

AN ABSTRACT OF THE THESIS OF

Alexander J. Werndli for the degree of Master of Arts in English presented on June 4, 2021

Title: Translingual Science Communication: From Local Publications to the STEM Writing Classroom.

Abstract approved:

Ehren H. Pflugfelder

In order to assist WAC/WID practitioners and science writing faculty in incorporating translingual perspectives in disciplinary writing instruction, this study extends translingualism to language practice in the sciences by conducting a corpus study of Al-Awamia, a Moroccan agronomic journal. Mapping rhetorically significant changes across abstracts authored in English, French, and Arabic suggests that European-language abstracts are generally tailored to an international specialist audience and Arabic abstracts favor a domestic policy maker audience. The rhetorical choices made to address these different audiences are typical of those studied by scholars of science communication, and accordingly this study suggests that non-specialist communication assignments may be a promising site to incorporate multiple language competencies into the STEM writing classroom.

©Copyright by Alexander J. Werndli
June 4, 2021
All Rights Reserved

Translingual Science Communication: From Local Publications to the STEM Writing
Classroom

by
Alexander J. Werndli

A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Master of Arts

Presented June 4, 2021
Commencement June 2021

Master of Arts thesis of Alexander J. Werndli presented on June 4, 2021

APPROVED:

Major Professor, representing English

Director of the School of Writing, Literature, and Film

Dean of the Graduate School

I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Alexander J. Werndli, Author

ACKNOWLEDGEMENTS

Some notes of sincere appreciation are in order.

First and foremost, I must thank my advisor, Dr. Ehren Helmut Pflugfelder, whose thoughtful advice and insightful feedback rapidly followed each and every draft and meeting.

Second, I am unendingly grateful for my partner, Chaimae Mahmoud-Werndli.

Reflecting with you was invaluable in reassuring me that I wasn't chasing ghosts in translation, but your support extends far beyond what any individual passage here can capture.

Finally, each member of my committee deserves recognition: Dr. Ana Milena Ribero,

Dr. Sarah Tinker Perrault, Dr. Vicki Tolar Burton, and Dr. Jacob Darwin Hamlin.

Each of you has shaped my perspectives through coursework, conversation, and consultation, without which this thesis would not be what it is.

TABLE OF CONTENTS

	<u>Page</u>
Introduction.....	1
1: Literature Review	6
1.1: International L2 Students and WAC/WID.....	6
1.2: Learners, Labels, and Languages.....	13
1.3: Fertile Grounds: WID as a Site of Translingual Intervention and..... Scholarship.....	22
1.4: Science, Specifically.....	27
1.5: Investigating Language in Practice: <i>Al-Awamia</i>	34
2: Corpus Analysis.....	36
2.1 Background.....	38
2.2 Methods	43
2.3 Results and Discussion	47
2.4 Conclusions	63
3: Return of the Pedagogical Implications.....	66
3.1 Introduction: Throughlines.....	66
3.2 Science Communication in the STEM Classroom.....	68
3.3 Science Communication and Multilingualism: Parallel Literacies.....	73
3.4 Strategies for Instructors Teaching Translingual Science Communication.	78
3.5 Expectations and Evaluation.....	84
3.6 Conclusions.....	89

TABLE OF CONTENTS (Continued)

	<u>Page</u>
Conclusion	95
Bibliography	98
Appendix	112

LIST OF TABLES

<u>Table</u>	<u>Page</u>
1 Concept categories.....	45
2 Presence of rhetorically significant changes (RCS) between European-language and Arabic abstracts, by concept category.....	49

DEDICATION

For Maggie

Introduction

Several years ago, I delivered a lecture at Mohammed I University's *École Nationale des Sciences Appliquées* in Oujda, Morocco. The 50-60 students in attendance were engaged in their capstone project, a technical report on their work as interns in a variety of companies. My presentation, "Tips for Process in Technical and Professional Writing," drew on my experience as a writing consultant and instructor to (at least hopefully) help these students navigate the often-arduous report composition process. Mohammed I does not have a dedicated writing center, and students were tasked with documenting their experiences, crafting a format, and composing their reports with relatively little guidance. Alongside me stood a co-presenter, Oussama Rafiq, a Oujda-born electrical engineer and computer scientist who had recently moved back to his hometown. Like me, he shared tips from his experience – an insider account of the skills that count in engineering, if you will. Writing skills were front and center throughout, but one story in particular has stuck with me.¹

~

"You may think to yourselves that all you need is English, now, but you would be wrong," Oussama informed the aspiring engineers. He drew back his shoulders, swept his gaze across the room, and began to recount the following.

In the mid-2010s, Oussama was working in Korea as a contractor. Most of his work, particularly within his workplace, was English-medium. This job, however, was more linguistically complex; the clients, themselves from the Gulf, were constructing a

¹ Story reproduced with permission.

Halal meat market in southern France. Many of their expected customers (primarily immigrants) were not proficient in French, although many others would avoid shopping there if French was not offered as a medium. The clients wanted to commission a Point of Sale (POS) system and interface that operated in both French and Arabic and could be switched at will. Among his Korean peers, Oussama was uniquely qualified for this work – most of his undergraduate and graduate education had been conducted in French, and Arabic was, of course, his native language. His bid was accepted on the basis of his language skills.

He allotted two billable hours per language, and four total to design the interface. He recalls designing the French portion of the POS over the course of around twenty minutes. The Arabic portion took him three days.

Oussama lingered on this point for a second, to dramatic effect. “And that’s why you should maintain your languages,” he said. “You never know when you’ll need *all* of them.”

~

Oussama’s story is illustrative of transnational science communication in the age of globalization. A Moroccan engineer at an English-medium Korean firm designs an Arabic-language POS working with clients from the Gulf for a project site in France – the national communities and languages of communication invoked in this story form a complex web. Navigating this series of professional relationships requires a number of finely tuned rhetorical and linguistic skills. It is telling that Oussama was selected primarily on the basis of his language proficiencies, clearly construed as assets for this highly situated task. It is also somewhat unsurprising that Oussama struggled with the

Arabic-language portion of his design work. For decades, Moroccan higher education has taught STEM fields in French (with English recently entering the curriculum) because these European languages are perceived as the universal languages of wider professional access. The Arabic-language POS was the first document Oussama had composed in Modern Standard Arabic since high school.

The treatment of one language variety as paramount to professional communication, often to the detriment of other linguistic resources, is undoubtedly familiar to those concerned with writing instruction in the sciences at North American universities. The idea that only one standardized ‘universal scientific/technical English’ exists in the professional sphere is enduring, even though it does not reflect the reality of either lingua franca English use around the world, nor the roles other languages play in transnational communication. Other language competencies, accordingly, have often been described as factors which “interfere” with acquiring scientific language rather than as assets. Ghanashyam Sharma (2018) terms this idea the “myth of universality,” and examining scientific communication in situated context quickly reveals greater nuance. Though Oussama’s story is but one micro-level illustration, many such illustrations add up to an incredibly complex portrait of situated language use which highlights the ways that the “myth of universality” can serve to underprepare students, particularly the international L2 students who comprise a major population in STEM programs at North American universities, for the realities of disciplinary communication.

This thesis will examine another such situated context in detail: the Moroccan agricultural science journal *Al-Awamia*, which publishes agronomic research with abstracts in French, English, and Arabic. My research and analysis shows that the

different languages of abstract appear to favor different audiences, with changes between languages indicating that European-language abstracts are meant for an international specialist audience while Arabic-language abstracts favor a domestic non-specialist audience. These findings demonstrate that international scientists regularly utilize multiple linguistic competencies to address different audiences, even in specialist genres like the research article abstract. In accordance with other pedagogical inquiry, I thus argue that linguistic competencies outside of standard written English should be integrated into the classroom via assignments which ask students to recompose research in other languages for non-specialist audiences, much like the clients and customers who comprised Oussama's stakeholders as he designed the POS system. I refer to these activities as Translingual Science Communication and suggest that they stand to hone future scientists' rhetorical skills, reinforce their understanding of content, and foster critical science literacy.

Translingual Science Communication activities as a means of reflectively incorporating diverse literacies in the classroom are inspired by emerging translingual pedagogies and research within the field of composition. This field's historical emphasis on standardization of the English language has been well-documented, and Writing Across the Curriculum (WAC) and Writing in the Disciplines (WID) programming have at times spread these monolingual orientations within disciplinary instruction. At other times, centering disciplinary faculty's expertise and specialist genres key to internal disciplinary communication has reinforced the monolingual perspectives already held by scientists and other practitioners. The same practices and epistemologies can serve as an impetus for change, however; by observing greater nuance in practiced communication

and challenging monolingual assumptions in instruction, WID practitioners can provide meaningful support to both international L2 writers and disciplinary writing instructors.

How can science writing instructors effectively and responsibly incorporate translingual writing pedagogies in upper-division curricula? What pedagogies can both reflect scientific practice and answer the translingual call, encouraging students to make full use of their linguistic resources and changing the way students and researchers relate to language difference? In order to answer these questions, the first chapter of this thesis outlines recent developments in translingual theory and practice with particular attention to the needs of international L2 students and the implementation of translingual pedagogies within the disciplinary writing classroom. The second chapter follows the recommendations of some translingual scholars by productively drawing on fields such as applied linguistics and English for Academic Purposes. This chapter provides a corpus analysis of abstracts from *Al-Awamia* wherein rhetorically significant changes between languages of abstract are coded into relevant concept categories. Claims regarding the different invoked audiences across languages arise from these categories, and it is the dynamics of science communication across languages thus identified that give rise to the pedagogical recommendations of the third chapter, which connects these claims to the classroom by proposing Translingual Science Communication activities. Additionally, this final chapter provides suggestions for effectively implementing such activities and speculates on the outcomes and benefits that they can offer.

Chapter 1: Literature Review

International L2 Students and WAC/WID

In WAC/WID, as in writing studies as a whole, questions of language difference are paramount. That L2 writers and writing are areas of concern to WAC/WID faculty and researchers is evinced by the publication of special issues of *Across the Disciplines* on related topics in both 2011 and 2018. The former highlighted the need for WAC/WID researchers and practitioners to seriously engage with language diversity by examining trends in L2 writer enrollment and writing support service use, the unique needs of L2 writers, and the ways that WAC initiatives had considered (or failed to consider) language difference (Frigo and Fulford, 2011). At the University of Missouri, for instance, WPA Martha Davis Patton (2011) conducted a needs analysis for the growing L2 student population and found that:

Needed to support this growing body of L2 writers is a network of robust services. Not only are these services under-funded and staff under-prepared to serve the special needs of L2 students on our campus, there is little connection between and among campus units associated with teaching of writing. (p. 6).

These needs undoubtedly extend beyond the University of Missouri's campus. With a similar administrative focus, applied linguist Ferris and WAC/WID specialist Thaiss (2011) worked from two collaboratively designed documents, *California Pathways* and "CCCC Statement on Second Language Writing and Writers," to lay out three important areas that must be grappled with in order to provide L2 students with appropriate support:

- The importance of clearly understanding the nature and characteristics of our student audience;

- The essential role of pre-service teacher preparation and in-service teacher development;
- Ways in which our curriculum can/should become more responsive to the needs of the many L2 writers in our courses. (p. 5)

Although both studies identify parallel systemic needs, the authors' local lenses remind us of the imperative for attention to local institutional contexts and situated action that form the bedrock of effective WAC/WID praxis. This chapter will provide an overview of WAC/WID's recent positioning towards such language differences, with an eye to how disciplinary writing instruction can both support students as writers and best take advantage of their many linguistic competencies.

The 'special needs' of L2 writers that such WAC articles often reference deserve elaboration. In general, writers from different linguistic backgrounds may struggle with the peculiarities of US academic discourse. Such particularities include the importance and nuance of stance-taking in academic writing (Lancaster 2011; 2014), the development of a sense of writerly authority (Fife 2018), unfamiliar rhetorical/argumentation patterns (Douglas 2015; 2020), and genre conventions. When L2 students receive instructor feedback, higher-order concerns such as these are often obfuscated by a focus on lower-order errors. In multiple interviews and surveys, disciplinary faculty (particularly L1 English faculty) have reported spending a significant amount of time and energy deliberating whether or not to (and how to) correct perceived errors (Ives et al., 2014). Oftentimes, those who report spending the most time responding to error also provided the most dedicated feedback overall. Yet a focus on lower-order concerns can potentially drown out feedback focused on higher-order

concerns like organization, content, and other rhetorical elements, maintaining for L2 students a pattern that WAC's longstanding emphasis on minimal marking has been meant to counter. The questions this trend poses for WAC/WID pedagogy are legion and have been raised by a number of observers.

As writing scholars become increasingly aware of the vast divergence in experiences between different demographics of L2 writers, it is necessary to preface any discussion of student support by distinguishing further amongst this broad category. Different student populations comprise those needing more comprehensive support and a new orientation to language difference: domestic writers whose home varieties of English are less privileged in the academy, "generation 1.5" writers whose developed proficiency in casual English may render their own needs for writing support less visible (see Nielsen, 2014), writers from countries with first languages other than English who come to the United States for the purposes of higher education, and more - this survey is by no means comprehensive. At the risk of homogenizing writers' myriad complex experiences and language backgrounds, identifying broad categories of students can highlight needs for institutional support and help to motivate institutional action. As writers' relationships with academic institutions vary wildly between these categories, this thesis's scope will primarily be limited to the latter category of writers, often referred to as "international" L2 writers, with the hope that the derivation of pedagogical implications for this specific group may contribute to a comprehensive expansion of language support and a treatment of language difference that benefits writers from all stigmatized language backgrounds.

For decades, the number of such international students enrolling at U.S. universities has steadily increased. International students have become an important

revenue source for major universities and, accordingly, are explicitly targeted by admissions. Matsuda has succinctly summed up the many motivations universities have to recruit these students: “many institutions continue to recruit international students because they bring foreign capital (at an out-of-state rate), increase visible ethnic diversity (which, unlike linguistic diversity, is highly valued), and enhance the international reputation of the institutions” (2006, p. 641). The fluid nature of the category makes it impossible to ascertain exact numbers of international L2 students, but per visa statistics alone, over 1 million international students were enrolled in U.S. universities during the 2017-2018 school year (CRS, 2019).² This demographic weight is immediately visible in local contexts: in Ferris and Thaiss’s survey, for instance, L2 writers made up over half of UC Davis’ 33,000 students (2011).³ Institutional support systems, however, as Matsuda (2006) and Patton (2011) have pointed out, have often not kept pace with enrollment.

Many of these international students come from privileged backgrounds in the rising middle classes of their countries of origin which enable them to foot the substantial bill of an overseas education. Accordingly, many arrive at North American universities with extensive educations and developed academic proficiency in an L1. These students often hail from sites of ‘linguistic super-diversity,’ as put forward by Blommaert (2010), formed and facilitated by the mobility of globalization. Accordingly, they often have a

² Not all of these students may identify as L2 English writers. Students from British commonwealth countries or former British colonies, for instance, are unlikely to identify as such. A truly comprehensive listing of international students’ various individual origins and language backgrounds, however, does not exist. For a more specific account of international student demographics, see Jordan and Kedrowicz (2011, p. 4) and the Congressional Research Service report (2019) cited here.

³ For clarity, this citation refers to all L2 writers, domestic and international.

wealth of linguistic resources and experiences to draw on, although within these super-diverse linguistic landscapes English often remains the language of access to wider global communities. In recognition of this global trend, international writers with experiences like these and a degree of English proficiency have been referred to as “the new global elite,” a term which recognizes the substantial intellectual and market power they wield. Yet ESL instructor and composition scholar Marino Fernandes (2014) draws a distinction between privilege and agency and argues that it is possible for second language writers to possess the former without the latter. The for-profit ESL classrooms that make up the foundation of many of these students’ English-language experiences often focus on improving standardized test scores (SAT, TOEFL, and ITELP, among others) and assign writing on topics detached from critical consequence. The results are tasks with linguistic and cognitive demands much different from those these same writers encounter upon reaching the college writing classroom where students “are asked to position themselves in relation to the world they are writing in and out of” (Fernandes, 2014, p. 257). A responsible university writing pedagogy should therefore foster the agency that is necessary for critical consciousness and authorial identity.

The same lack of agency extends to the manner in which writers from diverse language backgrounds are often discussed in administrative contexts. Too often are such students characterized only in terms of the support systems they may require rather than the linguistic resources they bring. That students need additional support to succeed in a university system that values the discourse and dialect of a linguistic community other than their own is unsurprising, but characterizing students only in terms of needed support assigns them a connotation of deficiency. This pattern frequently arises in faculty

discussions of L2 writing and “error” both in interviews (Zawacki and Habib, 2014) and in other sites of WAC/WID practice such as faculty seminars. Such a focus on “error” calcifies a deficit mindset and obscures the many pronounced strengths that international L2 writers bring to the classroom, namely experience navigating and blending multiple linguistic and cultural discourses. Instead of asking how L2 students can measure up to an assumed L1 normal, perhaps asking “how can instructors in writing-intensive courses engage linguistically diverse students in ways that appropriately recognize and further utilize the latter’s cultural and rhetorical background?” is more productive (Mao, 2018, p. 106). Such a responsible pedagogy has been likened to a notion of “linguistic justice” and carries the potential to transform students’ attitudes towards language difference (Mihut, 2020).

WAC practitioners have long heralded interactive writing in the classroom as revolutionary for engaging students of all types. It would follow that frequent opportunities to write, informal writing activities in the classroom, and the general treatment of writing as a unique tool for processing represented by writing-to-learn models could all help address concerns of agency for L2 writers. Questions have been raised, however, as to the efficacy of this belief: is there something inherently unique to the act of writing as a pedagogical tool? Issues of language acquisition complicate the writing-to-learn formula: many L2 students have trouble writing as naturally or fluidly as their L1 peers, potentially reducing writing’s effectiveness as a brainstorming tool; L2 writers also generally spend more time on any individual piece of writing and tend towards treating writing as a polished product, further limiting its effectiveness in informal activities; and finally, international writers may be accustomed to a very

different role for writing in pedagogy and may have trouble adjusting to significantly different classroom expectations without explicit instruction (Patton 2011, pp. 8-10; Mina and Cimasko, 2020). In 2011, Michelle Cox laid out these and other concerns in her article, “WAC: Closing Doors or Opening Doors for Second Language Writers?” Synthesizing a variety of L2 and second language writing scholarship, she summarizes a central concern with the WAC movement’s impact on L2 writers:

If WAC increases the amount of course learning and assessment that happens through writing without, at the same time, combating the inclinations of untrained faculty to pass L2 writers along, to penalize them for their “written accents,” and/or to assess them based on U.S.-centric assignments, WAC has then, by default, “closed doors” for L2 writers. (Cox, 2011, p. 5).

Cox goes on to survey contemporary WAC literature and show that most WAC/WID scholars acknowledge the need for more comprehensive and intentional support for this writerly demographic. Finally, she issues a call to action: to both collaborate with and learn from the research and insights of L2/Second Language-Writing (SLW) scholars, and to advocate for L2 writers through WAC research on L2 writers’ experiences, hurdles, and needs that can inform practice.

Situated analyses and longitudinal studies since the 2011 issue have suggested that comprehensive, integrated WAC drives such as George Mason university’s ACCESS program, a set of first-year courses organized through collaboration between writing, ESL, and disciplinary faculty, are one means of providing much needed support (Mallet and Zgheib, 2014). However, the claims of case studies like these regarding WAC and writing-to-learn pedagogy in general must be qualified; indeed, in responding to Cox’s

article the authors of this very case study stress the “foundation of available resources and collaborations particular to George Mason” [especially collaboration with ESL and Applied Linguistics faculty] and the importance of “substitutable institution-specific resources elsewhere” in order to “open doors for participating faculty and L2 writers that WAC institutionalized practices may have inadvertently closed in the past,” doors which may remain closed if WAC practices are deployed less comprehensively or intentionally (Mallett and Zgheib, 2014, pp. 392, 391). Notably, the ACCESS program was only available to freshman and featured limited class sizes for those students. Unfortunately, comprehensive international student support systems and collaborations are notably rarer at the upper-division and graduate levels at most institutions, and more comprehensive writing support at these levels would be of great benefit to this student population.

Learners, Labels, and Languages

Before discussing specific means of support, a discussion of the linguistic and rhetorical concepts this thesis will draw on to describe the roles multiple language competencies play in writing instruction is necessary. Today, non-native users of English outnumber native speakers by a ratio variously listed between 3:1 and 4:1, and localized dialects of English are overwhelmingly the norm rather than the exception of language usage. Despite these facts, students are often compared to an idealized “standard” of English language and communication, generally the varieties of English deployed by white, middle-class American and British users. Writing instructors have commonly conceptualized deviance from these dialects as degradation (in the cases of native speakers domestically, glossing over the richness of dialects such as African American

Vernacular English – see the work of Geneva Smitherman) or “error” (in the cases of international users). Paul K. Matsuda famously tied this grouping of beliefs and pedagogical practices to “the Myth of Linguistic Homogeneity” (2006); the pervasive assumption that “students are by default native speakers of a privileged variety of English from the United States,” though it reflects the reality of language in higher education just as poorly as it reflects the use of English in the world, has historically justified the relegation writers of less privileged varieties of language to basic writing and ESL courses (p. 639). These writers have historically been allowed into the mainstream only if they adopt the dialect of the dominant group, often termed Standard Written English (SWE).

Due to this deeply embedded language ideology, writers who trade in discourses other than American Academic English (AAE) are often characterized in terms of deviance or deficiency. These writers are variously assigned a number of labels, owing to the different angles by which they are considered: “Non-Native English Speakers” (NNES) contrasts these writers with the perceived normal; “English Language Learner” (ELL) emphasizes language acquisition as an ongoing [and unfinished] process; “English as a Second [or Foreign] Language” (ESL/EFL) derives from the traditions of ESL and Second Language Writing (SLW) pedagogy, and “L2” comes from linguistic studies of language acquisition later in life. Each of these labels foregrounds a linguistic otherness that obscures the complex realities of each writer’s linguistic history and their relationship to their various linguistic resources. Thus, over time, it has become common to avoid field-specific terminology and label writers with multiple language competencies, both domestic and international, as “multilingual” as a means of

emphasizing the plurality of their language resources rather than deficit in a single language. “Code-switching” has long been used to describe the process by which multilingual writers shuttle between different languages or dialects based on rhetorical context. Yet this concept too has recently come under attack; by describing a plurality of known languages, “multilingualism” can reinforce an idea of languages as closed, static categories. Instead, Lorimer (2013) argues that “looking for moments of rhetorical attunement” in language practice, rather than code-switching to the right language for a situation, “is one way to resist treating literate resources as stable and easily accessed knowledge, and instead accounting for the ongoing and often unstable practices that comprise multilingual writing,” (p. 197) a perspective seconded by Guerra (2016).⁴

These latter perspectives can be connected to the rise of translanguaging as a scholarly movement. “Translanguaging” is an umbrella term for a number of perspectives to language difference that have evolved out of similar scholarly inquiry in a number of different fields, ranging from Blommaert’s call for “a sociolinguistics of resources, not of languages” for which “mobility is a central theoretical concern” (2010, p. 21) to Vershawn Ashanti Young’s interdisciplinary work on code-meshing (2009; 2014). Jonathan Hall (2018) thus proposes that translanguaging is best approached “as a brief allusion to a complex of existing theories—not original to this translanguaging approach but

⁴ This latter practice has been referred to as “code-meshing” and contrasted with ‘code-switching’ (Young, 2009). Matsuda (2013, p. 158-159) takes issue with this distinction, citing terminological discrepancies in the use of ‘code-switching’ between composition studies and applied linguistics, where both activities would fall under the umbrella of ‘code-switching’. The distinction between code-switching and code-meshing is thus often more rhetorical than it is linguistic. Composition-influenced uses of the term have made their way back to its originating discipline, however, often to productive ends; indeed, Li Wei (2018) demonstrates what code-mixing (analogous to code-meshing) offers an applied linguist that code-switching does not.

rather building on decades of work in critical applied linguistics and other fields” (p. 30). Its terminology is in flux and often loosely defined; while *translingualism* encompasses all acts of language as the products of negotiation, *translanguaging* (analogous to code-meshing) refers to the specific act of crossing between discourses. In the words of one applied linguist defining both the concept and its potential scholarly benefits:

translanguaging reconceptualizes language as a multilingual, multisemiotic, multisensory, and multimodal resource for sense- and meaning-making, and the multilingual as someone who is aware of the existence of the political entities of named languages and has an ability to make use the structural features of some of them that they have acquired (Wei, 2018, p. 22).

In applied linguistics, for instance, Wei argues that translanguaging can help explain the complex hybrid language patterns of multi/translinguals in a way that classic code-switching approaches fail to.

As it pertains to composition and writing studies, translingual orientations have emerged out of a tradition of scholarship questioning pervasive assumptions of monolingualism (Lu, 2006; Matsuda, 2006; Trimbur and Royster, 2002; Villanueva and Arola, 2011). By extending a similar line of inquiry to considerations of language difference outside the US, scholars of World Englishes have also powerfully refuted a view of English as static and unchanging in favor of one of English[es] as dynamic and negotiated. A. Suresh Canagarajah, for instance, perhaps the most widely-cited scholar of World Englishes in rhetoric and composition, conducted a study of a single author’s research article abstracts in both Tamil and English and argued that rhetorical context, not language proficiency, was the strongest factor in the composing differences between

documents (2006). Based on this analysis, he called for a “multilingual pedagogy of writing” in which “we will treat the first language and culture as a resource, not a problem” and “accommodate diverse literacy traditions, not keep them divided and separate” (p. 603).

Each of these works observes linguistic heterogeneity in living English, and this variety of scholarship led to a particularly influential article published in *College English* in 2011, wherein Horner et al. established translanguaging as a landmark term in composition studies. They called for a translanguaging approach to both scholarship and pedagogy, an approach which “sees difference in language not as a barrier to overcome or as a problem to manage, but as a resource for producing meaning . . . expressively, rhetorically, communicatively” (Horner et al., pp. 305, 303), kicking off a wave of scholarship that observed the way writers negotiate, deploy, and shuffle between languages in a variety of contexts both national and international. This widely-cited paper launched a wave of attention to translanguaging research. On the more pedagogical side, for example, Canagarajah published “Negotiating Translanguaging Literacy: An Enactment” (2013a) wherein he applied an ethnographic lens to the literacy narratives of multilingual students in his own composition classroom, arguing that they engaged in different forms of “negotiation” between languages. In the same year, he also edited a collection titled *Literacy as Translanguaging Practice* (Canagarajah, 2013b).

It is worth noting that sweeping calls for explicit translanguaging practice often obviate existing pedagogical dispositions and practices that track with translanguaging goals without explicitly deploying the language of translanguaging. Many practitioners already espouse these principles; take, for example, the multidisciplinary writing workshop

described by Frederickson and Mangelsdorf (2014) which effectively encouraged translingual exchange among participants by emphasizing multilingualism and multidisciplinary as assets. These authors term such exchanges “language crossings” rather than using the term “translingual.” A similar dynamic has been observed in another writing support venue, the graduate writing center. Although the tutors in her study had received no formalized training in translingualism, Summers (2020) found through an openly coded series of interviews that tutors’ intermediary/hybrid role allowed them to:

offer spaces to reconsider not only how different populations of students prioritize writing problems—and therefore necessitate a reprioritization of writing center practices—but also how to integrate a focus on those problems with discussions about students’ scholarly identity and the mutual respect and inquiry that characterize a ‘translingual approach’” (pp. 246-247).

Thus, it is worth highlighting that one need not explicitly invoke the language of translingualism in order to exercise the dispositions that the movement calls for. WID best practices often favor highlighting and expanding existing practices and institutions, and in fact many practitioners (tutors and instructors alike) may already operate on these principles. Recent studies suggest, however, that *writers’* conceptions of language difference are just as important as (if not even more than) those of their instructors, and explicit treatment of translingual principles in class discussions and learning outcomes is perhaps the most direct way to affect writers’ conceptions in a classroom context (Mina and Cimasko, 2020; Bou Ayash, 2020).

Any translingual intervention in writing instruction or writing program administration would do well to engage in crossover with other fields that support L2

students, including SLW and English for Academic Purposes (EAP). Translingualism has been a source of conflict between these disciplines in the past; Jonathan Hall (2018) has likened competing terminology, approaches to the examination of language difference, and territory-staking between SLW and self-described translingual composition scholars to a form of “boundary work,” as each discipline establishes and differentiates itself in necessary moves for scholarly recognition and administrative support. Notable examples include an open letter “Clarifying the Relationship between L2 Writing and Translingual Writing” (Atkinson et al., 2015) and the works of Paul K. Matsuda, including the provocatively titled “It’s the Wild West Out There: A New Frontier in U.S. College Composition” (2013) and “The Lure of Translingual Writing” (2014). In these publications, Matsuda accurately points out that the roots of such concepts as code-switching and World Englishes have been well established in applied linguistics since the 1980s and partially attributes the spread of translingualism in writing studies to publishing pressures and academic bandwagoning. Both Matsuda’s publications and the open letter point out that this nascent conceptual framework had struggled to meet the pedagogical imperative and transfer to the classroom, and indeed contemporary translingualists of note shared “a general feeling that theorization of translingual literacy has far outpaced pedagogical practices for advancing this proficiency in classrooms” (Canagarajah, 2013a, p. 41). Among Matsuda’s most pertinent critiques is that publishing pressures for translingualism carry “the assumption... that translingual writing is visible” and assure that “negotiation is only acknowledged when it results in mixed language use, leaving out the possibility that negotiation may have led the writer to... make the rhetorical choice not to deviate from the dominant practices” (2014, pp. 480-481). While

his characterization of the resulting hunt for novel language difference (which he describes as a “linguistic freak show” (2013, p. 157)) is perhaps overly incendiary, his criticisms carry an important admonition which subsequent translingually-oriented publications must take special care to heed as publishing pressures continue to privilege the unusual.

Publications’ tendency to privilege the unusual over the commonplace can undercut the core tenants of translingualism: that language borders are *constantly* being crossed and negotiated and that all language acts are the product of negotiation. Privileging the unusual has the effect of exoticizing translanguaging and contrasting it with the “normal” language practices of dominant monolinguals, thus reifying rather than threatening monolingual practices in a process that has been cogently described as “domestication through exoticization” (Horner, 2020, p. 294). This has contributed to blurring the pedagogical applications of translingual research – unique composing processes are, by nature, less generalizable to a wide student population. Additionally, Canadian WID scholar Gentil points out that not all multilinguals perceive language fluidity and evolution as positives. Using the example of Quebecois speakers of French, he points out that, in certain political contexts, bi/multi-linguals can assert static views of language as a way of preserving linguistic and cultural identity (Gentil, 2018). This pattern undoubtedly holds true in other international contexts with far more dramatic imbalances of linguistic power, and an awareness of such factors is crucial for any WPAs hoping to take an active role in language issues in their local contexts.

In order to benefit from the criticisms summarized here, aspiring translingual scholars should:

- explore language with methodological rigor beyond isolated exceptional case studies,
- ground their research in the fields of SLW and applied linguistics via interactions that Christine Tardy (2017) describes as “productive crossovers,” and
- meet the pedagogical imperative with work that provides concrete benefits for students.

Recently, some translingual researchers and pedagogues have begun answering this call by engaging in productive crossover with applied linguistics and SLW scholarship and publishing concrete examples of translingual pedagogy in the classroom. For example, a recent open-source collection, *Translingual Dispositions: Globalized Approaches to the Teaching of Writing* (Frost et al. 2020), includes articles on classroom environments from Lebanon to Sweden and activities from translation to international digital collaboration (Baalbaki et al, 2020; Lavelle and Ågre, 2020; Palmer, 2020). So far, however, a problem lingers from early translingual work; even as translingual pedagogies have been explicitly enacted in a growing variety of transnational contexts, the lion’s share have, like Canagarajah’s “Enactment” (2013a), remained concentrated in the composition/writing classroom (e.g. Guerra, 2016; Khadka, 2020; Baalbaki et al., 2020). This too can have an exoticizing effect, making translingualism feel like a composition-specific phenomenon rather than an aspect of global communication in all fields.

Fertile Grounds: WID as a Site of Translingual Intervention and Scholarship

The irony is that disciplinary writing, including scientific and technical writing, represents a particularly potent site for translingual intervention and considerations of language difference, both in terms of instruction and research. Indeed, in Min-Zhan Lu's widely cited original call for living-English work (2006), she identified science and technical writing as key frontiers in living-language inquiry:

In their aspiration to join the professions or gain access to career prospects, students across the disciplines, along with professionals – research scientists, engineers, systems analysts, investment bankers, authors, editors, and so on – are increasingly pressured to perceive and market their competence in terms of their ability to process and manipulate information – to deliver products and services in the form of data, words, and images and to do so in the English most sought-after by the hiring and promotion practices of corporations surveyed by the College Board's Commission on Writing. A global perspective on the work of U.S. composition in a world driven by the logic of fast capitalism must address the politics of language practices in scientific, technical, commercial, legal, and administrative writing. (p. 616)

One can see certain ideological parallels between translingualism and Writing in the Disciplines as it is applied to writing; WID, after all, primarily deals with negotiating boundaries and practices across disciplines and in different rhetorical contexts.

Concerned with communication and language[s] at a broader level, translingualism too is concerned with communicators' crossing of fluid boundaries and varied performances in different rhetorical contexts. These compatible areas of inquiry suggest that WID could

stand to gain by borrowing from the fluidity with which translanguaging treats language borders; WID has occasionally been criticized for encouraging a view of disciplines as static, calcified boundaries in writing and some practitioners have called for “a more transdisciplinary view of academic writing” with greater attention to the elasticity of disciplinary boundaries (Hendricks, 2018, p. 48; Gere et al., 2018, pp. 73-74). Indeed, with the exigencies of increasing L2 enrollment in English-medium universities, it is no surprise that when translanguaging perspectives have recently been applied to writing instruction in the disciplines it has been toward productive ends, for example in the form of a 2018 special edition of *Across the Disciplines*.

The disciplinary classroom is also one of the most potentially impactful sites for translanguaging intervention. Closer investigation of the demographic under consideration reveals that international students are heavily represented in such disciplinary courses as engineering and business and often have specific aims behind their decisions to study in the United States. Disciplinary writing often purports to be informed by the “real world” of professionalization where, by all accounts, global Englishes, lingua franca English, and translanguaging occur with increasing frequency (Sharma, 2018; Montgomery, 2000, pp. 253-270). Again, this is not to say that translanguaging is never implemented in disciplinary writing contexts; on the contrary, some disciplinary writing instructors have actively taken advantage of their students’ multiple language proficiencies. Take, for example, the graphic design instructors in one student account who emphasized this student’s skill with Arabic and interest in calligraphy by working opportunities to use them into an English-medium course in Lebanon (Bou Ayash, 2020, pp. 29-31), or the celebration and encouragement of students’ ability to conduct groundbreaking L1

archival research in the “Roads to Democracy” history program at Uppsala university in Sweden (Lavelle and Shima, 2014; Lavelle and Ågre, 2020). It is telling that each of these examples arise in contexts outside of the US, as the ideology of monolingualism (though now present the world over) runs particularly deep in the United States and tends to discourage translanguaging in the classroom.

It should be noted that multilingual disciplinary faculty in the US are by no means rare and often themselves take part in translanguaging both in their scholarship and on a day-to-day basis. As Geller (2011) points out, WID pedagogical literature regarding language difference tends to assume a monolingual instructor, replicating the myth of linguistic homogeneity at another level. Multilingual faculty tend to consider their own language-acquisition experiences when giving their students language feedback. Whereas Native English-Speaking faculty often reported questioning the proper amount of language feedback with which to provide L2 writers and the fairness of treating L1 and L2 writers by similar standards (Zawacki and Habib, 2014; Ives et al., 2014), surveyed multilingual faculty were generally more decisive in their approach to language difference and generally recognized L2 students’ need for differentiated feedback (Geller 2011). Even this difference, though, must be qualified; taking a grounded approach to interview data with STEM faculty, Sharma (2018) found that many multilingual faculty perpetuate monolingual attitudes toward language:

participants implied that there is (or must be) a certain standard English as a “global” language for scientific communication. At first, the responses were surprising to me because the participants were scholars and students who used recognized varieties of world Englishes, including Indian English, Chinese

English, and Chicano English. Some of them acknowledged that NNES writers bring different writing styles and varieties of English into scientific communication. But they still insisted that variations should be ultimately eradicated... While describing a reality and expressing a legitimate desire to keep scientific communication universally consistent, this also embodies a language ideology that seems innocuous in itself. It demands a condition that is not realistically achievable without exacerbating unequal access to publication and other contributions to the advancement of science across national and social borders. (pp. 33-34)

Having succeeded in navigating a competitive environment colored by the pressures of monolingualism, compassionate multilingual faculty are thus likely to pass on to their students the same dispositions and attitudes that helped them succeed. Again, this is not to say that the “lower-order” concerns of sentence constructions and error do not deserve to be treated at all; on the contrary, surveyed faculty often report that concepts like grammar and error have pronounced impact on students’ professional success in a variety of fields. Even in translingual pedagogies, these concerns must be addressed – although there are means to do so that do not involve perpetuating monolingualism. The “Roads to Democracy” program at Uppsalla university, for example, adopts a lingua-franca approach to English in an environment of L2 speakers with myriad L1 backgrounds, an approach which values communication over standardization. Even in Sweden’s linguistically plural environment, however, the program’s faculty have observed that monolingual assumptions will tend to flourish if left unattended and uninterrogated. They are thus keen devote time to discussions of language and sentence level variance in order

to encourage their students to adopt this desired lingua-franca mindset (Lavelle and Shima, 2014; Lavelle and Ågre, 2020).

Previously, concrete research on language difference in the disciplines in the US has drawn productively from second language writing and linguistics. In their article “Lessons for WAC/WID from Language Learning Research: Multicompetence, Register Acquisition, and the College Writing Student”, for example, Hall and Navarro (2011) explicate a number of concepts from Second-Language Acquisition scholarship. Of particular note, they connect the linguistic concept of “register” and register acquisition to the process of disciplinary writing acculturation that is central to WID pedagogy, paving the way for a view of WAC/WID programs as part of a cross-register education system (pp. 8, 13-14). Gentil, writing from a bilingual context in Canada, found a similar use for modern language and translation studies in his writing classroom as he incorporated a translation activity and reflection. So central was this crossover to both his own experience and that of his student interviewees that he was prompted to call for the following:

Indeed, in many ways the challenges of bilingual WID development offer a case in point for the need to rewrite disciplinary and departmental boundaries in WAC/WID instruction, notably by bringing together modern languages, translation studies, and writing instruction in order to adequately support academic literacy development in two languages or more... not only to help bilingual writers learn to write in their disciplines in and across two languages, but also to harness the potential of bilingual and crosslingual writing for learning (in) the disciplines (Gentil, 2018, pp. 114-126).

While his claim emerges from a particular bilingual context, bi/multi/translingualism is increasingly the norm at global universities, and even in the English-only-influenced context of the US his prescription could provide meaningful development for an ever-growing population of multicompetent students, both domestic and international.

Productive crossover between disciplines and concrete connections to pedagogy remain the cutting edges of translingual writing research, and each of the previously cited studies conclude their findings with a call for similar explorations.

Science, Specifically

STEM writing instruction is of special importance to international L2 students, who disproportionately major in STEM fields. According to a report by the Congressional Research Service (2019), not only has the number of postsecondary STEM degrees awarded to international students increased by 315% over the past 3 decades, but the proportion of international students receiving STEM degrees has also doubled from 11% in 1989 to 22% of all degrees awarded in 2017. Furthermore, “this percentage is even higher for graduate degrees, as foreign students accounted for 54% of master’s degrees and 44% of doctorate degrees issued in STEM fields in the United States in SY2016-2017” (CRS, 2019). Across undergraduate, graduate, and non-degree enrollments, 49% of all international students study in STEM fields. While some of these students undoubtedly consider English their L1, the vast majority come from countries with different dominant languages and rhetorical patterns. There is thus substantial exigence for both increased language support to meet the unique needs of this population

of writers and substantial opportunity to unlock all of these students' myriad linguistic resources.

As with other disciplines, STEM faculty's willingness to engage with issues of language difference can vary. During a series of interviews with faculty in a graduate engineering program, for example, Jordan and Kedrowicz (2011) found that many attempted to distinguish between content feedback and writing/grammar feedback, often feeling that addressing the latter task was "not their job":

Time pressures are inevitable and understandable, and they may tempt some faculty members to believe that dividing approaches to student writing—between "the science" and "the English"—is an effective way to manage them. But the same faculty informants who described their attempts to divide response in this way also expressed their understanding that the writing and the technical content are inseparable. (p. 13)

It is also worth noting that faculty in the University of Utah graduate program that Kedrowicz analyzed often referenced an undergraduate program at the same university, CLEAR, which provided comprehensive language support to L2 undergraduate engineering students. This suggests that the generalized models of L2 and SLW support systems from lower-level courses could provide useful inspiration for writing support in smaller, upper-level programs, although Douglas (2015; 2020) reminds us that graduate writing entails different rhetorical and organizational demands and is best treated independently.

STEM writing is, as in other disciplines, often treated as a prerequisite skill to be mastered rather than an attunement to specific standards. The upper-division and graduate

courses in question are less likely to be supported by integrated programs like George Mason's ACCESS, and the process of language acquisition at these higher levels features a mix of linguistic and disciplinary demands. Several additional barriers stand in the way of explicit translingual language support and pedagogies in upper division STEM courses. For one, the omnipresent question of implementation looms: how will we get through the course material if we spend time talking about language? Yet monolingualism is also uniquely embedded in STEM fields through the notion of a "technical," "objective," and "impartial" English particular to the sciences, and this pervasive idea represents an obstacle to translingual intervention. In his article, "Internationalizing Writing in the STEM Disciplines," Sharma (2018) argues that STEM fields consistently privilege a concise, error-free idea of standard English despite a reality dominated increasingly by globalization, cross-cultural exchange, and the linguistic diversity that online access brings to communities of practice. He claims that "standard" STEM English is an idea constructed on a variety of myths: the myths of "transparency," "simplicity," and "universality" of language, each of which he debunks by sharing examples of living language use (pp. 29-34). He also highlights the deleterious effects of enforcing this invented standard of language in education; these myths

deny that both spoken and written communication in science use local idioms and references, situate science in social and cultural contexts, are shaped by contextual contingencies, and demand a range of complex rhetorical functions. Simply ignoring this reality confuses learners and undermines education because global communicative competencies are critical skills that students and scholars need (p. 35).

Interestingly, over the course of a series of longitudinal interviews with multilingual STEM faculty, Sharma found that shifting his questions from *beliefs* about language to language *practices* elicited much more flexible views of “correctness” and recognition of the need for students to be able to communicate to audiences with different linguistic and rhetorical standards (pp. 37-38). Along these lines, citing examples of several particularly effective engineering communication programs, he describes WID and WAC programs as a potential panacea “equipped to promote understanding and practice in the STEM fields, thereby fostering translingual and cross-cultural communicative competencies among future STEM professionals” (Sharma, 2018, p. 35).

Writers of all linguistic backgrounds face a number of writing challenges as they enter higher-level courses; they are asked to master a technical vocabulary, adapt to discipline-specific rhetorical patterns, and write as authorities. These hurdles are compounded for L2 writers who must meet these challenges while also balancing linguistic concerns, different cultural rhetorical patterns, and the loss of perceived authority that comes from writing in an L2 (Douglas, 2020). Hall and Navarro’s connection of disciplinary standards to register (2011) provides a useful way to bridge these concepts and visualize language acquisition in higher-level courses. Indeed, activities focusing on register and disciplinary discourse patterns are common to both STEM writing education and English for Academic Purposes (EAP) approaches. One of the most common forms of disciplinary writing instruction for international L2 students in the sciences is genre analysis. The many publications of EAP specialist John M. Swales (represented in, for example, his immensely popular guide *Genre Analysis: English in Academic and Research Settings*, originally published in 1990, or Swales and

Feak's 2012 *Academic Writing for Graduate Students*) have been extremely influential in this regard, and activities such as genre analysis, discourse coding, and the use of templates are staples of EAP instruction both abroad and in the United States (Blake and Holden, 2021; Cargill et al., 2018; Douglas, 2020). Such writing activities might ask students to identify key features of texts or provide them with templates that compare their research with prior findings and help establish stance (Douglas 2015, p. 5-6). Most international students are likely to have been exposed to a pedagogy of this sort at some point before arriving in the US.

The pedagogical benefit of such activities is clear; they can help L2 students adopt dominant language and thus offer meaningful improvement in publication outcomes. Publication (especially international) has for years been the yardstick against which academic accomplishment is measured; many international universities even require international publication for graduation, thus encouraging the adoption of EAP/genre writing pedagogies in STEM disciplines (see, for example, Blake and Holden, 2021; Cargill et al., 2018). However, uncritically adopting a pedagogy of genre analysis and reproduction can lead to the reproduction of monolingual ideology, and such pedagogies benefit from careful tempering in the classroom. Genre theorists in rhetoric and composition who have sought to draw from linguistics, such as Amy Devitt, have called for careful attention to this fact in order to:

address, within the shared contexts of communities and genres, the uniqueness both of individuals' language-use at any given moment and of communicative purposes, tasks, and texts. With a focus on the patterned and the typical, genre studies may underestimate the importance of those particular linguistic and

rhetorical circumstances for students or any language-users. As encountered and lived, genre is simultaneously unique and shared. Our theory and our teaching should not only recognize but work further to incorporate that fact. (2015, p. 47)

Devitt thus advocates for a concept of genre as performance both drawn from and actively recreating its context rather than as a static set of conventions to be learned, a conception with clear parallels to translingual views of language. Such a fluid orientation prepares students to encounter difference and reshape contexts, outcomes that characterize a pedagogy of *adaptive* transfer rather than a reproduction of static forms (DePalma and Ringer, 2014).

Many translingual scholars align with Devitt and agree that explicit treatment of translingual outcomes is necessary to counter international students' existing classroom expectations and encourage code-meshing and other translanguaging activities (Fife, 2018, Bou Ayash, 2020). Writers' existing classroom expectations are fashioned by previous experiences, and thus international L2 writers' expectations are likely to have been established in EAP classrooms with a reproductive relationship to linguistic norms and standards (Fernandes, 2014; Mina and Cimasko, 2020). As a contrasting example-in-action of the recognition and incorporation Devitt calls for, lessons which rhetoricize metadiscoursal features with a "collaborative investigative attitude toward authorial stance and other genre features of academic discourse" are necessary so that "teachers can focus on learning with our students about their powerful role in creating a writer's presence and authority within a text" and thus foster authorial agency instead of encouraging students to conform to existing standards of discourse (Fife, 2018, p. 68). Explicit discussion of language has also repeatedly been linked to L2 writers' confidence,

as unaddressed language differences have been connected to anxiety, stress, and insecurity when writing (Summers, 2020). This holds true both in terms of authorial stance and in linguistic risk-taking in general; when grades are on the line, L2 writers may attempt to reproduce dominant discourse to “play it safe” rather than experiment with language (Bou Ayash, 2020). This is especially true in courses within the major where there is increased pressure for students to perform.

One must also acknowledge an element of Mihut’s (2020) linguistic justice in STEM writing instruction’s treatment of language difference. US institutions hold a central role in both the global higher education landscape and international publishing, and many international scholars who receive degrees in the US return to their countries of origin to play influential roles in research and education. The ascendancy of monolingual ideology over the last decades has been due in no small part to US influence, and continuing to enforce the myths of linguistic homogeneity in STEM writing instruction exports these models and ideologies around the world. For these reasons, Lu (2006) described living-English work in the sciences and the pedagogical implementation of its findings as “imperative for all of us interested in using English to build a more just world for all” (p. 616). Disciplinary writing instructors are already asked to respond to a number of very real linguistic, institutional, and pedagogical restraints (not limited to increasing class sizes, their own linguistic resources, etc.), but the question must be acknowledged: how can translingual writing pedagogies be effectively and responsibly incorporated into upper-division STEM writing instruction as a means of both encouraging students to make full use of their linguistic resources and of changing the way we relate to language difference?

Investigating Language in Practice: *Al-Awamia*

WID research methods often emphasize interviews, surveys, and other approaches that seek the ways faculty consciously relate to issues in the field. One result of such worthy methodologies is that belief is often overrepresented in WID scholarship. As Sharma convincingly argues in his article, though, simply asking questions about language difference often begets answers that regurgitate monolingual ideology and obscure the complex realities of language which occur in practice (Sharma, 2018, pp. 27-28, 37). He thus argues for a shift in analysis from belief to practice. Languages and translanguaging are linguistic phenomena, and thus it is beneficial for WID researchers to seek “productive crossovers” by borrowing from the methodology of SLW and applied linguistics (Tardy, 2017). These fields commonly employ corpus analysis as a means of quantitatively examining groups of similar texts. While quantitative analysis alone carries its own risk of simplifying complex language negotiation, combining quantitative measures with qualitative coding via content analysis represents a promising way to answer Anson’s (2008) call to use data and observations of practice to test translingual models of language and inform pedagogy instead of relying solely on the beliefs of educators. Chapter 2 will thus engage in the analysis of situated, living-language corpus of abstracts taken from articles published in *Al-Awamia*, a Moroccan agronomic journal published by the *Institut National de la Recherche Agronomique*. While research articles in this journal are published varyingly in either French or English, each article includes three abstracts: one in French (résumé), one in Arabic (ملخص), and one in English.

Although English, French, and Arabic abstracts introduce the same article, differences between languages range from changes in wording to whole sentences that are unique to one of the three languages. While each of the three languages is confined to a single abstract, the process of negotiation that goes into composing abstracts with subtle differences for different audiences is worthy of attention, and examining such translanguaging practice in these undoubtedly finished products answers Matsuda's (2014) critique by focusing on language negotiation when it does *not* result in mixed language use, but rather when negotiation has resulted in a conscious choice to produce language that aligns with dominant categories of discourse and constructed language boundaries. Furthermore, because these examples are taken from a scientific journal published regularly for authentic and specific audiences, there is little risk of privileging unique individual composing phenomena along the lines for which translingual research conducted in composition classrooms has been critiqued. Rather, *Al-Awamia* is a pristine example of negotiation across languages, situated within a local context.⁵

⁵ The shared prefix between translanguaging and translation prompts a distinction between these two complex rhetorical activities. Chapters 2 and 3 will engage with this distinction at more length in the contexts of science writing broadly and *Al-Awamia* specifically.

Chapter 2: Corpus Analysis

Chapter 1 raises questions surrounding language dynamics, academic privilege, and translingual studies of disciplinary writing instruction. All of these issues are paramount for international L2 English-writing students and are deeply intertwined with the language politics of publication in an increasingly globalized world. Considering that this chapter's corpus of *Al-Awamia* abstracts is drawn from an academic journal, such questions of language, publication, and globalization must be addressed. In "Problematizing English as the Privileged Language of Global Academic Publishing," Curry and Lillis (2018) describe the linguistic pressure exerted by the drive to "publish or perish." This pressure is especially pressing in institutional contexts where research productivity is measured by publication in journals indexed by Web of Science indexes, common practice in many national contexts. As Curry and Lillis point out, English-medium journals predominate in these indexes to the exclusion of research published in other languages, guaranteeing standard English skills a central role in bibliometric analyses of research production. Such bibliometric analyses are commonly used as a basis for the allocation of funding, an institutional prerogative which explains the significant stress placed upon training international STEM students to produce knowledge in the varieties of English favored by international journals. Writing in English as such represents an additional barrier in terms of both difficulty and anxiety to L2 scientists (Hanauer et al., 2019). This exigence has led to a wealth of research in EAP, applied linguistics, and rhetoric and composition scholarship which studies international journals in order to better prepare L2 writers for the linguistic demands they will face to publish in them.

Genre analysis of articles published in indexed journals, a common feature of writing research and pedagogy, reinforces this focus on international journals and standardized English. Yet professional scientists engage in many forms of communication not represented by the high-stakes English-medium international research article genre. A truly translingual and transnational analysis must extend inquiry into other rhetorical contexts. Accordingly, this study will focus on a novel example: *Al-Awamia*, a Moroccan agronomic journal which publishes solely research conducted within Morocco. *Al-Awamia* is intrinsically linked to a specific geographic and national context and cannot be abstracted in the manner of international journals which often masquerade as universal. Indeed, a bibliometric review of Moroccan agricultural research labels *Al-Awamia* as one of several “local” journals in agricultural and veterinary sciences, and notes that these local publications tend to differ linguistically from publications indexed by Web of Science and Scopus, featuring more prevalent use of French and, rarely, Arabic (Zebakh et al., 2017, p. 258). Accordingly, this periodical provides a counterpoint to oft-overrepresented international journals. Analyzing situated language use therein stands to provide insight into how multiple language categories are invoked in scientific practice, with the ultimate aim of better preparing international students for the local linguo-rhetorical situations they will face as scientists.

Original research articles are published in *Al-Awamia* in both English and French. For each article, though, abstracts in English, French, and Arabic are included. This chapter zeroes in on the research article abstract sub-genre and identifies rhetorically significant changes between the language of each, using conceptual analysis to derive concept categories for the major patterns observed among these changes. Ultimately, the

changes identified seem to favor an international specialist audience in both English and French, and a domestic non-specialist audience in Arabic, suggesting that authors use multiple language competencies to address different audiences through this single genre. Such translanguaging science communication is underrepresented in the literature, and this chapter serves to highlight it in practice before exploring pedagogical implications in chapter 3.

Background

Al-Awamia is an open-access regional agronomic journal published by the *Institut National de la Recherche Agronomique* (INRA) of Morocco with the following mission statement, available on their website:

The objective of the AfriMed Agricultural Journal - Al Awamia is to contribute to the dissemination of research results for a sustainable development of agriculture on the African continent and in the Mediterranean basin by offering national and international researchers a publication support. This journal also offers decision-makers, professionals and researchers the opportunity to access research work likely to inform and guide their decisions and to rationalize their practices.

(Afrimed)

Originally published in French with Arabic and English abstracts, *Revue Al-Awamia* has disseminated scientific information both nationally and internationally since its creation in 1961. English-language articles have begun appearing in *Al-Awamia* recently and with increasing frequency. After a publishing hiatus from 2014-2019, “the journal [was] relaunched at the beginning of 2020 under the title *African and Mediterranean*

Agricultural Journal - Al Awamia with reference to the African continent and the Mediterranean basin and to the history of this journal by recalling the old name Al Awamia.” Throughout this study, both the original *Revue Al-Awamia* and its continuation (alternatively referred to as *Afrimed*) are referred to as *Al-Awamia*. While article submissions are accepted in either French or English, authors are asked to submit paragraph-long, “autonomous and complete” abstracts in all three languages – English, French, and Arabic – although the editorial staff offers to carry out translation to Arabic if the author is not an Arabic speaker.

In order to understand the context of language use in *Al-Awamia*, a note on language education in Morocco is necessary. Arabic and Amazigh are the official languages of Morocco, and most Moroccans grow up speaking Moroccan Arabic⁶ or one of several Amazigh languages.⁷ Public education in Morocco has long been bilingual, with classes conducted in Arabic and French. French is typically introduced in the third level of primary school (students aged ~9). French- and English-medium private schools are common and are often seen as means of economic access. In both public high schools and public universities, modeled on the French education system, STEM fields are taught almost exclusively in French and the humanities and social sciences are taught in classical Arabic. Many Moroccans lament the linguistic back-and-forth this split requires of students. As in some other national contexts, many Moroccans hold STEM fields in higher regard than the humanities, and STEM students often use the pejorative “adabi”

⁶ Moroccan Arabic (“Darijah”) varies by region and features elements of Arabic, Amazight, French, English, and Spanish.

⁷ Amazigh languages comprise an Afro-Asiatic language family, three varieties of which are primarily spoken in Morocco: *Tachlhit*, *Tamaziyt*, and *Tarifit*.

(literally, “literary”) to refer to humanities/social science students. On the other hand, some Moroccan scholars of the physical sciences are also embarrassed about their low proficiency in formal Arabic.⁸ Traveling abroad for post-secondary education is common, particularly in agronomy, a field in which U.S. land grant universities are held in high esteem. Two of the articles in this corpus (E3 and E6)⁹ were co-authored with Moroccan scholars at U.S. universities. For the many scholars who intend to practice in Morocco, though, the monolingual orientations of U.S. universities are insufficient.

Due to their well-defined rhetorical function and reproduction in multiple languages, *Al-Awamia*'s abstracts represent an ideal site to study rhetorical changes across language categories. Abstracts are generally the first point of contact for readers, and readers often use them to determine whether they will engage further with a research article [henceforth, RA]. Due to “their brevity, well-established purpose, and explicit format requirements,” along with their role in organizing search results, “RA abstracts are ideal for genre-based studies [such as those from the Swales school] and cross-linguistic analyses” (Friginal and Mustafa, p. 46). The importance of abstracts in advertising and disseminating research gives such studies a clear pedagogical function, and Swales and Feak's (2009) book-length treatment which synthesizes research with implications for graduate writers sees widespread use. The rhetorical moves typical in abstracts have been catalogued in a number of studies, which often narrow in on a single context of language-

⁸ Arabic is a diglossic language. Western linguists term formal varieties “Modern Standard Arabic” or “Classical Arabic,” though native speakers of Arabic generally do not distinguish between modern and historical varieties and refer to standardized written and spoken Arabic as *al-'Arabīyah al-Fuṣḥā* or “the eloquent Arabic.”

⁹ Corpus articles have been given two-character designations for ease of reference. A full table of table of citations and corresponding designations is provided in Appendix A.

medium, discipline, and rhetorical context (see, for example, Halleck and Connor, 2006, for a treatment of TESOL conference abstracts).

Corpus analysis of RA articles written in different languages is also relatively common in EAP and applied linguistics research. It has been conducted in the past by SLW researchers, comparative linguists, and contrastive rhetoricians, including between English and Arabic research article introductions (Fakhri, 2004) and abstracts (Friginal and Mustafa, 2017). As noted earlier, the majority of comparative analyses between English RAs and those written in other languages focus on internationally-published English RAs (including all those cited here; Fakhri, 2004; Friginal and Mustafa, 2017; Yakhontova, 2006; Wei and Duan, 2018), although comparative research on abstracts suggests that “it is increasingly doubtful whether viable comparisons can be made between “big” English-language journals and “small” ones publishing in other languages,” (Van Bonn and Swales, 2007, p. 105) due, among other factors, to substantial differences in breadth of readership and rhetorical function. *Al-Awamia* thus provides a novel example of an explicitly regional agricultural journal which publishes abstracts in both Arabic and English.

On the niche topic of Arabic-language agricultural science, relatively little has been written, excepting a 1990 dissertation published by a University of Michigan doctoral candidate advised by John Swales. Hazim Najjar:

investigated 48 Arabic introductions of RAs in the agricultural sciences and found out that 55% of these introductions fit “fairly closely” the CARS¹⁰ model, while

¹⁰ “Create a Research Space,” a term introduced by Swales which refers to various forms of gap delineation in RA introductions. This term sees frequent use in genre studies across multiple languages, EAP pedagogical materials, and Swales’ writing handbooks.

35% were “organized as problem–solution texts”. He also noted that previous research is simply summarized as background information with no challenges directed toward other scholars and very little self-promotion. These findings were attributed to the applied nature of the agricultural studies examined, which downplayed theoretical argumentation, and to the low degree of maturity of agricultural research in Arabic where, according to the author, rhetorical conventions of RAs have not been firmly established. (qtd in Fakhri, 2004, p. 1123)

It is worth questioning which of these conclusions hold true 30 years later. Some of Najjar’s observations related to CARS and the treatment of previous research, for example, are consistent with the *Al-Awamia* abstracts in this study. Other translational changes are perhaps better explained with reference to a somewhat analogous study, however, wherein Van Bonn and Swales (2007) compared paired English and French abstracts for articles from two corpora. They attributed the linguistic and rhetorical differences they observed between languages to different intended audiences; English abstracts tended to be oriented towards an international academic audience and French abstracts tended to be practitioner- or patient-oriented. Interviews they conducted with the RAs’ authors supported these conclusions. Likewise, in this study, differences between English-language abstracts and Arabic-language abstracts are better explained by a difference in audience than by a difference in the maturity of agricultural research.

As for this study’s objectives, Yakhontova’s 2006 study of English- and Slavic-language RA abstracts cautions us against using such corpora to speculate on socio-political influences or the rhetorical styles underlying languages and cultures, as

disciplinary conventions tend to be a far more consistent predictor of linguistic variation than culture or L1. In her words,

“the most plausible general explanation for all the differences, which are usually labeled as ‘cultural,’ is the inheritance of academic writing conventions, typical of this or that national culture, through various intertextual processes. Although discourses are socially constructed, the influence of societal factors seems to be more subtle and less straightforward in academic writing, which tends to adhere to rather stable discursive patterns” (Yakhontova, 2006, p. 164).

She argues that highlighting specific differences *can*, however, be useful for disciplinary writing education purposes, and that this area of inquiry is better suited to helping writers attain academic proficiency in an L2. Therefore, the aim of this study is not to generalize rhetorical or stylistic differences between the English, French, and Arabic languages. Instead, it aims to examine rhetorical changes across language categories in an understudied geo-political and linguistic context. Identifying rhetorical changes specific to this rhetorical context can grant insight into the various strategies that Moroccan agronomists employ when composing across languages and, ultimately, allow us to derive implications for disciplinary writing instruction in international contexts.

Methods

The corpus under consideration consists of the English, French, and Arabic abstracts of 14 different articles published in *Revue al-Awamia* and *Afrimed* from four volumes published in 2011-2012, 2013, 2020, and 2020, respectively. Eight of these fourteen articles were authored in English, and these comprise all *Al-Awamia* articles

published in English during this period. The six French-language articles were randomly drawn from these four issues to provide a baseline for comparison and a more representative picture of the journal.

As one embarks on content analysis of a multi-language corpus, it is important to keep in mind that coding and quantifying individual linguistic units would shift attention towards minor differences in translation. It is undeniable that the inversion of two phrases in a sentence, for example, can change the stress and emphasis placed on each individual phrase, but sentence structures of this sort are a common rhetorical feature of translation between Arabic and English. Reading cultural trends into aggregated data of this sort could quickly fall into overly simplistic dichotomies (Fakhri, 2004) and lies outside the scope of this study. Therefore, I turn to conceptual analysis (see Neuendorf et al., 2017), selectively reducing the corpus via a mixed linguistic and rhetorical lens. Rather than coding words, sentences, or correlations (as is common in relational analysis, see Busch et al., 1994-2021), I began by identifying purposeful or impactful changes with rhetorical implications between abstracts of different languages. This lens arose while browsing archived articles from *Al-Awamia*; I noticed that some findings were presented in English with “our findings point to X” and in Arabic with “*laa budd ann X*” or “there is no doubt that X,” a change with pronounced rhetorical implications. To my surprise, the majority of changes coded in this corpus were segments and phrases which were present in 1-2 languages and entirely absent from the others. Such conspicuous inclusions and omissions are easily identified as rhetorically significant.

I first identified all rhetorically significant changes (henceforth, RSCs) between different languages of abstracts in the eight English-language articles of the corpus.

Observing the changes as a group, I then derived eight concept categories through selective reduction to fit the major types of changes observed through this process and subsequently coded the French-language articles of the corpus accordingly. These concept categories are listed in Table 1.

Table 1: Concept categories.

#	Concept Category	Description
1	Methodological Information Presented	RSC in the abstract's inclusion of methodological or statistical information
2	Creating a Research Space (CARS)	RSC in the way the abstract establishes the significance of its inquiry/findings
3	Geographic Specificity	RSC in the specificity of geographic information
4	Scientific Terminology	RSC in the use of scientific nomenclature and/or popular names, as well as in explanation of terms
5	Degree of Certainty	RSC in the certainty with which findings are presented
6	Keywords	RSC in keywords listed
7	Additional Observations	RSC in inclusion/omission of observations tertiary to the study's findings
8	Signaling Changes	RSC in transitions and linking phrases between sentences

The instances of RSCs which fit a single category in a given article varied wildly depending on the subject matter. Ultimately, I opted to code for the *presence* of a category of RSC rather than trying to obtain quantitative measurements of the changes in each category within a given article.¹¹ Article E4 is a good example of the reasoning

¹¹ For an overview of coding options within conceptual analysis, see (Busch et al., 1994-2021).

behind this decision: the English abstract features no fewer than 17 instances of statistical/methodological information absent from the Arabic abstract, all fitting a relatively consistent pattern. In other articles, a single change in Geographic Specificity could have clear implications about intended audience. Thus, the presence or absence of a category was of more rhetorical significance than its frequency.

It bears distinction that the differences observed here will be considered rhetorical changes between finished products. Attempting to analyze the writing process by conjecturing about the “original language” an abstract was written in and observing its translations risks replicating monolingual approaches to language. For multilingual language users, “in the successive moments of meaning making, the use of linguistic resources may aptly be described as a flux of meaning in which language systems are both constantly drawn upon and reshaped in minute ways,” even as users interact with codified language categories that evolve on a different timescale (Gentil, 2018, p. 123). This is particularly true in the case of Morocco, where most authors’ hybrid first language, Darijah, is a living example of flux and reshaping which is absent from the finished products of these abstracts. Cataloguing changes between an “original” abstract and its translations is also reminiscent of looking for patterns of “interference” carried from L1 into L2, a paradigm that has been criticized for reinforcing flawed assumptions about the universal nature of scientific English. Even if some authors would describe their process as one of original authorship and translation, as discussed in chapter 1, Sharma (2018) reminds us that multilingual writers often obscure the complexities of language use in their initial descriptions of their own writing processes, and the act of translation itself is far more rhetorically complex than it is often given credit for in

writing and literary studies (Valentino et al., 2017). The commonality of multiple authorship among the corpus complicates this even further, and thus discussions of process lie outside the realm of this corpus analysis. As final products, however, these abstracts are authentic documents, and the existence of rhetorical changes between them suggests nuanced attention to the journal's differing readership.

Results and Discussion

Changes were coded for each of the different language pairings provided by the corpus: English <-> French, English <-> Arabic, and Arabic <-> French. However, the European-language abstracts were relatively consistent with one another; only four articles displayed changes of rhetorical significance between English and French (E1, E4, E7, and F3). By far the more interesting changes were observed between the European-language and Arabic abstracts. Thus, the remainder of this section will discuss changes between European-language and Arabic abstracts, referring to English <-> Arabic changes (except where otherwise noted) for clarity. On the other hand, language of publication has been maintained in the articles' E and F designators, as more significant differences reveal themselves in this category. The average number of observed concept categories differs, for instance, by language of publication; English-language articles average 2.875 categories/article and French-language articles average 1.67, for a 1.725:1 factor of difference.

In several key ways, European-language abstracts display changes which favor an international specialist audience and Arabic-language abstracts display changes which favor a domestic, policy-maker audience. Thus, taken as a whole, the impression which

arises from these rhetorical changes identified here is that the abstracts in different languages are intended for different audiences. Table 2 displays which categories of rhetorical changes were present between each article's English-language and Arabic-language abstracts. Articles are grouped by language of authorship (English-language demarcated by E# and French-language by F#) and are organized chronologically within these groupings. This section will provide a discussion of data organized by concept category, reproducing and exploring illustrative examples. All translations from Arabic are my own, produced via my knowledge of the Arabic language, reference to *The Hans Wehr Dictionary of Modern Written Arabic*, and consultation with a native speaker.

Table 2: Presence of rhetorically significant changes (RCS) between European-language and Arabic abstracts, by concept category.

Article (English-language)	Year	Issue (no.)	Cat. 1: Methodological Information Presented (MIP)	Cat. 2: Creating a Research Space (CARS)	Cat. 3: Geographic Specificity	Cat. 4: Scientific Terminology	Cat. 5: Degree of Certainty	Cat. 6: Keywords	Cat. 7: Additional Observations	Cat. 8: Signaling
E1	2012	125-126								
E2	2012	125-126								
E3	2013	127								
E4	2020	128								
E5	2020	129								
E6	2020	129								
E7	2020	129								
E8	2020	129								
Article (French-language)	Year	Issue (no.)	Cat. 1	Cat. 2	Cat. 3	Cat. 4	Cat. 5	Cat. 6	Cat. 7	Cat. 8
F1	2012	125-126								
F2	2012	125-126								
F3	2013	127								
F4	2020	128								
F5	2020	128								
F6	2020	129								

Cat. 1: Methodological Information Presented (MIP)

Some of the most telling differences between the European-language abstracts and Arabic abstracts can be noted in the amount of methodological information presented to the reader. Eight of the fourteen articles under consideration displayed changes in this regard, ranging from additional methodological details and specificity to entire subsections present in one language and absent in another. The prevailing trend, however, is towards more attention to methodology in the English abstracts than in the Arabic. In many cases, this comes in the form of sections present in English and absent in Arabic. In article E1, for example, which discusses the identification of plant pathogens in cucurbitaceous crops, the English abstract prefaces its discussion of sampling with the following: “The identification was carried out based on the microscopic observation of the morphological characters of conidia, conidiophores, perithecial stage of the fungus, and the type of germination” (Endo et al., 2012, p. 121). The Arabic omits this segment and proceeds to sampling directly. Along similar lines, article E5’s English abstract describes experimental design before its independent variable (fertilizer treatments): “The experiment was set up in a complete randomized block design with three blocks and the experimental unit was composed on 4 consecutive trees in the row” (Omari et al., 2020, p. 93). The Arabic, by contrast, moves directly into describing the study’s fertilizer treatment. On a slightly different note, while article E3’s English abstract (2013) does not contain whole sentences absent from the Arabic, the English does go into greater detail regarding the particular mechanisms of cloning and gene insertion in sentences which introduce the article’s operative treatment.

The additional information provided in English-language abstracts suggests that the intended readership of English-language abstracts places a greater weight on methodological transparency. Comparatively, by omitting this information, the indicated Arabic abstracts give a greater relative weight to their studies' results. It is thus logical to infer that the English-language abstracts are intended for a more specialist audience that is likely to engage with methodological information in more detail, while Arabic abstracts could be intended to give a quick brief or review to policy makers interested in the implications of the findings presented.

These RSCs could be seen as analogous to those made by science journalists, who often omit methodological information in favor of implications to make science more relevant to a non-specialist audience (Brechman et al., 2009), a dynamic which can similarly be applied to policy briefs.

In the course of coding, I also included inclusions/omissions of statistical information in this category. The chief article displaying presence of this concept category in its statistical variant was E4, "Adaptive practices of livestock breeders in the face of climate change and factors influencing their adoption in the arid rangelands of eastern Morocco" (Snaibi, 2020), which consisted of statistical analyses of a dataset obtained via structured surveys with herders. This article's conclusions were primarily based on regression and correlation calculations between different variables, and in this context statistical practice therefore warrants a similar designation to that of experimental design and methodology in articles such as E5. Although article E5's Arabic abstract does provide a good deal of information on this statistical methodology, their English abstract goes into greater detail and, unlike the Arabic, provides quantitative measures of

regression, correlation, and significance. These changes thus fall along the same lines as those of previously mentioned articles, suggesting one abstract targeted towards an audience more interested in statistical rigor and another targeted towards an audience interested relatively more in the study's conclusions and findings.

It is also worth noting that two articles which displayed rhetorical changes in MIP (E2 and F5) bucked the general trend by including slightly more methodological information in Arabic than in European languages. This deviation could be explained in part by their subject matter, as both deal with herders and rangeland management. In article E2, for instance (Nassif and Bouayad, 2012), the Arabic contains the following independent sentence: استخدمت الدراسة منهجية الاستبيان مرفقة باستخدام أدوات تشاركية, which translates to “The study used a questionnaire methodology with the use of collaborative elements” (p. 146). The English, by contrast, describes the conclusions as “based on survey and qualitative methodology” in a dependent clause introducing the study's findings. In Morocco, rural pastoral groups and especially tribal groups have historically had complex relationships with the central government.¹² Even in relatively contemporary times, some scholars have alleged that agricultural policies have functioned to expropriate tribal land and replace traditional pastoralism with more modernized forms of agriculture (see Davis, 2006). The addition of the term *teshaarukiyya* (translation: “collaborative”), specifically, could be a subtle move to address such concerns for a policy-maker audience and show respect for local

¹² In historical scholarship, the political dynamics between these two are often represented in the terms *bled al-makhzen* (country of the treasury, the term used to refer to the monarch and centralized government) and *bled al-siba* (country of anarchy). For more on this dynamic in the 20th century, see Wyrzten (2015).

collaborators. The changes between article F5's abstracts (Bechchari, 2020) are quite similar, increasing the plausibility of this theory. Specifically, while each of that article's abstracts references toponymic maps, individual interviews, and group workshops with breeders in the study area, the Arabic abstract elaborates on the designing of said maps: وكذا طرق اسغلال المجالات العرفية لمراعي المنطقة التي تم ضبطها على الخرائط الطبوغرافية عبر مشاورات مع المجموعات العرقية. Translation: "...as well as ways to map the region's customary fields and pastures onto topographical maps through consultations with ethnic groups" (p. 127). The additional specificity regarding consultation suggests a decidedly local audience and is likely tied to the observations presented in Category 3 (Geographic Specificity), particularly in research concerning toponymic (relating to the naming of places) maps, which are intimately related to land ownership.

Overall, the fact that both instances of additional methodological information in Arabic concern social science research with pastoral groups and emphasize collaboration, while the other five MIP changes emphasize experimental and statistical methodologies, is telling. These exceptions thus serve to prove the rule, suggesting that methodological information is, to a degree, tailored for an international specialist audience in English and a domestic policy-maker audience in Arabic.

Cat. 2: Creating a Research Space (CARS)

As discussed previously, the CARS model originates with the EAP work of John Swales and refers to the act of referencing and delineating gaps in previous research to create an exigence for the present study. The CARS paradigm is often broken down into different rhetorical "moves" which occur frequently in proposals or abstracts; in their

2006 study, Halleck and Conner identify 10 common moves in TESOL conference abstracts, including “gap,” “importance claim,” “benefits,” and “outcome” (p. 73). The difference in disciplinary standards makes for an imperfect parallel, but many of these moves can be found with frequency in the corpus. Due to the nature of the abstract genre, all abstracts deploy at least some of these moves and thus exhibit the CARS concept category to varying degrees. Differing audience priorities, however, suggest that we would likely see greater attention to CARS elements in abstracts meant for a researcher audience, as arguably less importance is attached to certain elements of CARS for a policy-maker audience.

Instances of this concept category in the corpus come with varying degrees of difference. In article E4, for example, the sentence “The current climate change adaptation measures practiced in the study area and the determinants of breeders’ implementation of these coping actions are not investigated,” present in English but absent in both Arabic and French, is a clear move to delineate a research gap which this study hopes to fill (Snaibi, 2020, p. 37). The RSC in article E2 is more subtle. The English contains the following: “The revisiting process of those communities’ development plans revealed *serious knowledge gaps* regarding women’s vital contributions. This study *aimed at filling the gaps* through examining the existing gender division of labor...” (Nassif and Bouayad, 2012, p. 145, emphasis added). The Arabic, by contrast, reads:

أظهرت مراجعة المخططات التشاركية للتنمية للوحدتين نقصا واضحا في معالجة إسهامات النساء و حاجياتهن العملية والإستراتيجية ومنظرهن. تهدف الدراسة إلى تحليل التقسيم السائد للعمل حسب الجنس...

translation: “The revisiting of the communal development plans for the two sites revealed a clear lack of treatment of the contributions of women, *their practical needs, and their viewpoints*. This study *aims to analyze* the prevailing division of labor according to gender...” (*ibid*, p. 146, emphasis mine).

The distinction between these two versions is subtle, but the operative verbs and nouns of the English emphasize the language of gap identification and research, situating the study within broader literature, while the Arabic emphasizes the language of collaborative decision-making and presents the analysis as the means to an end of policy decisions.

Often, some elements of CARS are present in both languages with extra elements in English. In article E4, for example (Snaibi, 2020), both English and Arabic abstracts comment on the potential impacts of climate change on livestock rearing before stating the study’s objective. The English, however, contains an additional sentence meant to highlight the novelty of said research – “the current climate change adaptation measures practiced... are not investigated” (Snaibi, 2020, p. 37) – which leads into the study’s objective with “therefore.” The difference between abstracts in article E6 operate along similar lines, as the English abstract contains an additional sentence about damage to crops to highlight the exigence of the study. Again, each abstract in each language exhibits elements of CARS; articles coded for the presence of this concept category, rather, tended to display one or more additional “moves” from Halleck and Connor’s framework in English, often “gap” or “importance claim.” It is these additional “moves” that grant us insight into the invoked audience.

Cat. 3: Geographic Specificity

One of the more easily distinguished types of rhetorical changes is the presentation of more specific geographic information. In four different articles, Morocco-specific geographical information is presented in Arabic abstracts but left out of English ones. Article E2, for instance, gives the individual study sites of Ouled Slimane and Sekouma-Irzaine in all languages, but reserves إقليم تاوريرت بالمنطقة الشرقية (translation: “province of Taourirt in the Eastern region”) for Arabic (Nassif and Bouayad, 2012, p. 146). Similarly, article E5 (Omari et al., 2020) provides the name of the experimental station (El Menzeh, INRA) in all languages, but while the English and French abstracts follow this location with the rather general “Morocco,” the Arabic abstract specifies the city of Kenitra. The implication of this choice would seem to be that the foreign language abstracts are intended (at least in part) for an international audience who may not be familiar with the research’s country of conduct, while the Arabic abstract is assumed to be read by domestic readers who could identify the city. It is worth noting that Kenitra is not a unique name in the Arabic world, and the choice to omit “Morocco” in Arabic could thus imply a more domestic audience than the journal’s mission statement evokes. Article F5’s change with regards to geographic specificity is also significant; while all abstracts situate the research “in rural communities in high plateaus of eastern Morocco,” only the Arabic follows this with the phrase انطلاقا من المجموعة الترابية لبني مطهر ومعتركة (translation: “[investigating these claims] based on/starting from the rural communities of *Beni Maṭher* and *Me‘terka*”). It is common for geographical names in Morocco to arise from affiliated tribal groups (generally Beni _____, or the sons/people of _____), and Beni Maṭher and Me‘terka are both tribal names of this variety. While a Moroccan reader

could be expected to make this connection, it is unlikely that an international subject specialist would be familiar with this local toponymic pattern.

Cat. 4: Scientific Terminology

Changes in scientific terminology in this corpus take several forms. A particularly stark example comes in article E1, where the English abstract lists “cucumber (*Cucumis sativus* L.), melon (*C. melo* L.), pumpkin (*Cucurbita maxima* Duch.), squash (*C. pepo* L.), watermelon (*Citrullus lanatus* (thumb.) Matsum. et Nakai), [and] bottle gourd (*Lagenaria sciceraria* Standl. Var. *hispida* Hara,” along with their scientific nomenclature, as the species under consideration, while the corresponding Arabic abstract merely cites a single word: القرعيات (translation: “gourds/squashes”) (Endo et al. 2012, pp. 121-122). القرعية is indeed used in Morocco to refer to many of these species,¹³ but the clear conflation of multiple species into a single category recognizable to a common audience implies an intentional difference in presentation. This first article is an extreme example, but it fits the general trend for the rest of the corpus: scientific nomenclature is emphasized in European language abstracts and somewhat more common or accessible language is present in Arabic abstracts.

These changes in scientific terminology can be further broken down into two general groupings: articles where scientific terms are replaced by common terms in Arabic abstracts and Arabic abstracts in which field-specific terminology is accompanied by a common-language explanation. The previous paragraph’s example fits into the

¹³ The species is generally designated by an accompanying adjective; for example, *ger3a 7amra’* is a winter squash, *ger3a khuḍra’* a summer squash, etc.

former category, alongside article F3, in the Arabic abstract of which *Artemisia herba alba* Asso. and *Stipa tenacissima* L. are replaced by الشيح والحلفاء, or “wormwood and related plants” (El Koudrim, 2013). Latin-letter scientific nomenclature is present in many of the Arabic abstracts (though certainly not all), reinforcing the idea that replacing such nomenclature with common names is an intentional rhetorical choice. Some articles, like F4, follow scientific nomenclature with a common name in Arabic rather than replace it, a trend not carried over to the European language abstracts. As for the latter grouping, articles E3, E6, and F1 accompany scientific terminology with short, common-language explanations in their Arabic abstracts which are not present in European-language abstracts. E6’s Arabic abstract, for example, prefaces “greening disease” with a short description of its symptoms, while E3 includes terms like “colony” and “bacterium” before introducing scientific nomenclature like E. Coli. E3’s Arabic abstract also speculates on applications in common language in ways which the European-language abstracts do not. This final change in the way applications are discussed relates to the presentation of findings discussed in category 5.

Cat. 5: Degree of Certainty

Another concept category which appeared in several articles was a modification in the degree of certainty with which results were presented across abstracts of different languages. Once again, article E1 provides the most vivid example of such a change. The English abstract makes specific, scientifically qualified statements about the study’s findings:

85 samples collected from different regions in the country were used confirming the existence of the characteristics of *Sphaerotheca fuliginea*; there was no instance of *Erysiphe cichoracearum*, *E. polyphaga*, or *Leveillula Taurica*.

Moreover, the morphological characteristics of perithecial stage, which was found on only one occasion, supported the idea that it was *Sphaerotheca fuliginea*.

(Endo et al., 2012, p.121)

The Arabic, by contrast, presents the study's findings with considerably more assuredness:

أجريت هذه الدراسة على 85 عينة مأخوذة من جل المناطق المنتجة لهذه الزراعات. ولقد تبين أن الفصيلة *Sphaerotheca fuliginea* المسببة لهذا المرض هي

Translation: This study was run on 85 samples taken from different cultivating regions. It has turned out that the causative species for this disease is *Sphaerotheca fuliginea*. (*ibid*, p. 122)

Stark changes such as these are the subject of Jeanne Fahnestock's well-known "Accommodating Science: The Rhetorical Life of Scientific Facts" (1986), which studies the transmission of scientific facts from peer-intended publications to popularizations meant for non-specialist audiences. Fahnestock alleges that popularizations tend to exaggerate the degree of certainty and remove hedges and qualifications, occasionally to deleterious effect. While the abstracts observed here certainly remain academic and generic in nature, article E1's pronounced shift in degree of certainty suggests correspondingly different rhetorical situations between languages.¹⁴

¹⁴ See also Walters and Walters (1996), which explores the editing of science stories for non-specialist audiences in more detail.

The remainder of the changes tagged as Degree of Certainty across the articles E4, E7, and E8 are more muted, relating to statistical significance. Whereas these articles' European-language abstracts clearly delineate the statistical significance (or lack thereof) of study results, their Arabic abstracts are considerably more ambiguous. E4's English abstract includes the following text: “[differences in breeders' adoption rates] *are due to a very significant difference (p<0.001)* between small herders on the one hand and large and medium breeders on the other” (p. 37, emphasis added), while the Arabic abstract rephrases this as إلى اختلاف كبير (translation: “to a large difference”) without a quantitative measure attached. Later in the same abstract, another reference to significance is replaced with بشكل كبير or “in a large form.” Articles E7 and E8 deal with the inverse end of statistical significance, as “no significant effect” (E7, English) corresponds to لم يكن لدى... تأثير كبير على هذا العامل or “did not have a large influence on this factor” (E7, Arabic) and “there was no significant difference” (E8, English) corresponds to لم يكن هناك فرق كبير or “there was not a large difference” (E8, Arabic). Without the presence or absence of a quantity, these changes in wording are quite subtle. However, as the Arabic word *kabiir* (translated above as “large”) can be read as “large,” “great,” or “old” in different contexts, it is a considerably less precise indicator than “significant.” Moreover, the Arabic abstracts of articles E5 and E6 demonstrate that language exists in Arabic to discuss statistical significance more directly. These articles include the phrasings بشكل ملحوظ (E5, “in an observable form”) and كانت العلاجات ذات أهمية عالية للغاية (E6, “the treatments had a very high importance”), following these phrasings with p-values. It is fair to say that the statistical connotation of the results/findings in articles E4, E7, and E8 thus undergo significant change, as a reader in Arabic has considerably more leeway

in interpreting a “not large” difference than a difference not statistically significant enough to reject the null.

It is entirely possible that the authors of the abstracts under consideration simply did not feel the need to include precise statistical information in the Arabic versions of their abstracts. This omission, however, indicates something about their understandings of their readerships’ differing preferences; what for some is essential information takes a back seat to potentially useful findings for others. Fahnestock, however, would argue that distortions of the certainty of scientific findings can potentially have substantial consequences in terms of the way publics understand research findings. The potential pedagogical implications of these differences in terminology will be addressed at greater length in chapter 3.

Cat. 6: Keywords

Although significant changes to articles’ keywords between languages occurred in only two cases (E7 and F3), the relative ease of directly translating individual words in the digital age makes these changes rather conspicuous when present. Additionally, keywords’ role in organizing search engine results sets them up as a major site to glean insight about intended audience. The more interesting of the two examples is article E7.

The keywords listed with each abstract are as follows:

E7 English (p.196): Nadorcott, rootstock, cold storage, internal quality

E7 Arabic (p. 198): الحمضيات, حامل الطعم, العصير, الحموضة, السكريات

(Translation: citrus, rootstock, juice, acidity, sugars)

Whereas other abstracts displayed a strong one-to-one correlation between languages, the difference between terms like “internal quality” and more consumer-friendly terms like “juice” and “sugars” would seem to invoke audiences which value different presentation of information. Again, the replacement of more technical terms could indicate a policy-maker audience more likely to appreciate the benefits of cold storage research in terms of what they would change about the consumable product than on their technical merit alone. Alternatively, comparatively palatable Arabic keywords may indicate a difference in stakes which dovetails with the larger distinction between specialist and non-specialist audiences.

Cat. 7: Additional Observations and Cat. 8: Changes in Signaling

The implications of these final two categories are less clear than the preceding six, but they merit discussion nonetheless. First, the European-language abstracts of articles E1, E5, and F5 contained additional observations tertiary to the main findings of the research that were not present in the Arabic abstracts. These ranged in size from an entire paragraph of observations about related plant pathology (E1) to individual sentences about which nitrogen treatment produced citrus fruits with the highest acidity (E5). It is possible that these additional observations, incidental to the main outcomes of the study, are included in European-language abstracts to be flagged by search engines or to interest international specialist readers working in related areas and are excluded in Arabic-language abstracts for policy makers because they are tangential. Without additional evidence, however, this connection remains loose conjecture.

Also worthy of note: several articles displayed structural differences between abstracts including different paragraphing splits and modified signaling phrases. Only the latter were coded for category 8, and then only for changes which modified the relationships between sentences. For example, article E8 begins a sentence with *ومع ذلك* (trans: literally, “and with that; furthermore”) in Arabic, corresponding to “however” in English, transitions which imply inverse relationships between adjoining sentences. As most writing instructors would be quick to note, both transition phrases and paragraphing can be used to signal logical organization to readers and emphasize particular points, both decidedly rhetorical aims, yet any connection between these changes and audience is unclear at best.

Conclusions

Any conclusions drawn from the analysis of this corpus must be tempered by several qualifications. First, while the analysis undertaken above stakes a compelling case that different languages of abstracts in *Al-Awamia* appeal to different audiences, one must note the frequency of the changes observed: an average of 2.875 categories of RCS were present in English-language articles and 1.67 were present in French-language articles. Future research may investigate the causes underlying the differential rates between languages of authorship, which may be connected to the treatment of different languages in Moroccan education, or extend similar lines of inquiry to journals in the social sciences which publish abstracts in multiple languages. For this study, though, the frequencies themselves are more pertinent than the differential rates. On the one hand, these are certainly not insignificant rates of occurrence in texts of <250 words. On the

other, the majority of text in most of the abstracts observed here is written more or less in parallel without impactful rhetorical changes between languages. This similarity owes at least in part to the specificity of the RA abstract genre. Previous comparative linguistic studies have likened such overwhelming structural similarities to “the universality of cognitive paradigms characteristic of hard sciences” and “internationalized rhetorical conventions” in many STEM fields (Yakhontova, 2006, p. 163). The presence of any consistent frequency of RSCs between languages is thus worthy of further observation.

It is in this context that consistent patterns in the RSCs observed across the six primary concept categories suggest differing audiences for *Al-Awamia*'s abstracts: international specialist audiences for European-language abstracts and domestic non-specialist (likely policymaker) audiences for Arabic language abstracts. Even in this most academic and formulaic of genres, scientists address multiple audiences and must utilize a variety of linguistic resources to do so. These findings constitute an educational exigence; in addition to the ethical imperative to avoid blindly reproducing the hegemonic structures of English-medium international publishing in disciplinary writing instruction, preparing students to write to different stakeholders by utilizing differing linguistic resources and considering socio-political differences in readership seems more important than ever to their careers as scientists in an increasingly transnational world. Chapter 3 will explore this exigence further with an eye towards pedagogical suggestions. Producing written communication for non-specialist policymakers would seem to be key to ensuring funding for future research, as the importance of grant-proposal writing in any national context would attest, but particularly in bureaucratized countries like Morocco. The need extends to other non-specialist audiences, as well; for instance, the

corpus analyzed here was published in a context colored by other new science communication efforts by the *Institut National de le Recherche Agriconomique* including the provision of digital French-medium guides for growers on their website.

Finally, one must credit these insights to the translingual orientation which inspired them. By approaching abstracts of *Al-Awamia* as texts in their own right, this study was able to use “difference as a shared resource rather than a problem to be eliminated” (Krall-Lanoué 2013, pp. 262). Treating differences across languages as evidence of fundamental cultural rhetorical styles, as instances of “interference” from an L1, or solely as markers of insufficient training in academic writing in one language would have obscured the rhetorical complexities present in these abstracts and obfuscated the resulting conclusions about audience. Krall-Lanoué developed this approach to language difference for pedagogical ends; by treating language difference as a site for negotiation, she hopes to foster her students’ agency as writers and encourage intentional authorship. It is with this mindset that the pedagogical implications of this study’s findings will be considered in Chapter 3.

Chapter 3: Return of the Pedagogical Implications

Introduction: Throughlines

Chapter 2's analysis of the cross-language corpus of abstracts from *Al-Awamia* suggests that authors draw on different language competencies to communicate to different audiences. Specifically, rhetorically significant changes identified between language categories favor international specialist audiences in European-language abstracts and domestic non-specialist audiences (likely policy makers) in Arabic-language abstracts. In order to situate Chapter 2's findings in context, it is helpful to first revisit the translingual research and practice paradigms which originally inspired this study. As Mihut (2020) points out, it is easy for a translingual analysis in rhetoric and composition to remain philosophical (or even simply observational), but to truly pursue an objective of "linguistic justice," inquiry must be extended to its pedagogical ends. All this is to say: while observing the rhetorical deployment of different language categories and communication strategies for different audiences alone could constitute a translingual analysis, this chapter moves beyond the observational by addressing the pedagogical implications of chapter 2's findings and providing speculative suggestions for classroom and curricular design.

What does taking initiative with translingual pedagogy look like? When discussing such pedagogies within writing classrooms across the curriculum, Jonathan Hall draws a useful distinction between "reactive translingualism" and "proactive translingual pedagogy." The former informs pedagogy only by opening instructors' minds and responses to language variation that they happen to encounter and is thus insufficient to encourage a critical reassessment of language resources. By contrast, a

“proactive translingual pedagogy will need to ask students to think about their complete communicative repertoire, and how it relates, or how they want it to relate, to their writing, including but not limited to their academic writing” (Hall, 2018, p. 42).

Providing thoughtful, productive opportunities for students to actively reflect on their linguistic choice is key, because asking students to do so in a cursory fashion is likely to result in the replication of the monolingual, “Standard English” frames which they have acquired through years of standardized education. Therefore, in order to foster Canagarajah’s “conducive pedagogical environment that will allow students to bring these strategies from contact zones outside the classroom” and “enable teachers to learn from the strategies students themselves employ in translingual communication,” it will be necessary to design assignments and activities in ways that *encourage* (rather than simply allow) students to draw on their multiple language competencies (2013a, p. 63).

Chapter 2’s conclusions suggest that scientists in transnational contexts and regional scientific practice outside of the United States use different language competencies to appeal to different audiences. The targeted uses of languages to address specialist and non-specialist audiences are reminiscent of the principles and uses of science communication. Through their focus on specialist genres and disciplinary-specific “ways of knowing,” WID practitioners may inadvertently privilege communication internal to the disciplines and thus contribute to assumptions about “universal STEM English.” Working non-specialist communication assignments into the WID classroom may therefore provide a worthy site to problematize monolingual assumptions and productively incorporate other language varieties into the classroom. Additionally, encouraging students to identify their own audiences in these assignments

and to use language competencies beyond Standard Written English to meet them would help responsibly prepare L2 international science students for their future careers.

The first section of this chapter will discuss science communication and its niche in science writing education in detail. Subsequently, this chapter will speculate on ways that such activities could be implemented in the classroom as well as the potential benefits to students' linguistic and rhetorical repertoires. Accompanied by metacognitive reflection, translingual non-specialist communication assignments would serve to develop multiple language competencies in ways that reflect genuine transnational scientific practice and reframe those multiple language competencies as assets in the English-medium classroom.

Science Communication in the STEM Classroom

WID pedagogies often focus on genres of specialist communication internal to disciplinary communities, but scientists regularly communicate with diverse publics in the course of their professional duties. The *Routledge Handbook of Public Communication of Science and Technology* distinguishes between several types of science communication in which scientists regularly engage: the publicization of new or ongoing research, metadiscourse about the role of scientists in society, and “the use of scientific knowledge in the reconstruction of non-scientific *problems* (e.g., climate change)” (Peters, 2014, p. 70). Among these aspects of public engagement in science, it is the latter function which constitutes scientists' role as public experts and in which they operate as both public communicators and policy advisors, requiring the negotiation of scientific norms in order to communicate a clear message to non-specialist audiences.

Much science communication literature focuses on journalists' roles as intermediaries in this relationship, as well as the attendant struggles, successes, and differences in outlook between scientists and journalists (see, for example, Hartz and Chappell, 1997). It is worth noting, however, that scientists' long-established roles in communication are rapidly changing:

As technical and financial restrictions on addressing the public directly online have largely disappeared, nearly all science organizations and many individual scientists have turned to the new communication sphere: they create Web sites and blogs, participate in social networks, and upload videos that compete with the content provided by professional science journalism. (Peters, 2013, p. 14,108)

Investigations of scientists' experiences with the media and attitudes toward emerging communication activities concluded that "many scholars welcome these [more symmetrical online] opportunities, as they expect them to enable a more dialogic form of science communication, increased participation of laypeople in scientific debates and debates on science policy, and discourses about the ethical, legal, and social implications of research" (Peters, 2013, p. 14108).

The near-ubiquity of access to digital networks eight years since Peters' evaluation has only accelerated this shift in the nature of science communication. Symmetrical engagement opportunities have proliferated; take, for example, digital forums like reddit's popular AMA ("Ask Me Anything") series, which connected interested members of the public directly with scientists (Moriarty and Mehlenbacher, 2019). In their chapter in *Theory and Best Practices in Science Communication Training* (2020), "Training scientists to communicate in a changing world," Gascoigne and

Metcalf treat these changes as an exigence to prepare more scientists for direct roles in communication with non-specialists, citing the range of audiences from “business and industry, [to] policy-makers, funding bodies, community groups and school children” with which scientists are regularly required to target their “content, tone, style, complexity and... focus” (2020, p. 83). Participating scientists in their workshops have noted that such direct preparation for public engagement activities is both professionally useful and confidence-building.

It is worth noting that inquiry in science communication has traditionally been conducted in Western-style democracies, primarily in North America and Europe. The participation of an informed citizenry (read: electorate) in democratic decision-making processes is an oft-cited exigence in works that research both public understanding of scientific concepts and bilateral engagement between citizens and scientists. The differing dynamics of scientific communication in other political systems, such as Morocco (a monarchy), is comparatively understudied. Nonetheless, the specialist/non-specialist RSCs that my earlier analysis of *Al-Awamia* has uncovered seem to suggest that digitalization has generated similarly direct scientist -> non-specialist communication opportunities in non-Western contexts. *Al-Awamia* has been published digitally and open-access over the duration of the corpus observed, and this relative ease-of-access could partially explain the presence of non-specialist communication in a normally specialist-exclusive genre (the RA abstract). Other forms of digital non-specialist communication available on *Al-Awamia*'s website, such as French-language pamphlets for growers, corroborate these trends in scientific communication.

By all accounts, addressing non-specialist audiences should be rightly considered central to scientists' professional communication, especially as many of these trends are likely only to increase in light of growing penetration by digital communication technologies. It may thus come as a surprise that, as revealed by a survey of major U.S. STEM universities' graduation requirements and curricula, "the fact remains that [most] science majors are *not* required to learn discipline-specific techniques for communicating for different audiences, purposes, and contexts—techniques that might be learned outside of science departments but have inherent value to science" (Gigante, 2014, p. 78, emphasis added). Students are thus expected to develop non-specialist communication skills outside of their coursework. Accordingly, science writing scholar Maria Gigante suggests "one pedagogical possibility for improving the communication of science to nonexpert publics by approaching 'critical science literacy' not only from the 'science side' of the equation but also from the perspective" of science writing instruction in higher education, and to this end she suggests incorporating non-specialist communication assignments¹⁵ into science writing curricula (p. 78). Undoubtedly, the sizeable presence of international L2 students in North American STEM programs and

¹⁵ A note on terminology is in order: when scholarship in public attitudes towards science and technology addresses non-specialist communication, the terms "general public" or "lay audiences" are common. These terms can unhelpfully conflate broad swaths of the public, and the downsides of doing so become quite clear when different publics are considered across different national contexts. Additionally, these broad terms are inadequate for writing instruction. Invoking more specific audiences (e.g., politicians, industry partners, or the eponymous "your grandmother") gives students a target to which they can tailor their rhetorical style and register. Although each of these audiences would require a different communicative approach, all such non-specialist communication assignments foster a similar form of rhetorical flexibility. To reflect the variety of audiences outside of students' disciplines that such assignments may invoke, this paper will rely on the term "non-specialist audiences."

the often-monolingual assumptions of STEM communication force a consideration of language variation in any program claiming to teach such critical science literacy.

A series of publications by Susanne Pelger (Lund University, Sweden) report on and evaluate the incorporation of such non-specialist communication assignments in the classroom. Her promising results suggest that non-specialist communication assignments have great potential for both conceptual and rhetorical learning. For example, in 2016, Pelger and Nilsson incorporated an assignment which asked students in a microbiology course to describe their completed capstone projects to a secondary-school audience. In anonymous follow-up surveys, 53 of 64 respondents reported that this popular science writing activity had given them new perspectives with which to view their work. This testimony was corroborated by the authors' observation of their completed assignments. A slightly smaller percentage of students reported that the activity also granted them deeper understandings of their own projects, especially in terms of how their research fits into a broader social context. In a subsequent course, Pelger (2018) employed a similar activity *before* [rather than after] students had completed their theses. She found that students once again broadened their perspectives, situated results more in context, and adapted language for audiences at different epistemic levels. Additionally, this latter study noted that completing the popular science assignment *during* the thesis process often led to greater meta-awareness in students' final documents for *specialist* audiences, as well as in their writing for non-specialist audiences. Pelger's findings provide the means for an effective appeal to disciplinary writing faculty, as writing-to-learn represents an increasingly valued practice in science assignment design and is frequently invoked in science education scholarship (for a survey, see Gere et al., 2019). If non-

specialist communication assignments can be used as a way of *reinforcing* rather than taking away from content instruction, they may be more easily incorporated into existing curricula, making them more appealing to faculty and students alike.

Observing the variety of platforms, digital and otherwise, by which scientists engage directly with various publics reveals that non-specialist communication has become a regular professional expectation of scientists. Although it undoubtedly requires different rhetorical skills than composition internal to scientific discourse communities, non-specialist communication should rightly be considered an aspect of disciplinary writing rather than something external and additional to scientists' disciplinary tasks. Educational initiatives which serve to prepare scientists for these forms of public engagement have suggested that non-specialist communication activities can simultaneously advance rhetorical education and other curricular goals, including conceptual understanding and critical science literacy. International L2 students, however, may regularly interact with vastly different publics than those often assumed by science communication scholarship, and preparing these students for those communicative contexts may thus require an alteration of these activities.

Science Communication and Multilingualism: Parallel Literacies

Science communication activities generally aim to prompt students to recompose their ideas in different registers and for different epistemic levels of audiences. Most commonly, an assignment of this form might ask students to write in English to an American "lay public." While recomposing one's ideas in a different register can be an effective way to develop both fluid conceptual understanding and rhetorical sensitivity,

not all students enjoy the same language competencies in informal English. Asking international L2 students to master an informal English register, which many of them may have to acquire anew, is unlikely to prepare them for communicating research to their grandmothers or other home publics in the same way it prepares “native speakers.” In general, a treatment of non-specialist audiences which limits students to informal registers of “standard” English could be seen as a manifestation of Native-speakerism;¹⁶ after all, in the majority of Anglophone countries outside of the U.S. and the Commonwealth of Nations,¹⁷ standard Englishes operate as a language of access to specialist communication while other L1s or World Englishes are dominant in non-specialist communication. It is these realities of global communication which prompt Sharma to declare that “writing support for STEM students should be designed with the idea that there are mixed and potentially plural “publics” with whom scientists must communicate; the publics may also be multilingual, multicultural, and increasingly transnational” (2018, p. 42). Multilingual students generally already display fine attunement to social context in their language practices, suggesting that disciplinary writing instructors may be able to “activate prior registers and knowledge” rather than teaching those differences from scratch (Hall and Navarro, 2011, p. 8).

As discussed in Chapter 1, there is a parallel to be made between register acquisition and language acquisition. The process of learning and teaching the lexicon,

¹⁶ Native-speakerism is “a pervasive ideology within ELT” which privileges teachers who have spoken English since birth and ‘western’ models of education and communication. For more, see Holliday (2006).

¹⁷ Even within these contexts, it is problematic to assume that all publics would respond equally to English-language science communication. Rhetorically-savvy yet English-only science communications in the U.S., for example, may be less effective in reaching the ~13% of the population that speaks Spanish as a first language.

syntax, and rhetorical styles favored by a particular discipline is somewhat similar to that of acquiring a new language, a parallel often drawn by WID practitioners. Hall and Navarro (2011) categorize skills in both linguistic categories under the broader portfolios of “multicompetence” and students’ “total communicative repertoires.” They assert that multi-register competence, plurilingualism, and translingual perspectives to language’s social functions and development generally “share a commitment to a redefinition of the boundaries between the individual language user and the social context in which all her language actions occur” (p. 13). Treating non-specialist communication activities as an opportunity for students to recompose research in other languages thus fills many of the same pedagogical goals of asking a student to recompose research in another register of English; both ask students to negotiate the boundaries of classroom language to fit a specific social context.¹⁸ Though acquisition of individual registers certainly tends to occur more subtly than that of entire languages, the jumps from register to dialect and from dialect to language are thus not as stark as they may seem.

To this point, while they were not explicitly translingual in their goals, Pelger and Nilsson’s (2016) and Pelger’s (2018) studies engaged in Translingual Science Communication in their practice. Most of the students in their studies had written degree projects (i.e., theses) in English, and the popular science assignment asked them to

¹⁸ The question of translation looms here. “Translation” is often adopted as a metaphor for science communication activities within a single language; take, for instance, “It Loses Something in the Translation: Syntax and Survival of Key Words in Science and Nonscience Press Releases” (Walters and Walters, 1996). From a translingual perspective, I would argue that presenting the same concept to different audiences and tailoring one’s language accordingly constitutes an act of translation whether it draws on different languages or operates entirely within one recognized language category. Despite the rhetorical complexity of translation between languages, however, there is a tendency to view translation as a simple and direct act (see Valentino et al., 2017). In order to reflect this rhetorical complexity and avoid confusion with “rote” or “word-to-word” exchanges, I opt for the term “recompose.”

recompose their assignments in Swedish for secondary-school students. While students at Lund University benefited from two more-or-less common languages (English and Swedish), it is reasonable to suggest that translingual non-specialist communication assignments in North American universities would grant students the same benefits in conceptual understanding and ability to place their work in broader social contexts that Pelger and Nilsson observed. In the case of L2 international students, recomposing research in an L1 may grant even more pronounced benefits for both conceptual understanding and authorial identity, the latter of which L2 international struggles with (Fife, 2018). For example, Baalbaki et al. (2020) found that translating between an L1 (Arabic) and English in the classroom increased students' confidence as English writers and provided a means for rhetorical attention to sentence-level details in their compositions. Similarly, a study of a Korean-language writing group at an English-medium university found that not only did the use of an L1 lower language anxiety and promote deep thought, it also afforded L2 students "the opportunity to break out of their self-deprecating ideologies and deficit identities as English language learners" and "enabled them to develop rhetorical identities in the language learning process" (Kang, 2020, p. 100). The application of an L1 to assignments also helped participants use English more purposefully than "memorizing, regurgitating, and mimicking the language of" dominant groups which can otherwise characterize the uncritical adoption of common disciplinary terms and phrasings in ways that disciplinary writing instructors often bemoan (Ibid).

Accordingly, it is more accurate and fruitful to view registers, dialects, and languages as part of a larger, linguo-rhetorical framework than as wholly separate aspects

of language and literacy education. Non-specialist communication assignments are valuable in the ways they ask students to navigate each of these forms of linguistic variation for specific rhetorical ends. It is the task of disciplinary writing instructors not to craft literacies from scratch but to develop existing literacies by guiding students towards metacognitive awareness in their deployment of their ever-expanding linguistic resources. Based on this comparison of register and language literacies, non-specialist communication activities could be a promising site for the incorporation of students' other language competencies into the science writing classroom.

To be clear, by “other language competencies,” I am referring to both World Englishes and languages which fall outside Englishes – Arabic, Spanish, and Chinese proficiencies, to name but a few of the myriad possibilities. By providing a space for these languages to operate in the primarily English-medium science writing classroom, instructors would serve to reframe multilingualism as an asset and foster their students' multiple literacies. Additionally, translingual non-specialist communication activities can better reflect the situated use of different language competencies that we have observed across both abstracts in *Al-Awamia* and those referenced in other translingual literature. Due to the rhetorical similarities between learning to deploy new registers and acquiring new languages, the strategies for employing Translingual Science Communication (henceforth, TSC) activities could be derived from those used to teach monolingual science communication. The subsequent section will explore the strategies necessary to integrate translingual non-specialist communication activities into instruction in more detail, fleshing out the roles and expectations of instructors willing to attempt them.

Strategies for Instructors Teaching Translingual Science Communication

Both Susanne Pelger's and Maria Gigante's experience incorporating and improving non-specialist communication assignments in science writing classrooms provide a number of take-aways for instructors looking to incorporate similar activities. It is worth noting that, while Gigante's dedicated science writing curriculum is quite worthwhile, TSC should ideally be integrated with students' disciplinary work. Confining translingual activity to the composition classroom risks reinforcing the monolingual perspective that science is the province of a single universal English. The strategies that this section provides are meant to demonstrate the feasibility of TSC activities so that WID practitioners can foster such writing instruction within disciplinary courses, with the recognition that writing support takes myriad forms in different institutional contexts and the hope that these strategies could be tailored accordingly. Most notably, both Gigante and Pelger suggest pairing non-specialist communication assignments with other, disciplinary-genre writing assignments. Asking students to take on a completely new research project at the same time as focusing on learning to adapt register, terminology, and language to new audiences could quickly become overwhelming, and taking this advice serves to reinforce the rhetorical outcomes of translingual non-specialist communication assignments. Gigante (2014), for instance, writing as a science writing instructor, suggests collaborating with disciplinary writing faculty so that students transform existing research projects for non-specialist audiences. Failing this, she assigns literature reviews and asks students to adapt these for non-specialists. Pelger (2018; Pelger and Nillson, 2016), herself a life sciences instructor, asks students to write about their ongoing microbiology capstone assignments. By integrating TSC with students'

existing work, both strategies intertwine language and rhetorical concerns with students' disciplinary education.

Along similar lines, both emphasize the imperative to scaffold non-specialist communication assignments with preparatory activities. In the syllabus Gigante (2014) provides, she includes landmark articles in the rhetoric of science (e.g., Fahnestock, 1986) for a direct discussion of the rhetorical and stylistic appeals common to popular science writing. Incorporating articles like Fahnestock's also highlights the potential for changes between genres so that students "become aware of the multifaceted nature of persuasion and use rhetorical appeals for the purposes of encouraging engagement with science issues, as opposed to using appeals, via framing devices, for purposes that are more aligned with the deficit model of communication" (Gigante, 2014, p. 82). Such outcomes connect to Gigante's goal of a "critical science literacy" for scientists, and accordingly her accommodation activities are accompanied by "continuous discussion about the ethics of communicating to nonexpert publics" (ibid). Such a critical orientation would dovetail especially well with a translingual one, as discussions of different language proficiencies would quickly complicate monolithic assumptions of nonexpert publics and raise ethical questions about global access to research and publishing, as outlined in the introduction of chapter 2.

Pelger, by contrast, takes a more practitioner-focused approach, preceding her popular science writing activity with a lecture where "genre specific traits were highlighted" in the form of "major differences between scientific writing and popular science writing... with respect to context, content, structure and style" (p. 443). While both approaches to the purpose of introductory readings have their merits, the common

thread between them is an explicit treatment of rhetorical differences between genres, whether these topics are approached critically or simply as skills. Though they might connect differently to the outcomes of TSC, both foreground register and rhetorical modifications reminiscent of the RSCs identified in Chapter 2 that students will make in their compositions. Both strategies could also be enhanced by a discussion of the role different language proficiencies play in scientific communication. In classes where international L2 students represent a significant demographic, for example, asking students about their own experience with popular science consumption is likely to elicit a variety of reflections that could be capitalized on as points for discussion.

Perhaps the most important aspect to be implemented in TSC assignments is a requirement that students identify their own audiences. The foregrounding strategies suggested above should scaffold this choice by presenting a general paradigm for science communication and encouraging students to reflect on how they might deploy these strategies in their own careers. Prompting students to choose an audience themselves will enable them to reflect on their own outcomes for the course, and such reflection is essential to flexibly tailor assignments to L2 students' individualized goals and competencies. Once an audience has been identified, students can be tasked with identifying the language and register most appropriate to communicating with that audience, itself an exercise in rhetorical sensitivity. Many multilingual students may decide to write in English; if that is the best way to serve their goals, instructors should honor this choice. However, instructors should not mistake lukewarm acceptance of English writing activities as meditated intent. As with other translingual pedagogies, students should be actively *encouraged* to draw on their extra-English linguistic

resources, as the classroom otherwise tends to privilege conformity to standard Englishes as a default (Bou Ayash, 2020, p. 32).

On that note, one of Canagarajah (2013a)'s practices for fostering a translingual disposition in student compositions may prove useful in teaching translingual non-specialist communication assignments: instructor-student conferencing. Gigante (2014) suggests that the dialogues for which one-on-one conferences allow can be just as important in encouraging students to reflect on the rhetorical moves they make in non-specialist communication as they can be in encouraging students to reflect on their deployment of different linguistic codes. Opportunities for this sort of reflection are critical in encouraging students to engage in translanguaging, as without direct encouragement students may be reluctant to draw on resources perceived as not belonging in the English-medium university classroom. On the topic of such resources, Gigante suggests that allowing students to draw on different media in their accommodation assignments may provide students with chances to draw on and develop their technological literacies. Such an option might be especially beneficial for international L2/multilingual students. In a 2015 study of multimodal compositions in a first-year composition classroom, Laura Gonzalez found that "L2 students exhibit advanced expertise and rhetorical sensitivity when layering meaning through multimodal composition," expertise which "comes in part from L2 students' experiences combining and crossing various modes when they cannot exclusively rely on words to communicate in English" (p. 1). The affordances of multiple modes of meaning allowed students to negotiate terminology which they find harder to express in English and could play a similar role in helping them communicate technical ideas to non-specialist audiences.

Images, gestures, and digital technologies might also prove important for audience understanding when students' verbal communication draws on language proficiencies not shared by all of their classmates. These mechanisms of evaluation will be addressed in the following section.

Many of the other facets of effectively teaching translingual non-specialist communication assignments are the same as those for teaching other writing assignments. It is important to note, for example, that the mere presence of writing assignments is not enough to encourage deep reflection on language usage and register – feedback is crucial. In a separate study of instructor feedback on 44 degree-project texts in biology, Pelger and Sigrell (2016) found that students' and instructors' understandings of the focus area and the significance of their feedback demonstrated significant discrepancies across both non-specialist-focused “popular science” and disciplinary science genres of student writing. The authors treat the discrepancies thus outlined as a symptom of broader need for defined feedback strategies in science writing instruction, which they suggest might be rectified by a shared rhetorical meta-language—essentially an explicit treatment of the principles, goals, and tools of communication. Establishing early understanding of terms (e.g., context, content, structure, style, and register) allows instructors to clearly focus students' attention on individual areas of their texts and thus avoid miscommunication. Such an explicit treatment of communication issues provides an ideal jumping-off point for discussions of linguistic variation and multiple language competencies and a site to introduce translingual ideas to the classroom and problematize unitary conceptions of “the public.” Moreover, a rhetorical meta-language along these lines would be essential for providing feedback on translingual non-specialist communication assignments;

students would need such meta-language to complete reflection assignments of the sort Shipka (2009) deploys and thus highlight the rhetorical choices made in their non-specialist communication to an instructor without a developed proficiency in their chosen language of communication. One notes that the literacy autobiographies Canagarajah explores in his 2013 study of “negotiation” relied “recontextualization” and “interactional” strategies to fill a similar role, and the use of a rhetorical meta-language is necessary for students to outline their strategies as such. The establishment of a rhetorical meta-language early on is thus both a useful staging activity and serves as a basis for feedback in translingual composition activities.

We may boil down some of the key strategies for implementing TSC activities to the following:

1. Encourage students to integrate TSC with their disciplinary work by adapting existing projects such as capstone, thesis, dissertation, or lab experiences;
2. Scaffold TSC assignments by introducing and exploring science communication in class settings;
3. Require students to identify their own audiences and identify the languages and registers necessary to meet them;
4. Develop a shared rhetorical meta-language to allow for efficient and effective writing feedback;
5. If time and resources permit, establish conferencing opportunities to engage students in discussion about their rhetorical choices.

Expectations and Evaluation

One may see this call for the introduction of other languages into the STEM writing classroom and think “surely we cannot expect STEM instructors to go out and learn new languages simply to permit students to use them in their classrooms?” After all, how can an instructor give effective rhetorical feedback without fluently speaking the languages and dialects students bring to the classroom? Such a question rings familiar to treatments of dialects of English outside of SWE in writing instruction. Asao Inoue addresses this topic in an interview where he encourages writing instructors to avoid holding up a false language hierarchy:

For me, this is mostly about *not* English teachers/writing teachers learning new languages so they can teach the students in front of them (although, that would not be a bad thing, for us to broaden our language capacities) but instead, it’s to find ways to use your own language and the languages that come into the classroom to good effect for those who are there. Part of that might mean finding out new goals and new outcomes for those classes. (Corrigan, 2019, 7:37-8:12)

While his interview primarily focuses on variance within English, Inoue makes clear in this quotation that the same implications apply to languages more broadly. Instructors certainly cannot be expected to develop proficiency (let alone specialist expertise) in *every* language that students bring into the classroom. Yet it should not go unremarked that discussions of linguistic obstacles tend to assume a monolingual, L1-English instructor. This common assumption has consequences:

by implicitly characterizing all faculty as monolingual English teachers who are trying to figure out their multilingual students, as most published scholarship

does, we miss the complex linguistic experience of faculty across the disciplines, we keep our monolingual faculty from learning from their multilingual colleagues, and we maintain a subtle bias against any language but a standardized English in the academy, especially in the American academy. (Geller, 2011, p.3)

The assumption of monolingualism among faculty is of especially dubious veracity in STEM fields broadly, which tend to have more multilingual and international faculty at U.S. universities than do many other departments. Multilingual STEM faculty, as Sharma (2018) found in his interviews, generally have extensive experience in negotiating meaning across language categories and could thus provide effective feedback to students in similar positions. TSC activities may be especially easy to implement at universities where many students share more than one common language proficiency, such as Lund University in Sweden, the University of Texas at El Paso, or countless other institutions.

Regardless, many instructors do not feel comfortable claiming proficiency in a dialect or language other than standard English. While encouraging monolingual faculty to learn from their multilingual colleagues is a worthy goal and represents a disposition worth pursuing, the question remains: how can an instructor evaluate and provide productive feedback on a composition in a language in which they themselves are not fluent? In some sense, this is always a relevant question for non-specialist communication assignments, even those conducted entirely within English. No STEM instructor can claim to be the target audience of a non-specialist communication assignment; the nature of their role as an instructor precludes membership in a non-specialist language community. And yet STEM instructors are still qualified to give instruction in these assignments because of both: 1) their intimate familiarity with the

subject material and 2) the value of their own professional experiences in the tasks they are asking students to complete, namely communicating with non-specialist publics. The value of these assignments comes from purposefully and agentively adjusting one's language to a target audience. Providing feedback about the strategies thus taken constitutes a productive and compassionate way for instructors to "use [their] own language," as Inoue urges, to help students use the languages they bring into the classroom to good effect. This extends across dialectical and language lines.

In order to answer questions of evaluation and response, it may be helpful to dip briefly into scholarship on teaching multimodal compositions, the assessment of which often entails a similar dilemma. Both multimodality and multilingualism require context-specific negotiations of mobile codes, and both interact with and reshape fluid genres. In her "Multimodality, Translingualism, and Rhetorical Genre Studies," noted translingual scholar Laura Gonzalez (2015) makes clear the connections between these broad groupings of literacies and investigates the ways they interact. Writing instructors offering students a choice of various multimodal resources often encounter similar issues of evaluation when students choose to compose meaning through "texts that may little resemble the kind with which instructors are accustomed to working" (Shipka, 2009, p. 353). Multimodal pedagogies scholar Jodi Shipka, however, argues that "from a pedagogical perspective, it seems less crucial that I [the instructor] am able to identify 'connections' or choices that students may or may not have thought to make than it is to require that students be prepared to share with me, their peers, and others exactly how and why their texts make, or conversely fail to make, particular meanings" (Ibid). To this end, she recommends evaluating multimodal compositions via paired reflective writing

assignments which ask students to outline the rhetorical choices they made during composition. In addition to encouraging metacognition and the transfer of learning, these reflective assignments would provide a basis for evaluating non-specialist communication which traffics in a wide swath of linguistic categories.

Some of Shipka's guiding principles are therefore useful for evaluating TSC. She outlines all of her assigned *statements of goals and choices* around a core set of questions, two of which could easily be adapted to translingual non-specialist communication assignments:

1. What, specifically, is this piece trying to accomplish—above and beyond satisfying the basic requirements outlined in the task description? In other words, what work does, or might, this piece do? For whom? In what contexts?
 2. What specific rhetorical, material, methodological, and technological choices did you make in service of accomplishing the goal(s) articulated above? Catalog, as well, choices that you might not have consciously made, those that were made for you when you opted to work with certain genres, materials, and technologies.
- (2009, p. 354)

In most non-specialist science communication assignments, this first goal is already somewhat laid out: non-specialist communication is meant to transmit scientific information in a way that informs and engages audiences with the implications of new research. Identifying the specific audience and reflecting on specific rhetorical and linguistic choices as outlined in Shipka's second bullet point, on the other hand, will require students to outline their "negotiations" and thus give them a chance to explain and reflect on any language unfamiliar to the assessing instructor. TSC reflective assignments

must therefore ask students to outline their writing process, emphasize the rhetorical choices they made during composition, and explain them to an instructor who may not share familiarity with the audiences invoked or the linguistic tools used the student used to meet them.

The chief aims of reflective writing are to engage students in critically assessing what knowledge and skills they have developed in the process of a particular assignment and to prompt students to speculate how they might be applied in different contexts. Metacognition is thus at the heart of this form of assessment. In writing studies, metacognition has been widely linked to transfer, particularly “high-road” or conscious transfer of genre awareness and writing practices across contexts (Rounsaville et al., 2008; Devitt, 2015). Including this reflective element is thus key in encouraging students to apply the skills and awareness gained during TSC to future communicative tasks. Along these lines, Tardy et al. (2020) offer a framework which lays out the role metacognition plays in the process by which “successful writers adapt their knowledge to external criteria and expectations and assess their performance within a broader sociorhetorical context” (p. 299). In the course of doing so, they suggest that recontextualizing a research project between different genres and contexts (in this case, between genres internal to the discipline and genres of science communication) can play a prominent role in any genre-based pedagogy—provided that students’ recontextualization is accompanied by annotation or justification of their rhetorical choices. Additionally, Tardy et al. emphasize that such activities may be particularly useful in facilitating multilingual writers’ cross-lingual application of genre awareness. Reflective assessment thus meets two distinct purposes: first, it allows instructors to

evaluate and provide feedback on students' rhetorical choices which draw on diverse linguistic resources; and second, by emphasizing metacognition, it encourages both students' awareness of rhetorical choices and transfer of that awareness to the communicative tasks they will meet as scientists. The latter in particular serves the professional preparation goals of both WID practitioners and STEM instructors.

Conclusions

Translingual non-specialist communication assignments have the potential to create a specific, negotiated space for language competencies beyond Standard Written English to enter the disciplinary writing classroom. By foregrounding science communication, specialist and non-specialist audiences, and language as topics of discussion, instructors can sufficiently rhetoricize different registers and languages before asking students to identify both their target audiences and the linguistic tools necessary to meet them. This agency thus afforded to students will allow them to tailor the course to their own personal and professional outcomes, including diverse international contexts. Additionally, the goal-oriented incorporation of languages other than SWE into the classroom can go a long way toward reframing multilingualism and multicompetence as assets rather than deficiencies in English STEM writing. Transferring meaning into, conversing, and composing in an L1 can foster a writer's adoption of authorial stances and help develop rhetorical agency in English (Kang 2020), suggesting that the incorporation of TSC activities could even address some of the issues L2 students frequently experience when learning to write in a given discipline: namely, a lack of

authorial identity and a reluctance to take defined stances in relation to existing scholarship.

Furthermore, translingual non-specialist communication assignments serve to prepare international L2 students for the kinds of complex rhetorical and linguistic contexts in which they will write as scientists. Chapter 2 effectively demonstrated that scientists writing in *Al-Awamia* deploy different language competencies to address different stakeholders in genuine scientific communication. Considering that such nuanced attention to different audiences occurs even in the highly specialized genre of the abstract, it seems that navigating different languages and registers for non-specialists constitutes a significant professional expectation for scientists, one which will only continue to increase due to the proliferation of digital communication venues and the heterogeneous publics international students are bound to encounter. Insofar as drawing on other literacies helps students make connections to varied stakeholders and the international “scientific networking community” extraneous to the American academe, translingual non-specialist communication activities may also prove valuable experiences for scholars aspiring to participate in international communities of exchange.

It is, of course, a fact that some students will arrive in our classes with more language proficiencies than others, and many will not have a fully developed non-English L1 on which to draw in order to complete these assignments. One alternative is drawing on students’ other dialects of English; as we have established, the rhetorical and linguistic skills necessary to navigate dialects and languages for different audiences run parallel. But still, some students are asked to code-switch and code-mesh more regularly than others, and translingual non-specialist communication assignments may be easier for

those students than for others. I would argue that this can be a strength of such assignments; not only should bringing other languages into the classroom “mean finding out new goals and new outcomes for those classes,” in Inoue’s words, but it should seek to accommodate the goals and outcomes of individual students within the same courses (Corrigan, 2019). After all, students have different post-education ambitions, and international L2 students may need modified outcomes to be prepared for venues like *Al-Awamia* in their home contexts. Rather than adapting our treatment of language difference to a standard of monolingualism,¹⁹ Translingual Science Communication celebrates multiple language competencies and encourages all students, including monolingual ones, to develop them.

For all students and all instructors, there is also a conceptual significance to translingual non-specialist communication assignments in that they serve to complicate monolingual assumptions about audience and language competencies. In addition to interrogating longstanding assumptions about the universality of STEM English, purposefully incorporating other language varieties into the classroom in a situated way which is reflective of the global reality of science communication decenters that very “standard” English and reframes other linguistic competencies as assets. The connections between the communicative needs of specific audiences, the linguistic competencies necessary to meet them, and language negotiation in genuine global practice are paramount for students to understand the larger picture of transnational science exchange. As Ghanashyam Sharma writes in his 2018 study cited throughout this thesis:

¹⁹ It is worth questioning whether any students can be accurately described as “monolingual” from a translingual perspective. See, for example, Roozen (2020) for a discussion of a traditionally “monolingual” student’s deployment of multiple literacies.

One of the ways in which more complex and realistic views about language and writing could be promoted in the STEM fields is by countering dichotomies between scientists and non-scientists, as well as between writing for “the general public” as opposed to “academic” audiences. The participants of my study embraced the idea that the academic audience, especially in the sciences, is monolithic; but when they discussed communication with people in the industry and the community, they adopted a more complex view of writing. This shift helped to envision the “public” as complex and overlapping groups of people with varying levels of knowledge and interest in scientific knowledge and projects, rather than a generalizable, singular audience. (42)

Invoking policymakers, as *Al-Awamia*’s abstracts do, would dovetail well with members of industry and the community. The shift which Sharma describes is intimately related to Gigante’s idea of critical science literacy for scientists. By pluralizing publics and interrogating the ways they interact with different languages and registers, TSC assignments could serve to effectively integrate these questions into disciplinary writing instruction.

It is important to note that ideal implementations of translingual non-specialist communication assignments will adapt to institutional context. While I focus here on implementation within the disciplinary writing classroom, similar activities may take different forms depending on the mediums of writing support at a given institution. Simpson et al. (2015), for instance, describes a STEM communication initiative at the University of New Mexico which trained and equipped STEM grad students to lead writing workshops and courses for their peers. Along somewhat different lines,

Gascoigne and Metcalf (2020) enjoyed success with inviting practicing journalists to scientist media workshops in a wide variety of national contexts. Collaboration at the instructor level has also borne fruit in the past; for example, when Watts and Burnett (2012) paired agronomy and communication course sections to prepare students to write recommendation reports to authentic clients (farmers), reports authored in paired course sections were consistently ranked higher by recipients than recommendations from stand-alone agronomy sections. Their experience suggests that integrated instruction represents another way improve students' science writing to non-specialist audiences. In addition to benefiting conceptual understanding in the manner of Pelger's (2018) assignments, any of these listed support mechanisms could usefully incorporate translingual approaches to non-specialist communication by encouraging L2 students to draw on their plural linguistic competencies. Some may do so by providing horizontal mentorship opportunities with other L2 grad students, others by inviting journalists from non- or plus-anglophone contexts, and still others by working to establish writing relationships between classes and clients who are themselves multilingual.

This chapter has outlined Translingual Science Communication assignments as well as the strategies and instructor interventions that may foster their implementation in the classroom. TSC assignments represent a promising site for the incorporation of other languages in the disciplinary writing classroom, one which reflects the realities of transnational science communication in the digital age and may thus serve to prepare international L2 students for the rhetorical situations they will face in their scientific careers. Scaffolding these assignments also provides a well-situated opportunity to discuss the relationships between language and access in scientific publishing and

education. Finally, previous activities which bear resemblance to the translingual scientific communication assignments suggested here have reinforced students' conceptual comprehension and understanding of the social significance of their research, particularly for the aforementioned L2 students, suggesting that these assignments could play a well-integrated role within science coursework.

Conclusion

This thesis set out to identify strategies for developing international L2 students' full linguistic repertoires and changing the way students and instructors relate to language difference by identifying strategies for the effective and responsible incorporation of translingual writing pedagogies into upper-division STEM writing instruction. In order to break ground for this avenue of inquiry, chapter 1 provides a brief overview of disciplinary writing support for international L2 students and WAC/WID studies' relation to language difference. Much of this overview focuses on developments in translingual theory and suggested that translingual inquiry should:

- engage with the methodologies of applied linguistics, Second-Language Writing, and English for Academic purposes
- and observe living language practice, rather than beliefs about language categories.

Studies which heed these principles have the highest potential to observe the true complexities of communication and thus lead to concrete interventions which support students with multiple language competencies throughout their acquisition of disciplinary registers.

Chapter 2 then put these principles into practice by conceptually analyzing a corpus of Arabic, French, and English abstracts from *Al-Awamia*, a Moroccan regional agronomic journal. Across the different languages of abstract, rhetorically significant changes identified in, for example, the presentation of methodological information or the ways abstracts establish the significance of the research, suggest that abstracts in *Al-Awamia* are subtly tailored to different audiences. In general, over the concept categories

observed, Arabic-language abstracts favored a domestic non-specialist audience, possibly policymakers, and European-language abstracts favored an international specialist audience. These findings provide yet another piece of evidence that the situated linguistic realities of scientific communication are more complex than the “myth of universality” leads many English-medium instructors to assume. However, this corpus analysis also offers more pointed implications, as the abstracts demonstrate the use of different language competencies to address audiences with different levels of specialization and insider knowledge. This confirms that scientists’ disciplinary writing tasks include regular communication with diverse publics, prompting my engagement with science communication scholarship.

Based on the latter implication, Chapter 3 engages with science communication scholarship to derive pedagogical implications for science writing instruction. Ultimately, I argue that Translingual Science Communication activities would serve multiple ends: by asking aspiring scientists to reframe their research for non-specialist audiences, they will build rhetorical skills which will prove useful in professional pursuits such as that represented by *Al-Awamia*; by reworking their research as such, TSC activities will strengthen students’ grasp on course content and introduce broader perspectives about their research’s role in society; and TSC activities will both require international L2 students to identify publics they will address in the future and develop all of their linguistic competencies to reach them. The latter point would also foster students’ critical science literacy; by creating a place for other languages and language varieties to function within the English-medium science classroom, TSC activities better reflect the nature of global scientific communication and counter the monolingual assumptions of

universal English that will otherwise fill the classroom space. These activities thus serve both to position students' multiple linguistic competencies as assets in the classroom and prompt more critical discussions of the linguistic politics of science production worldwide.

References

- Anson, C. (2008). The Intelligent Design of Writing Programs: Reliance on Belief or a Future of Evidence. *WPA. Writing Program Administration*, 32(1), 11.
- Atkinson, Dwight, Crusan, Deborah, Matsuda, Paul K., Ortmeier-Hooper, Christina, Rucker, Todd Simpson, Steve, & Tardy, Christine. (2015). Clarifying the Relationship between L2 Writing and Translingual Writing: An Open Letter to Writing Studies Editors and Organization Leaders. *College English*, 77(4), 383–386.
- Baalbaki, Rula, Fakhreddine, Juheina , Khoury, Malaki, and Rima, Souha. (2020). Arabic, as a Home Language, Acts as a Resource in an English Writing Class: Borrowing Translation Strategies in a First Year Writing Course. In A. Frost, J.Kiernan, and S. B. Malley (Eds.), *Translingual Dispositions: Globalized Approaches to the Teaching of Writing*. The WAC Clearinghouse. DOI: 10.37514/INT-B.2020.0438.2.10
- Blake, J. and Holden, W. R. (2021). Engaging and empowering scientific writers in different disciplines. In B. Morrison, J. Chen, L. Lin, and A. Urmston (Eds.), *English Across the Curriculum: Voices from Around the World*. The WAC Clearinghouse. 73-89.
- Blommaert, J. (2010). *The sociolinguistics of globalization*. Cambridge University Press.
- Bou Ayash, Nancy. (2020). Developing Translingual Language Representations: Implications for Writing Pedagogy. In A. Frost, J.Kiernan, and S. B. Malley (Eds.), *Translingual Dispositions: Globalized Approaches to the Teaching of Writing*. The WAC Clearinghouse. DOI: 10.37514/INT-B.2020.0438.2.01
- Brechman, Jean, Lee, Chul-joo, & Cappella, Joseph N. (2009). Lost in Translation? *Science Communication*, 30(4), 453–474. <https://doi.org/10.1177/1075547009332649>

- Busch, Carol, De Maret, Paul S., Flynn, Teresa, Kellum, Rachel, Le, Sheri, Meyers, Brad, Saunders, Matt, White, Robert, & Palmquist, Mike. (1994-2021). Content Analysis. The WAC Clearinghouse. Colorado State University. Available at <https://wac.colostate.edu/resources/writing/guides/>.
- Canagarajah, A. S. (2006). Toward a Writing Pedagogy of Shuttling between Languages: Learning from Multilingual Writers. *College English*, 68(6), 589–604. <https://doi.org/10.2307/25472177>
- Canagarajah, A. S. (2013). Negotiating Translingual Literacy: An Enactment. *Research in the Teaching of English*, 48(1), 40–67.
- Canagarajah, A. S. (2013). *Translingual practice global Englishes and cosmopolitan relations*. Routledge.
- Cargill, Margaret, Gao, Xin, Wang, Xiaoqing, & O'Connor, Patrick. (2018). Preparing Chinese graduate students of science facing an international publication requirement for graduation: Adapting an intensive workshop approach for early-candidature use. *English for Specific Purposes (New York, N.Y.)*, 52, 13–26. <https://doi.org/10.1016/j.esp.2018.05.002>
- Corrigan, Paul T. (2019, July 19). *White Teachers Are a Problem | A Conversation with Asao Inoue* [Video]. Youtube. <https://www.youtube.com/watch?v=UiSFABBRx6c&t=472s>
- Cox, M. (2011). WAC: Closing Doors or Opening Doors for Second Language Writers? *Across the Disciplines*, 8(4).
- Curry, M. J., & Lillis, Theresa M. (2018). *Global academic publishing : policies, perspectives and pedagogies*. Multilingual Matters.

Diana K. Davis. (2006). Neoliberalism, Environmentalism, and Agricultural Restructuring in Morocco. *The Geographical Journal*, 172(2), 88–105. <https://doi.org/10.1111/j.1475-4959.2006.00204.x>

DePalma, Michael-John and Ringer, Jeffrey M. (2014). Adaptive Transfer, Writing Across the Curriculum, and Second Language Writing: Implications for Research and Teaching. In T. M. Zawacki and M. Cox (Eds.), *WAC and second language writers : research towards linguistically and culturally inclusive programs and practices*. The WAC Clearinghouse ; Parlor Press. 43-68.

Devitt, A. J. (2015). Genre performances: John Swales' Genre Analysis and rhetorical-linguistic genre studies. *Journal of English for Academic Purposes*, 19(25), 44–51. <https://doi.org/10.1016/j.jeap.2015.05.008>

Douglas, J. (2015). Developing an English for Academic Purposes Course for L2 Graduate Students in the Sciences. *Across the Disciplines*, 12(3).

Douglas, Jennifer. (2020). Developing an English for Academic Purposes Course for L2 Students in the Sciences. In M. Brooks-Gillies, E.G. Garcia, S.H. Kim, K. Manthey, and T.G. Smith (Eds.), *Graduate Writing Across the Disciplines: Identifying, Teaching, and Supporting*. The WAC Clearinghouse.

Fahnestock, Jeanne. (1986). Accommodating Science. *Written Communication*, 3(3), 275–296. <https://doi.org/10.1177/0741088386003003001>

Fakhri, A. (2004). Rhetorical properties of Arabic research article introductions. *Journal of Pragmatics*, 36(6), 1119–1138. <https://doi.org/10.1016/j.pragma.2003.11.002>

Fernandes, Marino. (2014). English is Not a Spectator Sport: Privileged Second Language Learners and the For-Profit ESOL Classroom. In T. M. Zawacki and M. Cox (Eds.), *WAC*

- and second language writers : research towards linguistically and culturally inclusive programs and practices*. The WAC Clearinghouse ; Parlor Press. 257-268.
- Ferris, Dana, & Thaiss, Chris. (2011). Writing at UC Davis: Addressing the Needs of Second Language Writers. *Across the Disciplines*, 8(4).
- Fife, J. (2018). Can I Say 'I' in My Paper?: Teaching Metadiscourse to Develop International Writers' Authority and Disciplinary Expertise. *Across the Disciplines*, 15(1), 61.
- Fredericksen, Elaine and Mangelsdorf, Kate. (2014). Graduate Writing Workshops: Crossing Languages and Disciplines. In T. M. Zawacki and M. Cox (Eds.), *WAC and second language writers : research towards linguistically and culturally inclusive programs and practices*. The WAC Clearinghouse ; Parlor Press. 347-368.
- Friginal, Eric, & Mustafa, Sabah Slebi. (2017). A comparison of U.S.-based and Iraqi English research article abstracts using corpora. *Journal of English for Academic Purposes*, 25, 45–57. <https://doi.org/10.1016/j.jeap.2016.11.004>
- Frigo, Stefanie, & Fulford, Collie. (2018). Introducing Bringing the Outside In: Internationalizing the WAC/WID Classroom. *Across the Disciplines*, 15(1), 1–7. <https://doi.org/10.37514/ATD-J.2018.15.1.01>
- Frost, Alanna, Kiernan, Julia, and Malley, Suzanne Blum. (2020). *Translingual Dispositions: Globalized Approaches to the Teaching of Writing*. The WAC Clearinghouse.
- Gascoigne, Toss and Jenni Metcalfe (2020). Training scientists to communicate in a changing world. In Newman, T. P. (Ed.), *Theory and best practices in science communication training*. Routledge (pp. 73-89).
- Geller, A. E. (2011). Teaching and Learning with Multilingual Faculty. *Across the Disciplines*, 8(4).

- Gentil, G. (2018). Modern Languages, Bilingual Education, and Translation Studies: The Next Frontiers in WAC/WID Research and Instruction? *Across the Disciplines*, 15(3), 114.
- Gere, Anne Ruggles, Knutson, Anna V, & McCarty, Ryan. (2018). Rewriting Disciplines: STEM Students' Longitudinal Approaches to Writing in (and across) the Disciplines. *Across the Disciplines*, 15(3), 63.
- Gere, Anne Ruggles, Limlamai, Naitnaphit, Wilson, Emily, MacDougall Saylor, Kate, & Pugh, Raymond. (2019). Writing and Conceptual Learning in Science: An Analysis of Assignments. *Written Communication*, 36(1), 99–135.
<https://doi.org/10.1177/0741088318804820>
- Gigante, Maria E. (2014). Critical Science Literacy for Science Majors. *Bulletin of Science, Technology & Society*, 34(3-4), 77–86. <https://doi.org/10.1177/0270467614556090>
- Gonzales, Laura. (2015). Multimodality, Translingualism, and Rhetorical Genre Studies. *Forum - Conference on College Composition and Communication*, 31.
- Granovskiy, Boris and Wilson, Jill H. (2019, November 1). Report: Foreign STEM Students in the United States. *Congressional Research Service*.
<https://crsreports.congress.gov/product/pdf/IF/IF11347>
- Juan C. Guerra. (2016). Cultivating a Rhetorical Sensibility in the Translingual Writing Classroom. *College English*, 78(3), 228–233.
- Hall, J. (2018). The Translingual Challenge: Boundary Work in Rhetoric & Composition, Second Language Writing, and WAC/WID. *Across the Disciplines*, 15(3), 28.
- Hall, Jonathan, & Navarro, Nela. (2011). Lessons for WAC/WID from Language Learning Research: Multicompetence, Register Acquisition, and the College Writing Student. *Across the Disciplines*, 8(4).

- Halleck, Gene B, & Connor, Ulla M. (2006). Rhetorical moves in TESOL conference proposals. *Journal of English for Academic Purposes*, 5(1), 70–86.
<https://doi.org/10.1016/j.jeap.2005.08.001>
- Hanauer, David I, Sheridan, Cheryl L, & Englander, Karen. (2019). Linguistic Injustice in the Writing of Research Articles in English as a Second Language: Data From Taiwanese and Mexican Researchers. *Written Communication*, 36(1), 136–154.
<https://doi.org/10.1177/0741088318804821>
- Hartz J., Chappell, R. (1997). *Worlds Apart: How the Distance Between Science and Journalism Threatens America's Future*. First Amendment Center, Nashville.
- Hendricks, C. C. (2018). WAC/WID and Transfer: Towards a Transdisciplinary View of Academic Writing. *Across the Disciplines*, 15(3), 1–15. <https://doi.org/10.37514/ATD-J.2018.15.3.11>
- Holliday, Adrian. (2006). Native-Speakerism. *ELT Journal*, 60(4), 385–387.
<https://doi.org/10.1093/elt/ccl030>
- Horner, Bruce. (2020). Postmonolingual Projections: Translating Translinguality. In A. Frost, J. Kiernan, and S. B. Malley (Eds.), *Translingual Dispositions: Globalized Approaches to the Teaching of Writing*. The WAC Clearinghouse. DOI: 10.37514/INT-B.2020.0438.3.3
- Horner, Bruce, Lu, Min-Zhan, Royster, Jacqueline Jones, & Trimbur, John. (2011). OPINION: Language Difference in Writing: Toward a Translingual Approach. *College English*, 73(3), 303.
- Horner, Bruce, and Trimbur, John. (2002). English Only and U.S. College Composition. *College Composition and Communication*, 53(4), 594-630

Institut National de la Recherche Agronomique. *African and Mediterranean Agricultural*

Journal: Al-Awamia. <http://www.afrimed.ma/index.php/AFRIMED>

Institut National de la Recherche Agronomique. *Revue Al-Awamia.*

<https://www.inra.org.ma/fr/revue-al-awamia-s>

Ives, Lindsey, Leahy, Elizabeth, Leming, Anni, Pierce, Tom, and Schwartz, Michael. (2014). “I don’t know if that was the right thing to do”: Cross-Disciplinary/Cross-Institutional Faculty Respond to L2 Writing. In T. M. Zawacki and M. Cox (Eds.), *WAC and second language writers : research towards linguistically and culturally inclusive programs and practices*. The WAC Clearinghouse ; Parlor Press. 211-232.

Jordan, Jay, & Kedrowicz, April. (2011). Attitudes about Graduate L2 Writing in Engineering: Possibilities for More Integrated Instruction. *Across the Disciplines*, 8(4).

Kang, Yu-Kyung. (2020). Translingual Approaches as Institutional Intervention: Implementing the Single-Language Writing Group. In A. Frost, J.Kiernan, and S. B. Malley (Eds.), *Translingual Dispositions: Globalized Approaches to the Teaching of Writing*. The WAC Clearinghouse. DOI: 10.37514/INT-B.2020.0438.2.04

Khadka, Santosh. (2020). When Multimodal Meets the Translingual: Case Studies from an Experiment with a Multiliterate Composition Pedagogy in a Globalized Writing Classroom. In A. Frost, J.Kiernan, and S. B. Malley (Eds.), *Translingual Dispositions: Globalized Approaches to the Teaching of Writing*. The WAC Clearinghouse. DOI: 10.37514/INT-B.2020.0438.2.08

Krall-Lanoue, Aimee. (2013). “And Yea I’m Venting, But Hey I’m Writing Isn’t I”: A Translingual Approach to Error in a Multilingual Context. In A. S. Canagarajah (Ed.), *Translingual practice global Englishes and cosmopolitan relations*. Routledge. 262-269.

- Lancaster, Z. (2011). Interpersonal Stance in L1 and L2 Students' Argumentative Writing in Economics: Implications for Faculty Development in WAC/WID Programs. *Across the Disciplines*, 8(4).
- Lancaster, Zak. (2014). Making Stance Explicit for Second Language Writers in the Disciplines: What Faculty Need to Know about the Language of Stance-taking. In T. M. Zawacki and M. Cox (Eds.), *WAC and second language writers : research towards linguistically and culturally inclusive programs and practices*. The WAC Clearinghouse ; Parlor Press. 269-298.
- Lavelle, Thomas, and Ågre, Maria. (2020). Translingual Pedagogy and Anglophone Writing Instruction in a Swedish Department of History. In A. Frost, J.Kiernan, and S. B. Malley (Eds.), *Translingual Dispositions: Globalized Approaches to the Teaching of Writing*. The WAC Clearinghouse. DOI: 10.37514/INT-B.2020.0438.2.05
- Lavelle, Thomas and Shima, Alan. (2014). Writing Histories: Lingua Franca English in a Swedish Graduate Program. In T. M. Zawacki and M. Cox (Eds.), *WAC and second language writers : research towards linguistically and culturally inclusive programs and practices*. The WAC Clearinghouse ; Parlor Press. 439-464.
- Lorimer, Rebecca. (2013). Writing across languages: developing rhetorical attunement. In A. S. Canagarajah (Ed.), *Translingual practice global Englishes and cosmopolitan relations*. Routledge. 191-199.
- Lu, M.-Z. (2006). Living-English Work. *College English*, 68(6), 605–618.
<https://doi.org/10.2307/25472178>

- Mallett, Karyn E. and Zgheib, Ghania. (2014). In T. M. Zawacki and M. Cox (Eds.), *WAC and second language writers : research towards linguistically and culturally inclusive programs and practices*. The WAC Clearinghouse ; Parlor Press. 387-414.
- Mao, L. (2018). Thinking Through Difference and Facts of Nonusage: A Dialogue Between Comparative Rhetoric and Translingualism. *Across the Disciplines*, 15(3), 104.
- Matsuda, P. K. (2006). The Myth of Linguistic Homogeneity in U.S. College Composition. *College English*, 68(6), 637–651. <https://doi.org/10.2307/25472180>
- Matsuda, P. K. (2014). The Lure of Translingual Writing. *PMLA : Publications of the Modern Language Association of America*, 129(3), 478–483.
<https://doi.org/10.1632/pmla.2014.129.3.478>
- Mihut, Ligia A. (2020). Enacting Linguistic Justice: Transnational Scholars as Advocates for Pedagogical Change. In A. Frost, J.Kiernan, and S. B. Malley (Eds.), *Translingual Dispositions: Globalized Approaches to the Teaching of Writing*. The WAC Clearinghouse. DOI: 10.37514/INT-B.2020.0438.2.11
- Mina, Lilian W., and Cimasko, Tony. (2020). Expectations, Mismatches, and Translingual Dispositions in Teaching Multilingual Students. In A. Frost, J.Kiernan, and S. B. Malley (Eds.), *Translingual Dispositions: Globalized Approaches to the Teaching of Writing*. The WAC Clearinghouse. DOI: 10.37514/INT-B.2020.0438.2.03
- Montgomery, S. L. (2000). *Science in translation : movements of knowledge through cultures and time*. University of Chicago Press.
- Moriarty, Devon, & Mehlenbacher, Ashley Rose. (2019). The Coaxing Architecture of Reddit's r/science: Adopting Ethos-Assessment Heuristics to Evaluate Science Experts on the

Internet. *Social Epistemology*, 33(6), 514–524.

<https://doi.org/10.1080/02691728.2019.1637964>

Najjar, Hazim. (1990_). Arabic as a research language: The case of agricultural sciences.

Unpublished doctoral dissertation, University of Michigan, Ann Arbor, MI. Cited in A.

Fakhri (2004), Rhetorical properties of Arabic research article introductions. *Journal of*

Pragmatics, 36(6), 1119–1138.

Neuendorf, K. A., Skalski, Paul D., Cajigas, Julie A., & Allen, Jeffery C. (2017). *The content*

analysis guidebook (Second edition.). SAGE.

Nielsen, Kathryn. (2014). On Class, Race, and Dynamics of Privilege: Supporting Generation 1.5

Writers Across the Curriculum. In T. M. Zawacki and M. Cox (Eds.), *WAC and second*

language writers : research towards linguistically and culturally inclusive programs and

practices. The WAC Clearinghouse ; Parlor Press. 129-150.

Palmer, Zsuzsanna Bacsa. (2020). Expressions of Monolingual Ideology and Translingual

Practice in an Online International Collaboration Project. In A. Frost, J.Kiernan, and S. B.

Malley (Eds.), *Translingual Dispositions: Globalized Approaches to the Teaching of*

Writing. The WAC Clearinghouse. DOI: 10.37514/INT-B.2020.0438.2.09

Patton, M. D. (2011). Mapping the Gaps in Services for L2 Writers. *Across the Disciplines*, 8(4).

Pelger, Susanne, & Sigrell, Anders. (2016). Rhetorical meta-language to promote the

development of students' writing skills and subject matter understanding. *Research in*

Science & Technological Education, 34(1), 25–42.

<https://doi.org/10.1080/02635143.2015.1060410>

Pelger, Susanne. (2018). Popular science writing bringing new perspectives into science

students' theses." *International Journal of Science Education, Part B*, 8(1), 1-13.

- Pelger, Susanne, and Pernilla Nilsson. (2016). Popular science writing to support students' learning of science and scientific literacy. *Research in Science Education*, 46(3), 439-456.
- Peters, H.P. (2014) Scientists as public experts: Expectations and responsibilities. In Bucchi, M., & Trench, Brian (Eds.), *Routledge handbook of public communication of science and technology* (2nd ed.). Routledge (pp. 70-82).
- Peters, H. P. (2013). Gap between science and media revisited: Scientists as public communicators. *Proceedings of the National Academy of Sciences - PNAS*, 110(Supplement 3), 14102–14109. <https://doi.org/10.1073/pnas.1212745110>
- Romero, Yasmine, & Shivers-McNair, Ann. (2018). Encountering Internationalization in the Writing Classroom: Resistant Teaching and Learning Strategies. *Across the Disciplines*, 15(1), 47.
- Roozen, Kevin. (2020). Mapping Translingual Literacies: Encouraging and Enacting Translingual Perspectives of Literate Life. In A. Frost, J.Kiernan, and S. B. Malley (Eds.), *Translingual Dispositions: Globalized Approaches to the Teaching of Writing*. The WAC Clearinghouse. DOI: 10.37514/INT-B.2020.0438.2.06
- Rounsaville, Angela, Goldberg, Rachel, & Bawarshi, Anis. (2008). From Incomes to Outcomes: FYW Students' Prior Genre Knowledge, Meta-Cognition, and the Question of Transfer. *WPA. Writing Program Administration*, 32(1), 97.
- Sharma, G. (2018). Internationalizing Writing in the STEM Disciplines. *Across the Disciplines*, 15(1), 26.

- Shipka, Jody. (2009). Negotiating Rhetorical, Material, Methodological, and Technological Difference: Evaluating Multimodal Designs. *College Composition and Communication*, 61(1), W343.
- Simpson, Steve, Clemens, Rebecca, Killingsworth, Drea Rae, & Ford, Julie Dyke. (2015). Creating a Culture of Communication: A Graduate-Level STEM Communication Fellows Program at a Science and Engineering University. *Across the Disciplines*, 12(3), 1–15. <https://doi.org/10.37514/ATD-J.2015.12.3.08>
- Summers, Sarah. (2020). Developing Translingual Dispositions to Negotiate Gatekeeping in the Graduate Writing Center. In A. Frost, J. Kiernan, and S. B. Malley (Eds.), *Translingual Dispositions: Globalized Approaches to the Teaching of Writing*. The WAC Clearinghouse. DOI: 10.37514/INT-B.2020.0438.2.11
- Swales, J. (1990). *Genre Analysis*. Cambridge University Press.
- Swales, J., & Feak, C. B. (2009). *Abstracts and the writing of abstracts*. Ann Arbor, MI: The University of Michigan Press.
- Swales, J. M., & Feak, Christine B. (2012). *Academic writing for graduate students : essential tasks and skills* (3rd edition.). The University of Michigan Press.
- Tardy, Christine M. (2017). “Crossing, or Creating, Divides?: A Plea for Transdisciplinary Scholarship.” In B. Horner and L. Tetreault (Eds.), *Crossing divides : exploring translingual writing pedagogies and programs*. Utah State University Press. 181-189.
- Tardy, Christine M, Sommer-Farias, Bruna, & Gevers, Jeroen. (2020). Teaching and Researching Genre Knowledge: Toward an Enhanced Theoretical Framework. *Written Communication*, 37(3), 287–321. <https://doi.org/10.1177/0741088320916554>

- Valentino, Russell Scott, Emery, Jacob, Forrester, Sibelan, & Kuzmanović, Tomislav. (2017). Rhetoric, Translation, and the Rhetoric of Translation. *Poroi*, 13(1).
<https://doi.org/10.13008/2151-2957.1263>
- Van Bonn, Sarah, & Swales, John M. (2007). English and French journal abstracts in the language sciences: Three exploratory studies. *Journal of English for Academic Purposes*, 6(2), 93–108. <https://doi.org/10.1016/j.jeap.2007.04.001>
- Villanueva, V., & Arola, Kristin L. (2011). *Cross-talk in comp theory : a reader* (Third edition.). National Council of Teachers of English.
- Walters, Lynne Masel, & Walters, T. N. (1996). It Loses Something in the Translation. *Science Communication*, 18(2), 165–180. <https://doi.org/10.1177/1075547096018002005>
- Watts, Julie, & Burnett, Rebecca E. (2012). Pairing Courses Across the Disciplines. *Written Communication*, 29(2), 208–235. <https://doi.org/10.1177/0741088312438525>
- Wehr, H. (1994). *A dictionary of modern written Arabic : (Arabic-English)*. Fourth edition, Considerably enlarged and amended / by the author. Ed. Cowan, J. Milton. Student edition. Spoken Language Services.
- Wei, Jing, & Duan, Jing. (2018). A Comparative Study of Metadiscourse in English Research Article Abstracts in Hard Disciplines by L1 Chinese and L1 English Scholars. *Applied Research on English Language*, 7(3), 399–434.
<https://doi.org/10.22108/are.2019.110099.1264>
- Wei, L. (2018). Translanguaging as a Practical Theory of Language. *Applied Linguistics*, 39(1), 9–30. <https://doi.org/10.1093/applin/amx039>
- Wyrzten, J. (2015). *Making Morocco : colonial intervention and the politics of identity*. Cornell University Press.

- Yakhontova, T. (2006). Cultural and disciplinary variation in academic discourse: The issue of influencing factors. *Journal of English for Academic Purposes*, 5(2), 153–167.
<https://doi.org/10.1016/j.jeap.2006.03.002>
- Young, V. A. (2009). "Nah, We Straight": An Argument Against Code Switching. *JAC : a Journal of Composition Theory*, 29(1/2), 49–76.
- Young, V. A. (2014). *Other people's English : code-meshing, code-switching, and African American literacy*. Teachers College Press/Teachers College/Columbia University.
- Zawacki, T. M., & Cox, Michelle. (2014). *WAC and second language writers : research towards linguistically and culturally inclusive programs and practices*. The WAC Clearinghouse ; Parlor Press.
- Zawacki and Habib. (2014). Negotiating “errors” in L2 writing: Faculty dispositions and language difference. In T. M. Zawacki and M. Cox (Eds.), *WAC and second language writers : research towards linguistically and culturally inclusive programs and practices*. The WAC Clearinghouse ; Parlor Press. 183-210.
- Zebakh, Sanaa, Rigas Arvanitis, Hicham Boutracheh, & Mohamed Sadiki. (2017). Trends in the Moroccan agricultural research: an exploratory bibliometric analysis (2005-2015). *Revue Marocaines Des Sciences Agronomiques et Vétérinaires*, 5(3), 255–268.

Appendix

Appendix A: *Al-Awamia* Corpus

Article Designation	Citation	URL
E1	Endo T. et al. (2011-2012). Identification of powdery mildew fungus on Moroccan cucurbitaceous plants. <i>Revue Al-Awamia</i> , 125-126(1), 119-141.	https://www.inra.org.ma/fr/n-revue/125-126
E2	Nassif, F. and Bouayad, A. (2011-2012). Role of women in small ruminants' chains in Ouled Slimane and Sekouma-Irzaine communities of Taourirt province, Morocco. <i>Revue Al-Awamia</i> , 125-126(1), 143-166.	https://www.inra.org.ma/fr/n-revue/125-126
E3	Abdelwahd, R. et al. (2013). Cloning the construct HVA1 into a binary vector by gateway multisite system and genetic transformation of faba bean (<i>vicia faba</i> L.) with HVA1 gene for improving drought tolerance. <i>Revue Al-Awamia</i> , 127(1), 3-20.	https://www.inra.org.ma/fr/n-revue/127
E4	Snaibi, W. (2020). Adaptive practices of livestock breeders in the face of climate change and factors influencing their adoption in the arid rangelands of eastern Morocco. <i>AfriMed Agricultural Journal - Al Awamia</i> , 128(1), 31-61.	http://www.afrimed.ma/index.php/AFRIMED/issue/view/3
E5	Omari, F. E. et al. (2020). Effect of nitrogen level application on yield and fruit quality of Navel orange variety in a sandy soil. <i>AfriMed Agricultural Journal - Al Awamia</i> , 129(1), 92-107.	http://www.afrimed.ma/index.php/AFRIMED/issue/view/4
E6	Bouharroud, R. and Sétamou, M. (2020). Assessment of residual effects of three neonicotinoids commonly used to control Asian citrus psyllid <i>Diaphorina citri</i> Kuwayama (Hemiptera: Psyllidae). <i>AfriMed Agricultural Journal - Al Awamia</i> , 129(1), 161-176.	http://www.afrimed.ma/index.php/AFRIMED/issue/view/4
E7	El Guilli, M. et al. (2020). Influence of Rootstocks and Harvest Date on the Fruit Quality of the 'Nadorcott' Mandarin During Cold Storage. <i>AfriMed Agricultural Journal - Al Awamia</i> , 129(1), 195-210.	http://www.afrimed.ma/index.php/AFRIMED/issue/view/4
E8	Nadori, E. B. et al. (2020). Effects of Citrus Rootstocks on Fruit Yield and Quality of 'Nadorcott' Mandarin. <i>AfriMed Agricultural Journal - Al Awamia</i> , 129(1), 211-225.	http://www.afrimed.ma/index.php/AFRIMED/issue/view/4

F1	Nassif, F. et al. (2011-2012). Importance de la culture du blé dur et évaluation différenciée de dix variétés de blé dur dans la region Chaouia au Maroc. <i>Revue Al-Awamia</i> , 125-126(1), 57-79.	https://www.inra.org.ma/fr/n-revue/125-126
F2	Oukabli, A. (2011-2012). Caractérisation phénologique d'une collection de 102 variétés d'amandier en conditions de Moyenne altitude. <i>Revue Al-Awamia</i> , 125-126(1), 97-117.	https://www.inra.org.ma/fr/n-revue/125-126
F3	El Kourdrim, Mohammed. (2013). Impact des facteurs anthropiques et des strategies socio-foncieres sur l'amplification de la desertification au niveau des hauts plateaux de l'oriental. <i>Revue Al-Awamia</i> , 127(1), 71-89.	https://www.inra.org.ma/fr/n-revue/127
F4	Bechchari, Abdelmajid. (2020). Analyse socio-spatiale de l'exploitation des terres de parcours du Maroc oriental. <i>AfriMed Agricultural Journal - Al Awamia</i> , 128(1), 124-142.	http://www.afrimed.ma/index.php/AFRIMED/issue/view/3
F5	El Koudrim, M. et al. (2020). Production et valeur nutritive de <i>Medicago arborea</i> en intercalaire dans un système fourrager pluvial en zone semi-aride méditerranéenne. <i>AfriMed Agricultural Journal - Al Awamia</i> , 128(1), 173-186.	http://www.afrimed.ma/index.php/AFRIMED/issue/view/3
F6	Hadria, R. et al. (2020). Effet du régime hydrique sur le rendement et la qualité de la clementine de Berkane: vers une agrumiculture de précision. <i>AfriMed Agricultural Journal - Al Awamia</i> , 129(1), 108-127.	http://www.afrimed.ma/index.php/AFRIMED/issue/view/4