clauses, and paragraphs—i.e., cumulative sequencing, which is further differentiated into horizontal and vertical sequencing.

Horizontal sequencing is achieved by explicitly linking information using conjunctions to add information to the same topic, as in example (2):

> *Example 2 (horizontal sequencing)*: Drug interactions (DI) may occur **whenever** two drugs, **or** more, are taken together **because** each may alter how the other behaves, **and** together they may alter the concentration of substances normally present in the body. (Example adapted from the data of this study)

As seen in the example above, conjunctives are used to bring together information, making explicit relations of time/circumstance (e.g., whenever), cause-effect (e.g., because), and to add information (e.g., or, and) (for other horizontal sequencing conjunctives and functions, see Maton and Doran (2017b). These relations generate meanings additional to those offered in the passages themselves, thus strengthening epistemological density and condensing knowledge. Not all forms of horizontal sequencing contribute equally to strengthening epistemological condensation though (p. 96); thus, when students infer and clarify relations between concepts or passages not explicitly stated in the source, they come across as more active meaning makers (Chi, 2000; Chi & Wylie, 2014).

Vertical sequencing, which condenses meaning in shorter stretches, is achieved when the meaning of a term, clause, or passage is referred to elsewhere by other referents, thus transferring and strengthening meaning across a long stretch of discourse, as in example (3).

> *Example 3 (vertical sequencing)*: "<u>Vesicles</u> in the cytoplasm [...] <u>fuse with the phagosome</u> [...]. The result of *this fusion* is called phagolysosome. (Example from Maton & Doran, 2017b, p. 92)

In the example above, "this fusion" not only condenses the previously described process but also transports the meaning to a later point in the text.

Methods, Research Site, Participants, and Data Collection and Analysis

The doubts surrounding student learning in EMI due to their perceived low language levels (Carroll-Boegh, 2006; Doiz et al., 2012; Nashaat-Sobhy & Sánchez-García, 2020) and the limited occasions they have to language concepts in Chemistry, as previously mentioned (e.g., Blackie, 2014; Taber & Watts, 2000), require evidence of the processes they engage in when languaging understanding. In knowing the areas where students face challenges (linguistic and subject-specific) to meet task requirements, lecturers can help students so they may progress. Thus, the research aim of the study was to explore the summarization processes that students employ when self-explaining (using Seidlhofer's, 1991, framework) and also the knowledge-building instances in the same productions (using Maton & Doran's semantic profiling, 2017a, 2017b). Both explorations complement each other to identify aspects of knowledge building in the writing of this group of EMI students. The question driving the study is:

> What aspects of knowledge building are visible in the students' self-explanations?

Improving assessment and providing qualitative feedback in relation to the task rests on identifying these knowledge-building aspects.

Participants

The data was gathered during a tandem collaboration between the researcher and a lecturer of Pharmaceutical Chemistry in a school for Health Sciences in Spain. In preparation for other activities that require conceptual knowledge of "DI", the lecturers carried out the task with third-year EMI Pharmacy students (N = 21).

Instruments

Two instruments (described below) were used to prompt the students to explain their individual understanding of "DI".

Instrument 1: The first instrument was the material used as source text (Figure 9.2). This text, which was adapted from WebMD Site, was altered in such a way that the students would not come across pre-packaged definitions or a single section explaining DI, thus pushing students to comprehend and evaluate the relevance of blocks of text to the task. The numbers in bold (1–21) are a rough representation of meaning units (uninterrupted text around the same core meaning), roughly selected by the course teacher. The sections in bold are the meaning units (henceforth "units") that the Chemistry lecturer considered relevant to explain DI. Analysis of the text by the researcher showed that units 4–9 act as expansions or extensions on units 1–3 and unpack the meaning in these units, so could justifiably be selected. In contrast, units 16–18 are concerned with "drug metabolism", which though related, is not central to explaining what "DI" mean. As the meanings in units 12–14 can be inferred from units 4–9, and units 15 and 19 carry the same meaning, students need not select all the units in bold to explain the target term. It is important though that they suppress the less relevant information.

Instrument 2: The students consented that their writing be monitored and installed a learning application—nStudy—on their personal computers, a state-of-the-art configurable web tool for learning (Winne et al., 2016), to trace their digital footprints while working on the task to gauge web consultation of web sources, including automatic summarization and translation applications, as well as register their selection decisions.

Data Collection and Procedure

In the first step, the students were asked to (1) read and highlight propositions relevant to defining and explaining the meaning of DI from the adapted source text (685 words). These could be parts of any sentence, of any word length. For example, students could highlight a phrase from any of the numbered chunks in Figure 9.2. They were then asked to (2) classify their highlights using in-built tags—previously explained to the students with which they practiced using an alternative text on "drug metabolism—with the purpose of reviewing the

TEXT

1. Whenever two or more drugs are being taken there is a chance that there will be a process of interaction among the drugs. 2. The likelihood of drug interactions (DI) increases as the number of drugs being taken increases. 3. There are several mechanisms by which drugs interact with other drugs, food, and other substances. Most of the important drug interactions result from change (an increase or a decrease) in the absorption, metabolism, or elimination of a drug from the body. 4. Drug interactions may also occur when two drugs that have similar (additive) effects are administered together. **5**. For example, there may be major sedation when two drugs that has sedation as side effects are given. **6**. like narcotics and antihistamines. **7**. DI may also occur when two drugs have opposite (cancelling) effects on the body and are administered together. **8**. Another source of DIs occurs when one drug alters the concentration of a substance that is normally present in the body. The alteration of this substance reduces or enhances the effect of another drug that is being taken. **9**. The DI between warfarin (Coumadin) and vitamin K-containing products is a good example of this type of interaction.

10. **DIs that are of greatest concern are those that reduce the desired effects or increase the adverse effects of the drugs. 11. People who take several drugs are at the greatest risk for interactions,** which can lead to psychological suffering that can be avoided. **12. DIs may lead to an increase or decrease in the beneficial or the adverse effects of the given drugs. 13. Drugs that reduce the absorption or increase the metabolism or elimination of other drugs tend to reduce the effects of the other drugs, which may lead to failure of therapy or warrant an increase in the dose of the affected drug. 14. Conversely, drugs that increase absorption or reduce the elimination or metabolism of other drugs increase the concentration of the other drugs in the body and to more side effects. 15. A known interaction may not occur in every individual and many of the listed interactions may be rare, minor, or only occur under specific conditions and may not be important.**

16. Most drugs are eliminated through the kidney in either an unchanged form or as a by-product that results from the alteration (metabolism) of the drug by the liver. Therefore, the kidney and the liver are very important sites of potential drug interactions. **17.** Some drugs are able to reduce or increase the metabolism of other drugs by the liver or their elimination by the kidney. **18**. Metabolism of drugs is the process through which the body converts (alters or modifies) drugs into forms that are more or less active (for example, by converting drugs that are given in inactive forms into their active forms that produce the desired effect) or that are easier for the body to eliminate through the kidneys. Most drug metabolism takes place in the liver, but other organs also may play a role (for example, the kidneys, intestine, etc.). The cytochrome P450 enzymes are a group of enzymes in the liver that are responsible for the metabolism of most drugs. They are, therefore, often involved in drug interactions. Drugs and certain types of food may increase or decrease the activity of these enzymes and therefore affect the concentration of drugs that are metabolized by these enzymes. An increase in the activity of these enzymes leads to a decrease in the concentration and effect of an administered drug. Conversely, a decrease in enzyme activity leads to an increase in drug concentration and effect.

19. **There are several factors that affect the likelihood that a known interaction will occur. These factors include differences among individuals in their: genes, physiology, age, lifestyle (diet, exercise), underlying diseases, drug doses, the duration of combined therapy, and the relative time of administration of the two substances. 20. The adverse effects of DI extrapolate to healthcare expenses because of the costs of medical care that are required to treat problems caused by ineffectiveness or side effects. 21. All the consequences that DI may lead to are sufficient for physicians and pharmacists to warn patients about mixing drugs when not necessary.**

Figure 9.2 Source text used by the students to extract propositions to self-explain “DI”.

adequacy of their initial selections and minimize text dumping. The tags they could choose from included: superordinate classifiers (e.g., an element, a process, a mechanism); functional descriptions and relationships (e.g., cause-effect, reasons for, uses…); physical characteristics (location, components, sequence…); and examples for abstract concepts. In the process of classifying their highlights using these tags, students could change their minds about their initial selections, highlight others, or not, and tag again until satisfied that they had included the propositions that they would eventually use for their self-explanations. nStudy has a white canvas for writing to which students can drag and drop information from the tagging highlighting-tagging view. Students then (3) dragged their final selections to the writing canvas to draw on them while completing the task. No word limit was given in order to not influence their investment in the task.

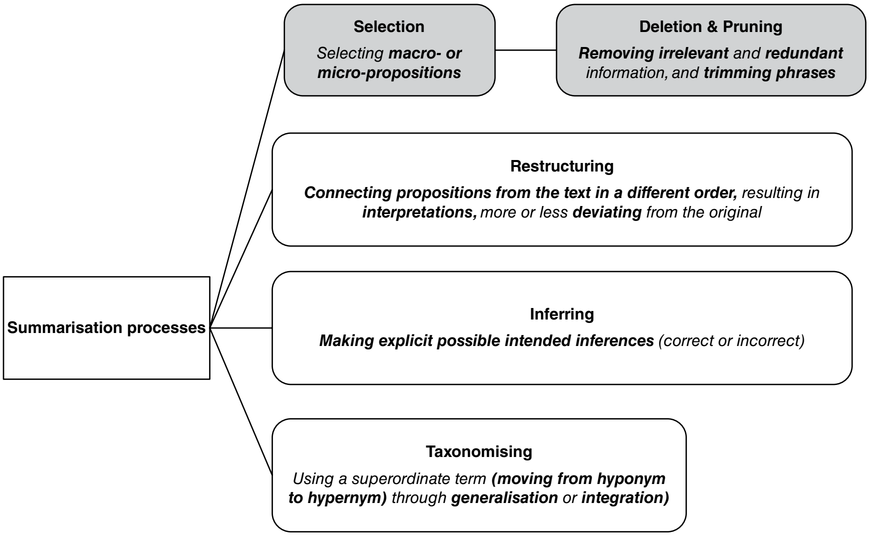

Figure 9.3 Representation of summarization processes, adapted from Seidlhofer (1991). The gray cell represents "less-effort" zones of processing.

Data Analysis

For the analysis, first, students' decisions (highlighting, tagging, and dragging units to writing canvas) were retrieved from nStudy and compared against the units marked as relevant by the Chemistry teacher (in Figure 9.2). Second, students' written self-explanations were contrasted against the original text to identify instances of patchwriting. Finally, students' texts were examined for the summarization processes (see "Tracking Processes in Self-explanations"), which I represent in Figure 9.3, as well as for shifting between different strengths of semantic density and gravity (SD+–/SG–+) and sequencing information, which indicate the level of knowledge building undertaken.

Results and Discussion

First, the trace data registered by nStudy with regards to students' initial and final selections from the source text are presented and compared with the suggestions given by the lecturer (see "Students' Digital Footprints"). This is followed by self-explanation profiles that emerged from the students' approaches to completing the task (see "Self-Explanation Profiles").

Students' Digital Footprints

Table 9.1 shows students' engagement in proposition-selection in three stages: reading and highlighting (column 1); classifying and tagging (column 2); and

Table 9.1 Number of proposition-selection by the students in each stage compared against the Chemistry lecturer's selections

	No. of students (N = 21)		
	No. of highlights	*No. of tags*	*No. of drags to writing canvas*
Meaning unit (1)	**10**	**9**	**9**
Meaning unit (2)	7	7	7
Meaning unit (3)	**17**	**16**	**16**
Meaning unit (4)	14	13	14
Meaning unit (5)	14	13	13
Meaning unit (6)	14	13	12
Meaning unit (7)	16	15	14
Meaning unit (8)	15	14	12
Meaning unit (9)	17	16	16
Meaning unit (10)	10	9	9
Meaning unit (11)	10	9	5
Meaning unit (12)	11	10	6
Meaning unit (13)	**12**	**12**	**4**
Meaning unit (14)	**9**	**8**	**3**
Meaning unit (15)	**2**	**2**	**1**
Meaning unit (16)	**11**	**10**	**4**
Meaning unit (17)	**9**	**8**	**1**
Meaning unit (18)	**17**	**16**	**3**
Meaning unit (19)	**12**	**11**	**2**
Meaning unit (20)	**9**	7	**2**
Meaning unit (21)	**6**	**5**	**0**

dragging their final selections to the canvas to write (column 3), facilitated by nStudy, which were then compared against the propositions considered relevant by the Chemistry lecturer (in bold).

As observed, students' initial selections reflected in the highlighting stage (column 1) were abandoned when tagging or dragging the selections to include in the writing canvas (e.g., units 11–21), suggesting that students reflect on the adequacy of their selections at different points while working on the task. The lecturer's selections (in bold) included units (1–3) and (13–21), not selected by all the students (e.g., units 13, 14, 19, 20, and 21), yet as some of the units carried similar information (see Instrument 1), a complete teacher-student match when selecting units is not considered detrimental to knowledge building in this specific task.

Self-explanation Profiles

Three self-explanation profiles from the performances of five students (ALU23, ALU6, ALU1, ALU8, and ALU3) are presented below to illustrate different levels of task engagement and attempts for meaning-making, conducive to knowledge building, in the form of summarization processes (selecting, deleting/pruning, restructuring, inferring, and taxonomizing) and semantic shifts (SD, SG, and sequencing). Their distinct features are highlighted in the figures accompanying the description of the results. To observe the extent of patch-writing in each profile, text lifted from the original text is highlighted in bold throughout. When a student restructures the original text, the propositions are numbered in the order of their appearance in the student's texts.

Profile A and B: Proposition-selection and Segmental Sequencing

The first two profiles A and B show low investment in knowledge-building, limited to selection/deletion of gist from the source, minimal proposition restructuring (Figure 9.4), and minimal pruning (Figure 9.5); all are subtle enough to pass unnoticed unless qualitatively analyzed.

In profile A (Figure 9.4), ALU23 lifted many parts of the original text. There is also error in understanding the relationship in unit 3; this was changed from effect–cause (in the source) to cause–effect (in the text) by substituting "provoke" for "result from" and changing the order of the sentence constituents. There was an attempt to restructure the order of the meaning units (see propositions 2, 1 and 6) and prune parts of the text, both facets of the summarization process (see "Data Analysis"). The overall performance is one that shows the student's inability to structure coherent text at the sentence level (units 2 and 6) or link the meaning units to one another (see "Sequencing").

In profile B (Figure 9.5), the self-explanation follows the same order of meaning units in the original text. ALU6 selects and deletes information without any textual changes (e.g., the comma splice in proposition 5 shows no attempt to link the sentences differently though these were copied from different places), minimal pruning is observed (see proposition 2), and there are hardly any lexical substitutions. The outcome is a *risk-free* compilation of clauses; a classic case of "patchwriting", which reads better than the previous example (Figure 9.4) because it is a collage of clauses lifted from the source.

In both profiles A and B though, the students erroneously included the parts on "drug metabolism" and excluded others still relevant to "DI" (e.g., units 19–21).

Profile C: Inferring and Cumulative Sequencing

In profile C (Figure 9.6), besides better proposition-selection, with more *pruning and lexical substitutions* throughout, ALU1 attempted more restructuring, cumulative sequencing and inferring, which together involve connecting propositions differently, with possible acceptable deviations from the meaning of the source.

The student's entry point to the text (see proposition 1) corresponds to meaning unit (3), and the student draws on unit (19) before (12), an example of *restructuring*. In proposition (10), we see an instance of *inferring*, where the student draws on meaning unit (21) and infers that Pharmacists "study" prescribed drugs, which, in turn, helps patients "avoid" side effects. The student

	Original Text	Student Text (ALU23-137 words)
meaning unit (2)	*The likelihood* of drug interactions (DI) increases as *the number of drugs* being taken increases.	2) *How much drugs* we're taking, there´s *more probability* of Drug Interactions.
meaning unit (3)	Most of the important drug interactions ***result from*** change (an increase or a decrease) in the **absorption, metabolism, or elimination of a drug** from the body.	1) **Absorption, metabolism of elimination of a drug** are the factors which ***provoke*** drug interactions.
meaning unit (5) meaning unit (6)	For example, there **may be major sedation when** two drugs that has **sedation as side effects** are given. like, narcotics and antihistamines	6) Examples: Narcotics and antihistamines **may be major sedation when** are together than **sedation as side effects** (alone).
meaning unit (11)	**People who take several drugs are at the greatest risk for interactions**, which can lead to psychological suffering that can be avoided.	3) **The greatest risk for interactions are people which take several drugs.**
meaning unit (12)	DIs may lead to an increase or decrease in the beneficial or the adverse effects of the given drugs.	
meaning unit (16)	**Most drugs are eliminated through the kidney in either an unchanged form or as a by-product that results from the alteration** (metabolism) **of the drug by the liver**. Therefore, the kidney and the liver are very important sites of potential drug interactions.	4) **Most of drugs are eliminated through the kidney, as a product that results from the alteration of the drug by the liver.**
meaning unit (17)	Some drugs are able to reduce or increase the metabolism of other drugs by the liver or their elimination by the kidney.	
meaning unit (18)	Metabolism of drugs is the process through which the body converts (alters or modifies) drugs into forms that are more or less active (for example, by converting drugs that are given in inactive forms into their active forms that produce the desired effect) or that are easier for the body to eliminate through the kidneys. Most drug metabolism takes place in the liver, but other organs also may play a role (for example, the kidneys, intestine, etc.). **The cytochrome P450 enzymes are a group of enzymes in the liver that are responsible for the metabolism of most drugs.** **Drugs and certain types of food may increase or decrease the activity of these enzymes and therefore affect the concentration of drugs that are metabolized by these enzymes.** An increase in the activity of **these enzymes leads to a decrease in the concentration and effect of an administered drug.** Conversely, a decrease in enzyme activity leads to an increase in drug concentration and effect.	7) **Cytochrome P450 enzymes are enzymes in the liver that responsible for the metabolism of most drugs.** 5) **Drugs and certain types of food may change the activity of these enzymes and therefore affect the concentration of drugs that are metabolized by these enzymes.** If the activity [...] increases, **these enzymes lead to a decrease in the concentration and effects of an administrated drug.**

Figure 9.4 Patchwriting, minimal preposition restructuring, and text dumping (profile A).

uses "or", "due to" (erroneously) then "and" in propositions (3), (4), and (5) to connect the meaning in units (4), (7), and (8)—"the effect of a single drug on the concentration of naturally produced substances in the body" and "the effect of one drug on the other when taken together"—in one orthographic sentence with three coordinate clauses, thus clarifying in fewer and shorter turns the circumstances leading to DI, which is an instance of *horizontal sequencing* (see "Sequencing").

	Original Text	Student Text (ALU6, 101 words)
meaning unit (2)	The likelihood of drug interactions (DI) increases as the number of drugs being taken increases.	1) The likelihood of drug interactions (DI) increases as the number of drugs being taken increases.
meaning unit (4)	*Drug interactions* may also occur when two drugs that have similar (additive) effects are administered together.	2) *DI* may occur when two drugs have similar (additive) effects are administered together
meaning unit (6)	*like* narcotics and antihistamines.	3) *for example*, narcotics and antihistamines.
meaning unit (7)	DI may also occur when two drugs have opposite (cancelling) effects on the body and are administered together.	4) DI may also occur when two drugs have opposite (cancelling) effects on the body and are administered together.
meaning unit (18)	Metabolism of drugs is the process through which the body converts (alters or modifies) drugs into forms that are more or less active (for example, by converting drugs that are given in inactive forms into their active forms that actually produce the desired effect) or that are easier for the body to eliminate through the kidneys. **Most drug metabolism takes place in the liver**, but other organs also may play a role (for example, the kidneys, intestine, etc.). **The cytochrome P450 enzymes are a group of enzymes in the liver that are responsible for the metabolism of most drugs.** They are, therefore, often involved in drug interactions. Drugs and certain types of food may increase or decrease the activity of these enzymes and therefore affect the concentration of drugs that are metabolized by these enzymes. **An increase in the activity of these enzymes leads to a decrease in the concentration and effect of an administered drug.** Conversely, a decrease in enzyme activity leads to an increase in drug concentration and effect.	5) Most drug metabolism takes place in the liver, the cytochrome P450 enzymes are a group of enzymes in the liver that are responsible for the metabolism of most drugs. An increase in the activity of these enzymes leads to a decrease in the concentration and effect of an administered drug.

Figure 9.5 Patchwriting, proposition compilation with minimal pruning, and text dumping (profile B).

Instances of *vertical sequencing*, which transport meaning across passages and create more cohesion, are seen in ALU 1's use of "patient" in propositions (2) and (6) (a patient; the patient). Similarly, the student transported "side-effects" from proposition (8) to (9) as "those side-effects" and then to proposition (10) as "them". The student used "patient" and "side effects" in turns different to those in the original text, more than once, varying the determiners and pronominalizing appropriately (a patient, the patient; side effects, those side effects, them), "tracking" the object throughout the text (Whittaker et al., 2011), eventually strengthening the integration of meaning throughout the passages.

Profiles D and E: Knowledge Condensation

Profiles D (Figure 9.7) and E (Figure 9.8), besides showing gist selection/suppression, pruning, and restructuring, present instances of weakening and strengthening SD.

	Original Text	Student Text (ALU1 — 136 words)
meaning-unit (2)	**The likelihood of drug interactions (DI) increases** as **the number of drugs** being **taken** increases.	2) If the **number of drugs** that *a patient* is **taken** is high, **the likelihood of drug interactions** will **increase,** ...
meaning-unit (3)	There are several mechanisms by which drugs interact with other drugs, food, and other substances. Most of the important **drug interactions** *result from* **a change in the absorption, metabolism, or elimination of a drug.**	1) Drug interactions *may occur due to* **a change in the absorption, metabolism or elimination of a drug.**
meaning-unit (4)	Drug interactions may also occur when two drugs that have **similar** (additive) **effects** are administered together.	4) ..., or **similar effects**
meaning-unit (7)	DI may also occur when **two drugs have opposite** (cancelling) **effects** on the body and are administered together.	3) ...due to **two drugs can have opposite**
meaning-unit (8)	Another source of DIs occurs when **one drug** *alters the concentration of* a **substance** that is *normally present* **in the body.** The alteration of this substance reduces or enhances the effect of another drug that is being taken.	5) and even **one drug** is able to *modify the normal quantity of* some **substances in the** own **body**.
meaning-unit (12)	DIs may lead to an increase or decrease in the **beneficial** or the adverse effects of the given drugs.	7) Drug interactions can be **beneficial** for *the patient*, ...
meaning-unit (14)	Conversely, drugs that increase absorption or reduce the elimination or metabolism of other drugs increase the concentration of the other drugs in the body and *lead to* increased amounts of drug in the body and to more ***side effects***.	8) ..., but also, *can produce* ***side effects***.
meaning-unit (19)	There are several **factors** that **affect** the likelihood that a known interaction will occur. These factors include differences among *individuals* in their: **genes, physiology,** age, **lifestyle** (diet, exercise), **underlying diseases,** drug doses, the duration of combined therapy, and the relative time of administration of the two substances.	6) Also *the patient* can be **affected** by another **factors (genes, lifestyle, underlying diseases, physiology...)**.
meaning-unit (20)	The adverse **effects** of DI extrapolate to **healthcare** *expenses* because of the costs of medical care that are required to treat problems caused by ineffectiveness or ***side effects***.	9) ***those side effects*** make an increase of the **healthcare** *spending*, ...
meaning-unit (21)	All the consequences DI may lead to are a sufficient reason **for** physicians and pharmacists to warn *patient* about mixing drugs when not necessary.	10) ... **so** each treatment HAS TO BE STUDIED TO AVOID *them*.

Figure 9.6 Proposition restructuring, inferring (a discontinued underline), and transporting meaning through vertical sequencing (connected asterisks) (profile C).

In profile D (Figure 9.7), ALU 8 unpacks the meaning of "adverse effects" (meaning unit 12) into "effects of the drug in a negative way" (proposition 2), followed by reference to it as "unwanted" in proposition (3), which is seen as an attempt to rephrase a technical expression in a simpler one that the student can retain and recall, or may simply be paraphrasing.

ALU 8 also packs meaning unit (1) "absorption, metabolism and elimination" into the term "the processes" (written "process" by the student), by categorizing (an example of generalization in Seidlhofer's 1991 model). This instantiates strong epistemological condensation, as each metabolic process, on its own, is part of other mechanisms and interactions, i.e., each belongs to other constellations of meaning. Another example is the categorical modification in proposition (3), where the student uses "therapeutic effects' instead of "desired effects" (unit 10), categorically modifying the nature of the effect from a general

	Original Text	Student Text (ALU8, 186 words)
meaning unit (1)	Whenever two or more drugs are being taken there is a chance that there will be a process of interaction among the drugs	
meaning unit (2)	The likelihood **of drug interactions** (DI) *increases* as **the number of drugs** being taken increases.	4) **The number of drugs** *rises the risk* **of interactions** taking place.
meaning unit (3)	There are several mechanisms by which *drugs interact with other drugs, food, and other substances.* Most of the important drug interactions result from *a change in {the absorption, metabolism, or elimination}* of a drug.	1) When any of **the process* occurring in the body after the intake of a drug are modified by another drug* there is an interaction between them
meaning unit (4)	Drug interactions may also occur **when two drugs** that **have similar** (additive) **effects** are administered together.	4) Drug interactions *can happen* **when two drugs have the same effect**
meaning unit (7)	DI may *also* occur **when two drugs have opposite** (cancelling) **effects** on the body and are administered together.	5) …, *or* **when** the **drugs have opposite ones**.
meaning unit (10)	*DIs that are of greatest concern are those that reduce the {desired effects} or increase the adverse effects of the drugs.*	3) *We will worry about the interactions that cancel the {therapeutical effects} or boost the unwanted ones.*
meaning unit (12)	*DIs may lead to an increase or decrease in the beneficial or the {adverse effects} of the given drugs.*	2) *These interactions may change the {effects of the drug in a positive or negative way.}*

Figure 9.7 Packing and unpacking information ({underlined italics within brackets} and connecting arrows) (profile D).

affective one to a specific functional one (one that is medical to alleviate, heal, or cure). In doing so, the student conjures a taxonomic image (a type of effect), by which the epistemic SD of the concept is strengthened (see "Semantic Gravity and Semantic Density".

Profile E (Figure 9.8) presents another instance of knowledge condensation worth highlighting as well, where ALU3 condenses the meaning of "taking two or more drugs" (unit 1) in the single term "polymedication" (proposition 1). Conglomerates, words with multiple distinct parts (Maton & Doran, 2017a), possess a technical meaning, where, in this case, "poly" modifies "medication". In doing so, the *SG* was changed from one that is situational and specific (SG+) to a more technical term that is context-independent, i.e., abstract, academic (SG–). Also, the weaker *SD* of the multi-word string—"whenever two or more drugs are being taken" (SD–)—was packed into a term with stronger SD, "polymedication" (SD+)—that carries all related meanings (e.g., "risks", "reactions"), and the transitory action of "taking two or more drugs" (SG+, SD–) reads instead as a known metabolic outcome (SG–, SD+). The transformation from the multi-word string to "polymedication" (as an example) is represented in the partial wave in Figure 9.9. These two last profiles then show considerably more knowledge transformation, particularly through information unpacking and creating taxonomic relations.

Students clearly have different levels of subject understanding, language abilities, and skills, they begin from different places on the starting line and

	Original Text	Student Text (ALU3, 58 words)
meaning unit (1)	*{Whenever two or more drugs are being taken}* there is a chance that there will be a process of interaction among the drugs.	1) *{Polymedication}*...
meaning unit (2)	***The likelihood of drug interactions (DI) increases*** as the number of drugs being taken increases.	2) ...***increases the risk of possible interactions between different drugs*** ...
meaning unit (3)	There are several mechanisms by which ***drugs interact with other drugs*, food**, and other substances. Most of the important drug **interactions** result from **a change in the absorption**, metabolism, or **elimination of** a **drug**.	3) ... or **food**. ***These interactions*** can cause **changes in the absorption, elimination** and increases or reduction **of drug´s** effect.
meaning unit (19)	There are several factors that affect the likelihood that a known interaction will occur. These factors include differences among individuals in their: **genes**, physiology, **age**, lifestyle (diet, exercise), underlying diseases, **drug doses**, the duration of combined therapy, and the relative time of administration of the two substances.	4) DI depends on several factors (**age, drug doses, genes**...) so they can be different depending on the individual.
meaning unit (20)	***The adverse effects of DI*** extrapolate to **healthcare** expenses because of **the costs** of *medical care that are required to treat problems* caused by ineffectiveness or **side effects**.	5) *Treatment* of drug interactions and **side effects** increases **the cost** of **healthcare**.

Figure 9.8 Packing information to construe a concept ("polymedication") ({underlined italics within brackets} and connecting arrows) (profile E).

their output logically reflects different degrees of knowledge. As students combine more processes and semantic shifts, more transformations are observed, creating more complex texts. These results contribute to understanding how EMI students use source texts and can cater to improving teaching and assessment practices. Student thinking could be observed in the described actions, processes, and phrasings, which are drawn on to offer an instrument for teaching, and that can be transformed into qualitative assessment criteria. The self-explanation profiles presented here show three distinct levels of engagement in knowledge building that can be used as a teaching—assessment instrument. It is proposed that:

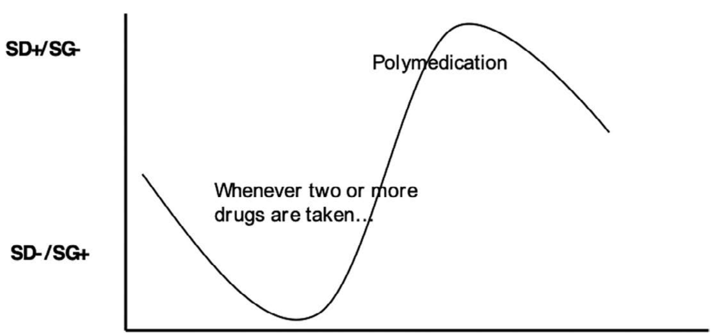

Figure 9.9 Upward shift in a semantic wave, moving from SG+/SD– to SG–/SD+.

1 The most basic level of engaging in knowledge building (LEVEL 1) involves the *selection of relevant gist* and *deletion of irrelevant information*—as opposed to information dumping. Students at this level can already restructure the order of gist in the source and select alternative entry points to the topic as seen in Profile A. The deletion of irrelevant information will optimally involve *pruning/trimming* the extracted relevant gist for succinctness—as opposed to lifting the whole meaning unit, as seen in Profiles A & B.

   It should be noted that the processes mentioned so far reflect the students' engagement in comprehension and evaluating information for relevance, but they do not remedy patchwriting. Also, though patchwriting and information dumping are both undesirable, the latter is likely to distracts students from identifying and accessing important content and hinder learning.

2 A higher level of engaging in knowledge building (LEVEL 2) subsumes the previous processes in addition to the expression of new relations by *inferring*, or through *horizontal sequencing*, making certain relationships that were not clearly expressed in the source explicit (e.g., by using conjunctives). It also involves referring to certain terms by other referents across passages through *vertical sequencing*. The three strategies help condense knowledge in shorter turns and create more cohesion in students' writing, as seen in Profile C.

   Evidently, students who are more active in knowledge building pull the gist that they perceive important from different passages in the source text and transform them into more compact propositions in their writing. This suggests that varying degrees of condensation of knowledge, in addition to all the former mentioned processes, contribute to higher levels of involvement in knowledge building. Therefore,

3 A greater level of engaging in knowledge building (LEVEL 3) subsumes the previous processes in addition to unpacking technical terms (SG+/SD−) to define and explain as well as to demonstrate knowledge of the topic. Equally important is repacking or condensing information (SG−/SD+) in other instances as when establishing taxonomic knowledge, an aspect of knowledge building seen in Profiles D & E. Both unpacking and condensing information require varying the *SG* and *SD* of the source wording, which is likely to somewhat change the meaning of the original text.

   This last level, as far as can be observed in the presented profiles, seems to require taking language risks, regarded as a feature conducive to better language learning when these are logical and tested in low-to-moderate-risk situations (for a short review, see Dewaele, 2012).

Conclusion

This chapter tackled the phenomenon of patchwriting in the productions of L2 students in an EMI content course, where students with first languages other than English shift from studying English as a foreign language to using it as a medium of instruction. The importance of assessing knowledge building in the writing of these students despite their inclination to over-rely on source-texts was established for TNE and EME settings alike.

In bringing together the perspective of languaging for learning (Swain, 2006) from Applied Linguistics and LCT devices for exploring knowledge building (Maton, 2013), the goal of this study was to engage EME students in knowledge construction through written self-explanations (Chi, 2000)—a type of biased summary with a specific assessment task design to encourage more meaning-making when explicating a course-related concept. To qualitatively explore visible aspects of knowledge building in the students' self-explanations, two frameworks were combined: Maton and Doran's (2017a, 2017b) semantic codes from LCT (Maton, 2013), intended from its conception for understanding knowledge building in educational settings, and Seidlhofer's (1991) summarization model, which is pertinent to understanding the cognitive and linguistic actions required for producing self-explanations. Describing the processes in these frameworks facilitated the exploration of the characteristics of task achievement and knowledge-building practices in relation to the performed task. These characteristics were discernible in the students' texts, despite patchwriting, and were classified into three different levels of complexity, proposed as a success continuum to draw on when planning for teaching and to provide students with qualitative feedback.

Though LCT is not a linguistic theory, discussions of knowledge building can only take place through discussions about language, and thus, using LCT generates a metadiscourse that highlights aspects of disciplinary language use, suitable for EME ecologies. This study generated examples of this metadiscourse, seen in the visualizations and discussions of the different self-explanation profiles and in the described levels of knowledge building. Connecting subject matter (e.g., Pharmaceutical Chemistry) and ways of languaging (e.g., unpacking and condensing information) to accomplish a task (e.g., summarizing to self-explain) has generated here a richer display of academic achievement criteria, beyond the disciplinary traditions of a singular subject, conducive to strengthening interdisciplinary collaborations, and to improving assessment practices in EMI.

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Notes

1 This is the view adopted in this study, not only for developmental reasons but since the source texts in this EMI subject are always assigned by the lecturer, and so known to her.

2 A term coined by J. Nesbit, personal communication, November 2017.

References

Aguilar, M., & Rodríguez, R. (2012). Lecturer and student perceptions on CLIL at a Spanish university. *International Journal of Bilingual Education and Bilingualism*, *15*(2), 183–197. https://doi.org/10.1080/13670050.2011.615906

Barnawi, O. Z. (2011). Finding a place for critical thinking and self-voice in college English as a foreign language writing classrooms. *English Language Teaching*, *4*(2), 190–197. https://doi.org/10.5539/elt.v4n2p190

Bereiter, C. (2002). *Education and mind in the knowledge age*. Routledge: Lawrence Erlbaum Associates.

Bereiter, C., & Scardamalia, M. (2014). Knowledge building and knowledge creation: One concept, two hills to climb. In S. Tan, H. So, & J. Yeo (Eds.), *Knowledge creation in education* (pp. 35–52). Education Innovation Series. Springer. https://doi.org/10.1007/978-981-287-047-6_3

Blackie, M. A. L. (2014). Creating semantic waves: Using legitimation code theory as a tool to aid the teaching of chemistry. *Chemistry Education Research and Practice*, *15*, 462–469. https://doi.org/10.1039/c4rp00147h

Carroll, J. (2009). Plagiarism as a threat to learning: An educational response. In G. Joughin (Ed.), *Assessment, learning and judgement in higher education* (pp. 115–132). Springer.

Carroll-Boegh, A. (2006). Internationalisation and teaching through English: A Danish perspective. *Educate~*, *5*(2), 19–30.

Chi, M. T. H. (2000). Self-explaining expository texts: The dual processes of generating inferences and repairing mental models. In R. Glaser (Ed.), *Advances in instructional psychology* (pp. 161–238). Lawrence Erlbaum Associates.

Chi, M. T. H., & Wylie, R. (2014). The ICAP framework: Linking cognitive engagement to active learning outcomes. *Educational Psychologist*, *49*(4), 219–243. https://doi.org/10.1080/00461520.2014.965823

Connelly, S., Garton, J., & Olsen, A. (2006*). Models and Types: Guidelines for good practice in transnational education*. Observatory on Borderless Higher Education.

Dafouz, E. (2020). Undergraduate student academic writing in English-medium higher education: Explorations through the ROAD-MAPPING lens. *Journal of English for Academic Purposes*, *46*, 100888. https://doi.org/10.1016/j.jeap.2020.100888

Dafouz, E., & Smit, U. (2016). Towards a dynamic conceptual framework for English-medium education in multilingual university settings. *Applied Linguistics*, *37*(3), 397–415. https://doi.org/10.1093/applin/amu034

Dalton-Puffer, C. (2013). A construct of cognitive discourse functions in CLIL and multilingual education. *European Journal of Applied Linguistics*, *1*(2), 216–253. https://doi.org/10.1515/eujal-2013-0011

Dearden, J., & Macaro, E. (2016). Higher education teachers' attitudes towards English medium instruction: A three-country comparison. *Studies in Second Language Learning and Teaching*, *6*(3), 455. https://doi.org/10.14746/sllt.2016.6.3.5

Del Campo, C., Cancer, A., Pascual-Ezama, D., & Urquía-Grande, E. (2015). EMI vs. non-EMI: Preliminary analysis of the academic output within the INTE-r-LICA project. *Procedia-Social and Behavioral Sciences*, *212*, 74–79. https://doi.org/10.1016/j.sbspro.2015.11.301

Denyer, G., & Hancock, D. (2012, October). Multiple choice questions to combat plagiarism and encourage conceptual learning. In *Proceedings of The Australian Conference on Science and Mathematics Education (formerly UniServe Science Conference).*

Dewaele, J. M. (2012). Risk-taking and foreign language learning. In M. Byram, & A. Hu (Eds.), *Routledge encyclopedia of language teaching and learning* (pp. 598–600). Routledge.

Doiz, A., Lasagabaster, D., & Sierra, J. M. (2012). *English-medium instruction at universities: Global challenges*. Multilingual Matters. https://doi.org/10.21832/9781847698162

Doran, Y. J., Maton, K., & Martin, J. R. (2021). The teaching of science: New insights into knowledge, language and pedagogy. In J. R. M. Karl Maton, & Y. J. Doran (Eds.), *Teaching science: Knowledge, language, pedagogy* (pp. 1–20). Routledge.

Fang, Z., & Coatoam, S. (2013). Disciplinary literacy: What you want to know about it. *Journal of Adolescent & Adult Literacy*, *56*(8), 627–632. https://doi.org/10.1002/JAAL.190

Feast, V., & Bretag, T. (2005). Responding to crises in transnational education: New challenges for higher education. *Higher Education Research & Development*, *24*(1), 63–78. https://doi.org/10.1080/0729436052000318578

Gallant, T. B., Picciotto, M., Bozinovic, G., & Tour, E. (2019). Plagiarism or not? Investigation of Turnitin®-detected similarity hits in biology laboratory reports. *Biochemistry and Molecular Biology Education*, *47*(4), 370–379. https://doi.org/10.1002/bmb.21236

Galloway, N., Kriukow, J., & Numajiri, T. (2017). Internationalisation. Higher education and the growing demand for English: an investigation into the English medium of instruction (EMI) movement in China and Japan. The British Council. https://doi.org/10.4324/9781351184335-11

Hélot, C., Frijns, C., Van Gorp, K., & Sierens, S. (Eds.). (2018). *Language awareness in multilingual classrooms in Europe: From theory to practice* (Vol. 109). Walter de Gruyter GmbH & Co KG.

Howard, R. M. (1993). A plagiarism pentimento. *Journal of Teaching Writing*, *11*(3), 233–245.

Howard, R. M. (1995). Plagiarisms, authorships, and the academic death penalty. *College English*, *57*, 788–806. https://doi.org/10.2307/378403

Hull, G., & Rose, M. (1989). Rethinking remediation: Toward a social-cognitive understanding of problematic reading and writing. *Written Communication*, *6*(2), 139–154. https://doi.org/10.1177/0741088389006002001

Julliard, K. (1994). Perceptions of plagiarism in the use of other authors' language. *Family Medicine*, *26*(6), 356–360.

Keck, C. (2006). The use of paraphrase in summary writing: A comparison of L1 and L2 writers. *Journal of Second Language Writing*, *15*(4), 261–278. https://doi.org/10.1016/J.JSLW.2006.09.006

Kintsch, W., & Van Dijk, T. A. (1978). Toward a model of text comprehension and production. *Psychological Review*, *85*(5), 363. https://doi.org/10.1037/0033-295X.85.5.363

Llinares, N.-S. (2021). What is an ecosystem? Defining science in primary school CLIL contexts. *Language Teaching for Young Learners*, *3*(2), 337–361. https://doi.org/10.1075/ltyl

Maton, K. (2013). Making semantic waves: A key to cumulative knowledge-building. *Linguistics and Education*, *24*, 8–22. https://doi.org/10.1016/j.linged.2012.11.005

Maton, K., & Doran, Y. J. (2017a). Semantic density: A translation device for revealing complexity of knowledge practices in discourse, part 1 – Wording. *Onomázein, Special Issue*, 46–76. https://doi.org/10.7764/onomazein.sfl.03

Maton, K., & Doran, Y. J. (2017b). Condensation: A translation device for revealing complexity of knowledge practices in discourse, part 2 – Clausing and sequencing. *Onomázein, Special Issue*, 77–110. https://doi.org/10.7764/onomazein.sfl.04

McKay, S. L. (2018). English as an international language: What it is and what it means for pedagogy. *RELC Journal*, *49*(1), 9–23. https://doi.org/10.1177/0033688217738817

Moskovitz, C., & Kellogg, D. (2011). Inquiry-based writing in the laboratory course. *Science*, *332*(6032), 919–920. https://doi.org/10.1126/science.1200353

Nashaat-Sobhy, N., & Sánchez-García, D. (2020). Lecturers' appraisals of English as a lingua franca in European higher education settings. *Journal for the Psychology of Language Learning*, *2*(2), 56–72. https://doi.org/10.52598/jpll/2/2/5

Palmer, A., Pegrum, M., & Oakley, G. (2019). A wake-up call? Issues with plagiarism in transnational higher education. *Ethics & Behavior*, *29*(1), 23–50. https://doi.org/10.1080/10508422.2018.1466301

Pecorari, D. (2006). Visible and occluded citation features in postgraduate second-language writing. *English for Specific Purposes*, *25*(1), 4–29. https://doi.org/10.1016/j.esp.2005.04.004

Pecorari, D. (2010). *Academic writing and plagiarism: A linguistic analysis*. Continuum.

Pecorari, D. (2012). Textual plagiarism: How should it be regarded. *Office of Research Integrity Newsletter*, *20*(3), 3–10.

Pecorari, D. (2016). *Plagiarism, international students and the second-language writer*. In Britag Tracey (Ed.), *Handbook of academic integrity* (pp. 537–550). Springer. https://doi.org/10.1007/978-981-287-098-8_69

Pecorari, D., & Petric, B. (2014). Plagiarism in second-language writing. *Language Teaching*, *47*(3), 269–302. https://doi.org/10.1017/S0261444814000056

Pennycook, A. (1996). Borrowing others' words: Text, ownership, memory, and plagiarism. *TESOL Quarterly*, *30*(2), 201–230. https://doi.org/10.2307/3588141

Perkins, M., Gezgin, U. B., & Roe, J. (2018). Understanding the relationship between language ability and plagiarism in non-native English-speaking business students. *Journal of Academic Ethics*, *16*(4), 317–328. https://doi.org/10.1007/s10805-018-9311-8

Roscoe, R., & Chi, M. (2007). Understanding tutor learning: Knowledge-building and knowledge-telling in peer tutors' explanations and questions. *Review of Educational Research*, *77*, 534–574. https://doi.org/10.3102/0034654307309920

Seidlhofer, B. (1991). *Discourse analysis for summarization*. Doctoral dissertation, Institute of Education, University of London. Retrieved from https://discovery.ucl.ac.uk/id/eprint/10018780/1/125469.pdf

Shi, L. (2004). Textual borrowing in second-language writing. *Written Communication*, *21*, 171–200.

Swain, M. (2006). Languaging, agency and collaboration in advanced second language learning. In H. Byrnes (Ed.), *Advanced language learning: The contributions of Halliday and Vygotsky* (pp. 95–108). Continuum.

Swain, M., & Watanabe, Y. (2021). Languaging: Collaborative dialogue as a source of second language learning. In C. A. Chapelle (Ed.), *The encyclopedia of applied linguistics* (pp. 667–674). John Wiley & Sons. https://doi.org/10.1002/9781405198431.wbeal0664.pub2

Taber, K., & Watts, M. (2000). Learners' explanations for chemical phenomena. *Chemistry Education: Research and Practice in Europe*, *1*(3), 329–353. https://doi.org/10.1039/B0RP90015J

Villalta-Cerdas, A., & Sandi-Urena, S. (2013). Self-explaining and its use in college chemistry instruction. *Educación Química*, *24*(4), 431–438. https://doi.org/10.1016/S0187-893X(13)72498-4

Wette, R. (2010). Evaluating student learning in a university-level EAP unit on writing using sources. *Journal of Second Language Writing*, *19*(3), 158–177. https://doi.org/10.1016/j.jslw.2010.06.002

Whittaker, R., Llinares, A., & McCabe, A. (2011). Written discourse development in CLIL at secondary school. *Language Teaching Research*, *15*(3), 343–362. https://doi.org/10.1177/1362168811401154

Wilkins, S., & Juusola, K. (2018). The benefits and drawbacks of transnational higher education: Myths and realities. *Australian Universities' Review*, *60*(2), 68–76.

Winne, P. H., Marzouk, Z., Nesbit, J. C., Rakovic, M., Ram, I., Samadi, D., Stewart, J., Teng, K., Truscott, D., Vytasek, J., & Woloshen, S. (2016, August). nStudy: Software for gathering trace data about learning and generating learning analytics. American Psychological Association.

World Educators Forum (2015). *Education 2030: Incheon Declaration and Framework for Action for the Implementation of Sustainable Development Goal 4: Ensure Inclusive and Equitable Quality Education and Promote Lifelong Learning Opportunities for All.* United Nations Educational, Scientific and Cultural Organization. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000245656