Reading for the Technical Workplace: Developing a Diagnostic Reading Assessment for Understanding Instructional Texts

Nathan J. Devos

Proficient communication, particularly reading comprehension, is vital for career progression, yet many college-level English as an Additional Language (EAL) students encounter hurdles in this area. Weak reading skills can impede job prospects, underscoring the need for tailored interventions during students' studies. Therefore, post-entry language assessments (PELAs) can serve as essential tools for post-secondary institutions, aiding in identifying and supporting students struggling with English proficiency. PELAs adopt a diagnostic approach, facilitating language development while maintaining educational experiences. Despite increased interest in PELAs, few diagnostic assessments cater specifically to reading proficiency. This paper explores the creation of a PELA for first-year college students in Canada, designed to prepare them for diverse workplaces. Utilizing Evidence-Centered Design (ECD) ensures validity in assessment development, emphasizing inference-based reasoning from individuals' responses. Insights from a task survey with 12 professionals underscored the significance of understanding instructional texts for academic and professional success, informing the development of a diagnostic reading assessment beneficial to both multilingual and L1 literacy students.

Une communication efficace, en particulier sur le plan de la compréhension écrite, est vitale pour l'avancement professionnel. Cependant, de nombreux étudiants de l'anglais comme langue additionnelle (ELA) au niveau universitaire rencontrent des obstacles sur ce niveau. De faibles compétences en lecture peuvent entraver les perspectives d'emploi, ce qui souligne la nécessité d'interventions personnalisées pendant les études. Par conséquent, les évaluations linguistiques à l'entrée (ÉLE) peuvent constituer des outils essentiels pour les établissements d'enseignement postsecondaires, en aidant à identifier et à soutenir les étudiants qui éprouvent des difficultés en anglais. Les ÉLE adoptent une approche diagnostique, facilitant le développement de la langue tout en maintenant le vécu éducatif. Malgré l'intérêt croissant pour les ÉLE, peu d'évaluations diagnostiques portent spécifiquement sur la compétence de compréhension écrite. Cet article explore la création d'une ÉLE pour des étudiants de première année universitaire au Canada, conçue pour les préparer à des lieux de travail diversifiés. L'utilisation de la conception centrée sur les preuves (CCP) garantit la validité dans le développement de l'évaluation, en mettant l'accent sur le raisonnement basé sur l'inférence à partir des réponses des individus. Les résultats d'un sondage sur les tâches mené auprès de 12 professionnels mettent en lumière l'importance de la

compréhension des textes pédagogiques pour la réussite scolaire et professionnelle, ce qui a permis d'élaborer une évaluation diagnostique de la lecture qui peut être utilisée avec des étudiants en apprentissage de la littératie en langue première et dans des langues additionnelles.

Keywords: evidence-centred design, instructional texts, post-entry language assessment, reading comprehension, workplace communication

In order for people to obtain employment and be successful in the workplace, communication skills play a critical role. However, college-level students may not be well prepared for communication in the workplace, especially across all four major language skills (reading, writing, listening, and speaking) (Oliveri & McCulla, 2019). Weak reading skills in particular can become a major hurdle for potential or current employees and have lasting negative effects on their abilities to find meaningful jobs, retain work, and be promoted (CCRW, 2023), making strong reading skills important for career pursuits. In fact, reading comprehension, as a basic employment skill, ranks higher for STEM professionals than the ability to write, speak, or actively listen (Conference Board of Canada, 2022). Public safety and well-being also depend on employees' abilities to communicate in all language skills in some professions (Knoch & Macqueen, 2020). More specifically, comprehending written instructional texts in the workplace is crucial and carries with it significant responsibility that can have negative ethical, legal, or physical implications if instructions are not followed correctly (Lannon et al., 2018).

For individuals reading in an additional language, such as English, many factors can inhibit the development of strong reading comprehension skills in the additional language. Harding et al. (2015) suggest that differences between readers' first language (L1) and second language (L2) cause the most reading problems. Besides the obvious orthographical variations between languages, Grabe (2009) outlines three key differences between L1 and L2 reading: linguistic and processing; developmental and educational; and sociocultural and institutional. According to Grabe, these differences can be more apparent with weak readers who struggle with low-level attributes of reading. If an individual's EAL skills are still emerging, then reading comprehension issues can be equally language-related as reading-related (Harding et al., 2015). As reading for the workplace is about employees "being able to accomplish job-related reading tasks" (Middleton, 1996, p. 64), multilingual job seekers for whom English is an additional language can be negatively impacted in their employment chances as well as in their opportunities to advance and be promoted in the workplace.

College as Path to Career Preparation

Increasingly, international students and newcomers[1] to Canada for whom English is an additional language are attending vocationally oriented programs in colleges and polytechnic institutes to gain workplace-ready skills. For many, a post-secondary credential in English often has a twofold goal: students want to achieve the appropriate learning outcomes in the discipline to graduate and work, and they want to

[1] A newcomer to Canada is someone who has immigrated to Canada and established residential ties or is a protected person (including refugees) under Canada's Immigration and Refugee Protection Act (Government of Canada, 2022). It does not include persons with temporary visiting permits (e.g., study permits, work permits), such as international students.

improve their English skills to a level that would allow them to succeed in the workplace in national or international English-speaking settings (Arkoudis et al., 2012). For career preparation, Canada relies heavily on its strong college sector (Skolnik, 2021; Statistics Canada, 2022a). Overall enrollments in college programs have risen by 22% in Canada since 2011 (Statistics Canada, 2021), and the number of international students in short (one- to two-year) college STEM programs grew by about 470% between 2010 and 2021 (Statistics Canada, 2022b).

More international students are also contributing to the workforce during and after their college studies. According to Crossman et al. (2022), the number of international students in colleges who are participating in the labour market increased from 7% to 57% between 2000 and 2018. To attract and retain international students, host countries are offering post-graduation work permits and residency incentives for international students. Arkoudis et al. (2012) state, "The opportunity to work in a host country after graduation is becoming a common marketing tool for countries competing in the international student market" (p. 137). Canada offers the Post-Graduation Work Permit (PGWP) program, which allows students to stay in Canada longer after graduation if they have a job. The number of PGWP holders with positive income earnings grew 1,300% between 2000 and 2018, from 10,300 to 135,100 (Crossman et al., 2022).

Finally, to fill labour shortages and grow the economy, Canada introduced the Immigration Levels Plan, accepting 401,000 new permanent resident applications in 2021, the most in recorded Canadian history, with the plan to invite 1.45 million permanent residents to Canada by 2025 (Government of Canada, 2021, 2022). Skilled immigrants are, therefore, encouraged to reskill or upskill with a Canadian credential, and more are choosing college programs as they are often cheaper and have lower entrance standards than universities.

Supporting EAL College Students' Language Needs

Lower entrance requirements and intense schedules in vocationally oriented programs may cause some students for whom English is an additional language to struggle academically (Heeren et al., 2021). Students can experience high levels of anxiety, distress, and frustration when they cannot meet academic demands (Barbayannis et al., 2022; Hashemi, 2011; Lopez & Bui, 2014). Consequently, these factors can have negative effects on students' attitudes and motivation, regardless of the discipline of study or students' gender and language proficiency (Jain & Sidhu, 2013). Thus, as higher education has become more diverse and universally accessible, more onus is being placed on institutions to ensure that their graduates have the communication skills to succeed academically and work in their chosen professions (Arkoudis et al., 2012). As a result, there has been growing interest in finding ways to support students' English communication skills as part of their overall workforce skills development. Banta and Palomba (2015) state that, "with 'massification,' students with diverse needs necessitated the creation of a full range of student services and the institutional research function to support this infrastructure" (p. 7). Post-admission language support is one approach institutions are using to address these needs.

Post-Entry Language Assessment (PELA)

Post-entry language assessments (PELA) have become an indispensable tool for many post-secondary institutions to identify and offer post-admission language support to students who may struggle with the rigours of their studies in English (Fox, von Randow, & Volkov, 2016). PELAs are low-stakes language tests taken after students have entered their programs to identify and support those who may be at risk of failing (Fox, Haggarty, & Artemeva, 2016). PELAs tend to follow a diagnostic approach to language testing, which has become an evolving area of theory and research in the field of second language acquisition and language testing (Alderson et al., 2015). Read (2015) suggests that PELAs, as a diagnostic instrument,

should be formative and offer test takers some direction in their language development. They should also be low-stakes, in that they do not exclude test takers from participation in programs but rather offer access to language support services. This form of assessment in higher education should also not be "so onerous that it hampers or interferes with the delivery of the educational experience that it attempts to assess and improve" (Banta & Palomba, 2015, p. 11). As language tests, diagnostic assessments are generally less authentic than proficiency tests (Alderson, 2007) and lend themselves to being computer-administered (Read, 2015). Finally, Read (2015) claims that diagnostic assessment should ideally be based on second language acquisition theory. However, Alderson posits that this is challenging because theory and research have not yet offered clear ideas of how second language ability develops.

Despite the increased interest in diagnostic assessment as a tool, few assessments have been constructed solely for diagnostic purposes (Alderson et al., 2015). However, there are examples. DIALANG was developed as an online diagnostic assessment system (Alderson & Huhta, 2005), and there are several PELAs in Australia and New Zealand (see Read, 2015, 2016), as well as in Hong Kong (Urmston et al., 2013) and in Canada (Fox, von Randow, & Volkov, 2016). Some of these PELAs include reading components that seek to test higher-level reading processes such as understanding main ideas, making inferences, finding specific information, summarizing main topics, and others (Harding et al., 2015). Furthermore, multiple studies have discussed the development of reading assessments for diagnostic purposes by retrofitting already existing proficiency or placement tests using a cognitive diagnostic assessment framework (Jang, 2009; Kim, 2015; Ranjbaran & Alavi, 2017; Toprak & Cakir, 2021).

However, little literature exists on the development of purposefully designed diagnostic reading assessments for college students in preparation for workplace settings. Therefore, in this article, I discuss the development of a post-entry reading diagnostic assessment for language support in a college setting using Evidence-Centered Design (ECD) (Mislevy et al., 2003). As part of the assessment argument, a conceptual assessment framework was constructed for a blueprint of tasks and item development (Risconscente et al., 2016). This article focuses largely on a domain analysis, which gathered validity evidence about reading in the workplace. ECD has been used from the outset of the test design to create tasks and items that might obtain diagnostic information about test takers' reading abilities and guide them to language-learning materials customized to what inferences the test makes about their reading skills.

Theoretical Framework

ECD is a design process that consists of layers, structures, and representations that develop the construct argument for an assessment (Risconscente et al., 2016). ECD contends that assessment is a "process of reasoning from the particular things people make, say, or do to draw inferences about their knowledge, skills, and abilities" (Risconscente et al., 2016, p. 40). That is, ECD requires the collection of validity evidence throughout the design process of an assessment so that test developers can make inferences about what test takers think, know, or can do based on their responses to the assessment (Wang et al., 2021). Every assessment has its own logic and structure based on the setting, purpose, technologies, interpretation, impact, and more. To organize and construct a useful assessment, an assessment designer needs to find out what people in the domain setting deem salient for working, learning, and interacting; this is done through a domain analysis (Mislevy et al., 2003).

Domain Analysis

The goal of domain analysis is to gather information about the target domain and to identify the knowledge, skills, and abilities (KSA) about which the assessment wants to make claims (Risconscente et al., 2016). For language assessment, this can begin with finding evidence of the target language use (TLU)

domain. Bachman and Palmer (1996) suggest that the TLU domain consists of (a) a specific set of language use tasks that a test taker is likely to encounter outside of the test itself, and (b) the language abilities about which a test developer wants to make inferences. An analysis of the TLU domain is important in any needs analysis for assessment design for specific and professional purposes (Douglas, 2000; Knoch & Macqueen, 2020). To investigate language use in the domain setting, a specific domain language analysis should be conducted that focuses on typical communication tasks (Knoch & Macqueen, 2020). Within the ECD framework, components of a domain analysis include gathering information for seven various themes (Risconscente et al., 2016, pp. 46-47). These themes are defined below with the notion of TLU domain in mind:

1. Valued work: real-world situations in which people engage in communication tasks and use language knowledge, skills, and abilities to complete these tasks
2. Task features: salient features within a communication task that can be used for assessment purposes
3. Representational forms: different forms of communication tasks to solve problems, transform data, or communicate with others that are central for developing proficiency (e.g., workplace correspondence via emails, collaborative documents, internal messaging)
4. Performance outcomes: the ways in which language knowledge is recognized through what someone has said or done (e.g., indigenous assessment criteria)
5. Valued knowledge: important materials that can be used to create an assessment of language-use criteria (e.g., rating scales, rubrics)
6. Structure and relationships: valued knowledge developed from within individuals or groups
7. Knowledge-task relationships: situations and tasks interacting with language knowledge to create different communicative task features.

To conduct a domain analysis, Knoch and Macqueen (2020) suggest various methods for information collection: published or unpublished literature; interviews; surveys; participant or non-participant observations; journals, logs, and diaries; and bodies of collected texts.

Domain Experts

The present study focuses on a survey with domain experts. Knoch and Macqueen (2020) suggest that for the development of tests for professional purposes, theoretical constructs should arise from domain experts. Douglas (2000) also emphasizes the importance of using domain experts to understand TLU domains in which the test developers have little or no experience. If domain experts are involved in the assessment development process, insights about language use and task types can make the test more useful and authentic. Domain experts can be used to investigate which communication tasks are conducted daily and how these tasks are successfully performed and evaluated. Knoch and Macqueen argue that developers often start with texts from within the domain, but starting with frequent and important tasks may be more effective.

Methods

In this study, a qualitative survey design was used to conduct a domain analysis with domain experts following the ECD framework. To start, an online survey was developed to uncover common domain language tasks and TLU in the area of reading in the workplace. The purpose of the survey was to gather information from the experts for the broad TLU domain of reading for the workplace in technical fields.

Research Questions

The research focused on moments in an employee's workday when they were expected to read texts and perform related actions in a timely manner in the workplace. Three research questions guided the study:

1. What timed reading tasks do employees generally engage in during their workday?
2. How is reading comprehension evaluated in the workplace?
3. What reading knowledge, skills, and abilities (KSA) are required in the workplace?

Instrument

Within the ECD framework, Risconscente et al. (2016) propose the use of a survey that includes collecting information on "how often people encounter various situations and what kinds of knowledge demands are important or frequent" (p. 45). They argue that it is through the investigation of real-world tasks that important features for carrying out the responsibilities of a certain job can be discovered. Therefore, an 11-item online survey was developed and distributed through the school's advisory committee, a group of industry experts who give counsel on program development, and the researcher's immediate contacts in various industries. Using convenience sampling involved selecting individuals who were available for the study, and despite the disadvantage of being biased and not being representative of a larger population, sampling by convenience is common in second language research (MacKay & Gass, 2005).

Participants

Responses to the survey came from 12 high-level working professionals in western Canada from seven different sectors. Their experience varied from more than 15 years in their roles to less than one year.

Table **1** shows the professional backgrounds of the survey participants.

Analysis

To analyze the numerical data, MS Excel 2016 was used for descriptive statistics and for frequency and proportions of responses. To analyze the qualitative data, a thematic content analysis was conducted using MAXQDA (Version 20.4.1). Thematic content analysis with MAXQDA allows for an accessible and flexible method to analyze qualitative data (Oliveira et al., 2013; Xu & Zammit, 2020). It describes content based on themes and involves finding repeated meanings across a data set. To organize the data, MAXQDA allows for different weighting of responses, so comments from respondents with higher professional ranks, more years in the role, and more direct reports were weighted higher than those with a lower professional rank, fewer years in the role, and fewer direct reports.

Both inductive and deductive coding were used in the analysis. Deductive coding was used based on three of Risconscente et al.'s (2016) areas for domain analysis: valued work, task features, and performance outcomes. After the initial deductive coding, an industry insider with five years of experience in business improvement in the professional and technical sectors helped to identify and refine common themes. Inductive coding was used to explore language abilities, including language knowledge and strategic competence, as outlined by Bachman and Palmer (1996). These dovetailed with the notions of domain task analysis, including how to uncover common reading tasks, different forms of reading, and how reading success may be evaluated by employers (i.e., indigenous assessment criteria).

Table 1

Survey Respondents' Professional Background

Professional rank	*N*
C-Suite	2
Vice presidents	3
Directors	1
Managers	3
Supervisors	1
Others	2
Sectors	
Agriculture, forestry, fishing, and hunting	1
Finance and insurance	2
Hospitality	1
Information	2
Professional, scientific, and technical services	4
Software	1
Technology	1
Years in position	
More than 15 years	2
11–15 years	2
6–10 years	0
1–5 years	6
Less than 1 year	1
Unknown	1
Number of direct reports	
More than 15	2
11–15	2
6–10	4
1–5	3
Unknown	1

Finally, a genre analysis was conducted to examine how written instructional texts for the workplace and school are structured and organized. Drawing also on literature, conventional patterns of written instructional texts for school and work in "best case" scenarios based on literature were analyzed. For this analysis, Nesi and Gardner (2012) offered insights into genres across professional disciplines, while Nickl (2018) presented ideals for conventional patterns in written instructional texts for the workplace.

Results

Specific Language-Use Tasks

With respect to the first research question, respondents were asked to identify and rank the top five text types that employees read in their workplace. Using an inductive approach to categorize types, these were initially grouped into 10 sub-themes. After review by the industry insider, task-type sub-themes were re-categorized to create six final themes. These are displayed in Table 2 in order of frequency reported by the respondents. Technical documents to perform work to specification (e.g., technical directions, job tickets, work orders, design documents) were mentioned 17 times, while emails were mentioned 12 times. The analysis with the industry insider showed that documents to perform work to specifications were indeed more frequent and perhaps more salient for work performance and promotion in the workplace. However, these themes are neither mutually exclusive nor exhaustive.

Table 2

Thematic Analysis of Common Text Types for Reading in the Technical Workplace

Sub-themes	*Themes*
Task specification, technical directions, technical bulletins, job tickets, job instructions/work orders, technical documents, technical specification, reports, product documentation, design documents, technical information, technical drawings, technical manuals	**Technical documents to perform work to specification**
Internal & external emails	**Email**
Company policies, policy changes, policy updates, procedures, procedure updates	**Policies & procedures**
Slack, Teams, Yammer, Loop, internal newsletters, company blogs	**Internal messaging & collaborative platforms**
Market research, research content, scientific papers, competitive analysis, project data, external documents/publications	**Data & research**
General education material, training material, community updates, trade news/publications, shift reports, performance reports	**Educational materials**

Although the word "email" appeared frequently in the data set (58 times), emailing itself is a channel for communicating different genres. According to Darics and Koller (2018, p. 290), emails function

in three ways to transport information in business communications: (1) as a noticeboard to inform of corporate issues, (2) as a mail carrier to deliver documents, and (3) for dialogue to exchange information. Respondents mentioned emails often in the data set; however, they did not define for which of these three functions they were most often used. In addition, it appears that responding to emails in a timely manner is more about performance evaluation than reading the email dialogue itself. This appears especially especially important for two managers in the finance and insurance sector when it came to evaluating performance and responding to emails:

> Reading Emails that are time sensitive, impact to member experience and Fraud and Security. These are all scenarios where staff would need to read, absorb, and then execute the information. Many times there is an action required or a written response. (Branch manager, Finance & insurance)

> Any external emails (client/partner emails) require to be responded to within 24 hours. For internal emails, for example operational emails, dependent on the urgency of the request, it would be any time between <24 hours to 48 hours or more. (Assistant branch manager, Finance & insurance)

These examples underscore emails as a dialogue that requires timely replies, such as in face-to-face, telephone, and text-message communication. However, it appears that in professional scenarios emails function more often as the media to convey information, allowing employees to "get a job done," as seen in the following situation from a respondent in the professional, scientific, and technical sectors:

> An example scenario would be an email I'd send to a pump manufacturer. I'd give them the information required and then they would have to work on the design; any questions they would have during this time I would respond to in a prompt manner. (Mechanical designer, Professional, scientific, and technical services)

This example shows how email is a delivery system for other text types (in this case, design documents) so that work can be completed to certain specifications. It is only dialogic in that the respondent has an opportunity to ask for clarification via email.

The idea of workplace genres being mostly instructional fits with Nesi and Gardner's (2012) notion that professional genres prepare for professional practice by discussing and seeking solutions to practical problems. To simplify the theme of technical documents to perform work to a certain standard, I have focused on written instructional texts, which prepare students for their academic and professional futures by incorporating demands in both settings. These genres are referred to as "boundary objects" and act as an "interface between different communities of practice and fulfilling different purposes for different people" (Nesi & Gardner, 2012, p. 172).

Evaluation of Reading Abilities in the Workplace

The second research question was "How is reading comprehension evaluated in the workplace?" To answer this question, domain experts were also asked what employees need to be able to do after they have read something for work. This aimed to inform the indigenous criteria for evaluation of the communicative task and examine real-world situations in which people engage in behaviours and utilize the knowledge that is key in the domain. Using an inductive approach, three themes were identified: (1) perform tasks accurately, (2) summarize understanding, and (3) ask and engage (see Table 3).

The ability to perform a job accurately after reading any workplace materials appears to be salient for technical workplace reading scenarios. Also, the ability to summarize what was understood in writing

or orally to others is a reading strategy that employees should have. Finally, asking questions (e.g., clarification questions, thoughtful questions) about what one has read, as well as participating in oral discussions about what one has read in meetings, also came through in the data. These themes are exemplified in comments from the CIO, CEO, and supervisor in the data set when asked about what they look for when evaluating whether employees have understood something they have read:

> Accurate understanding of the work being tasked, accurate estimates, comprehensive requirements, thoughtful questions, ability to contribute to related discussions. (CIO, Software)
>
> Comprehension of task requirements, correct coding as per the specifications, and ability to explain and document would indicate understanding of what they have read. (CEO, Technology)
>
> Engagement is something I look for. Have they asked any questions? Do they have pertinent comments? Did they perform the work correctly as outlined in the work order I gave them? (Supervisor, Agriculture, forestry, fishing, and hunting)

Table 3

Thematic Analysis of Performance Outcomes in Reading in the Technical Workplace

Sub-themes	*Themes*
• Complete work correctly • Perform tasks appropriately • Capture information accurately • Comply with required action • Have no errors or complaints • Create accurate estimates • Complete assigned task without issues • Respond to emails appropriately • Reply clearly and concisely to emails	**Perform tasks accurately**
• Summarize what has been read • Provide summaries • Explain what has been read • Simplify message for others • Present to team	**Summarize understanding**
• Ask thoughtful questions • Ask questions • Make pertinent comments • Contribute to related discussions • Engage in meetings • Participate in team meetings	**Ask and engage**

Unlike reflective or creative reading tasks that may be more indicative of academic genres, allowing students to reflect, discuss, and respond, the function of reading in workplace settings appears to be more functional, "focusing on the practical outcome" (Nesi & Gardner, 2012, p. 172). That is, valued

work related to reading in the workplace includes the ability to (1) identify factual information, (2) make logical deductions, (3) summarize information, and (4) take the correct action.

Reading Abilities in the Workplace

To answer the last research question, "What reading KSAs are required in the workplace?," a deductive approach was used. Multiple indicators of reading abilities in the workplace were uncovered. To begin, Bachman and Palmer (1996) define language ability as both language knowledge (e.g., grammatical, textual, and functional) and strategic competence (i.e., goal setting, assessment, and planning). Using a code-subcodes-segments approach, a model was created to map comments from respondents with the parent codes of language knowledge and strategic competence (see Figure 1).

An analysis of the model suggests that both careful and quick reading components are required for reading in the workplace. Expeditious reading includes skimming to establish discourse and main ideas, while scanning involves locating specific information. Careful reading requires the ability to read for accurate comprehension of ideas as well as the ability to deduce meaning from grammar and context. This concurs with Urquhart and Weir (1998), who identify a matrix of different reading components that includes expeditious and careful reading as well as global and local reading types. For some sectors, it appears that reading comprehension plays a key role in workplace performance, putting the onus on writing and reading abilities so that work can be done to an expected standard:

> Given the nature of our work, my team is generally expected to ensure that anything they're reading would be easily understood by every employee. We operate at a high level of comprehension and strive to simplify messages for others. (Director of communications, Information)

Using Bachman and Palmer's (1996) framework for language knowledge and strategic competence, each reading attribute is underscored by theory in practice. Respondents were asked to select from several reading attributes identified in the literature. The results of this closed-item survey are displayed in Figure 2.

For expeditious reading in the workplace, skimming and scanning are salient reading attributes. A definition of skimming, which is a cognitive strategy to comprehend text quickly, involves "skimming a large chunk of text to comprehend its meaning (with speed)" (Kim, 2015, p. 257). Scanning, as well, is a cognitive strategy that requires searching a text for relevant information (Kim, 2015). These strategies seem fitting for the workplace, where employees must read through correspondence to determine if further action is required. One comment from a manager in the data set underscores this notion:

> The Financial Industry is fast moving, and service related. The amount of change, information sharing, training (from Org and Development Department, Online and Self directed Training and Peer Coaching) is at an all time high. There are communications, there are JOB AIDS, there is "good to know" information and "must know" information. We are also in a habit of putting links into these communications which leads to even more information within the information. […] Humans can only absorb so much. (Branch manager, Finance & insurance)

Figure 1

Code-subcodes-segments Model of Reading Abilities in the Workplace

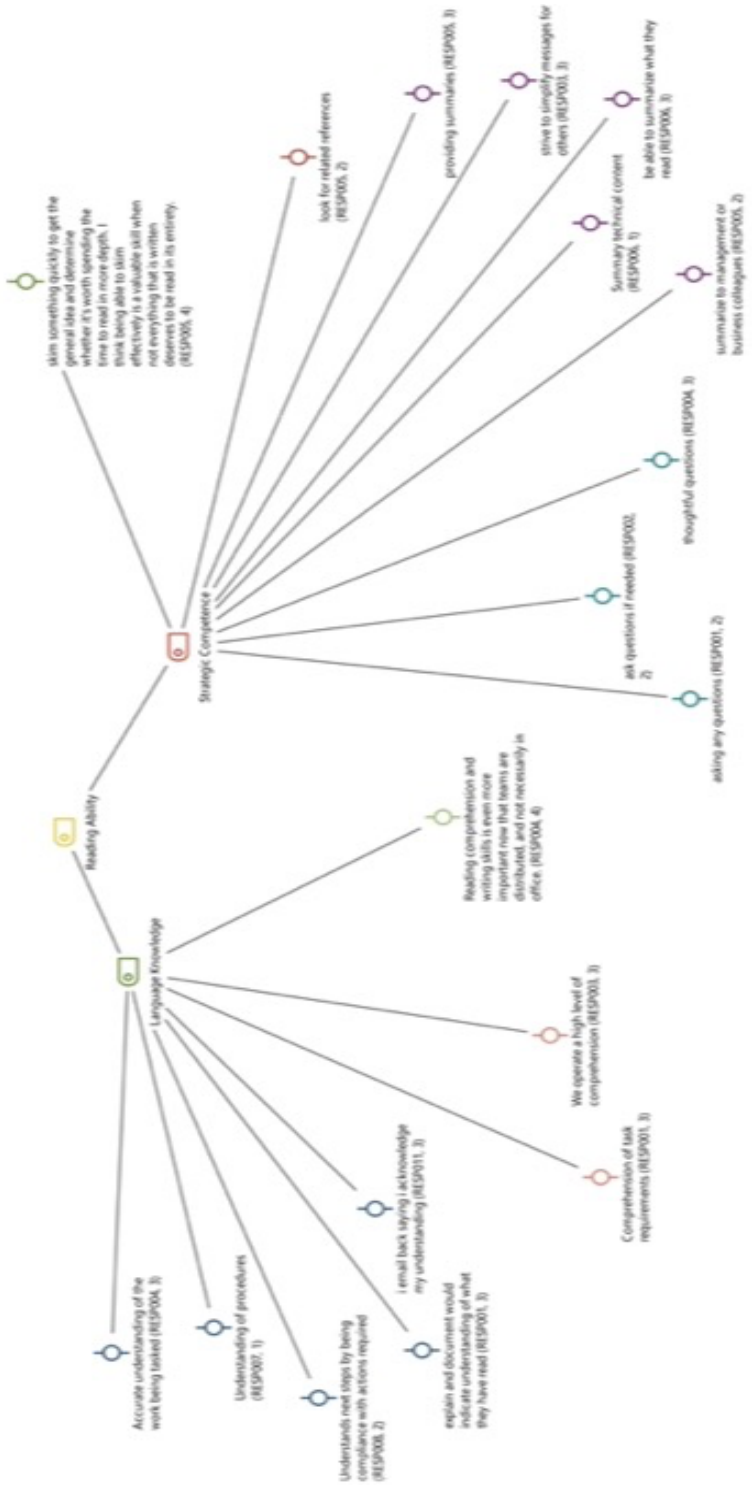
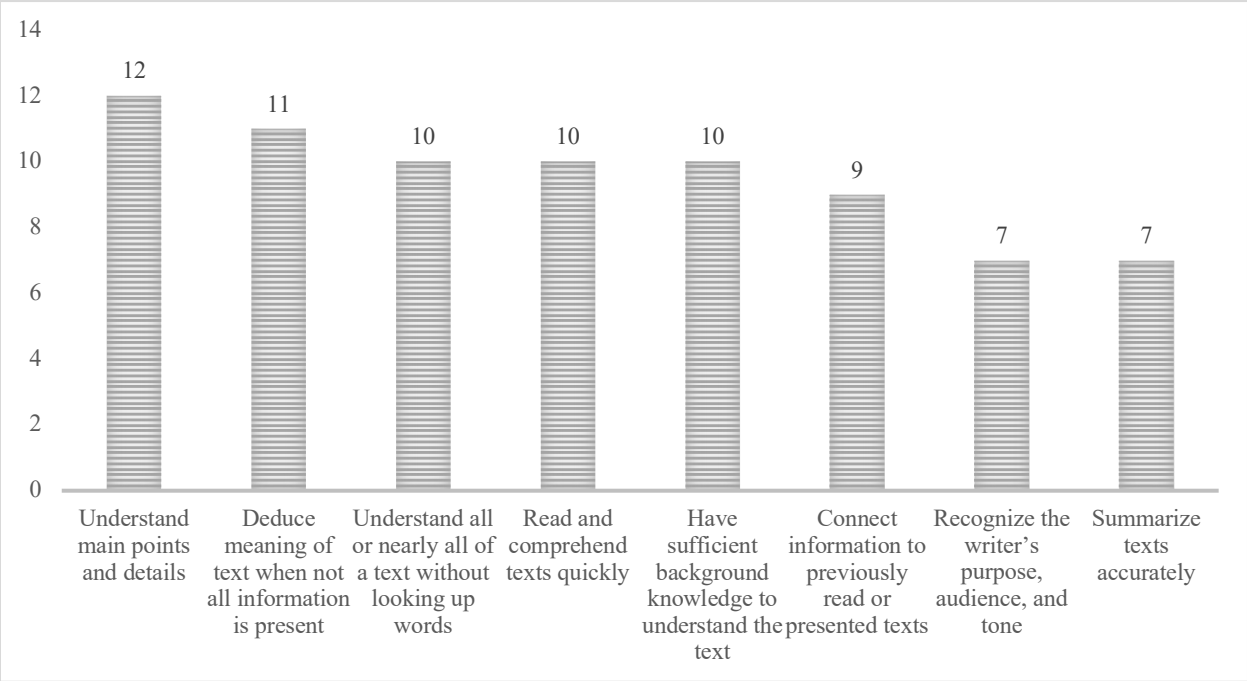


Figure 2

Reading Attributes Respondents Expect Employees to Have for Work



With skimming and scanning reading attributes, employees can determine if close reading should be undertaken to perform further required action. One respondent commented directly on skimming as a reading strategy in their workplace:

> a few of my employees use an approach where they will skim something quickly to get the general idea and determine whether it's worth spending the time to read in more depth. I think being able to skim effectively is a valuable skill when not everything that is written deserves to be read in its entirety. (Vice president, Technology, professional, scientific, & technical services)

For careful reading in the workplace, employees appear to require different areas of language knowledge for successfully reading written instructional texts. First, deducing the meaning of unknown words from context entails grammatical and semantic knowledge to define keywords, other word forms, or the use of common words in different contexts (Bachman & Palmer, 1996). According to Jang (2009), this reading attribute involves "deducing the meaning of a word or phrase by searching and analyzing text and by using contextual clues appearing in the text" (p. 44). This attribute may be important for employers in the workplace, as being an expert presumes prior knowledge of vocabulary in technological fields (Atkinson, 1993). Also, although looking up unknown words in dictionaries is effective for language learners and predicts vocabulary learning gains (Zhang et al., 2021), some employers may perceive it as inhibiting workflow and hinting at inadequate knowledge of the domain.

Second, identifying the main point(s) in a text or sections in a text requires instrumental functional knowledge and, more specifically, instrumental and heuristic functional knowledge (Bachman & Palmer,

1996). Toprak and Cakir (2021) define this attribute as "understanding relationships between sentences and the organization of a text, as well as evaluating the relative importance of information by distinguishing between main ideas and supporting details" (p. 113). Understanding the main points in written instructional texts allows employees to find the most important parts of a task to meet deadlines, reply to requests, consider suggestions, comply with commands, heed warnings, and more. Furthermore, heuristic knowledge affords the ability to identify which problems need to be solved (and in which order), what questions need to be answered before commencing a task, and what is still unclear and needs clarification.

Third, identifying explicit details in written instructions requires knowledge of grammar, semantics, cohesion, and function. Jang (2009) defines this attribute as the ability to read selectively across a paragraph to recognize salient ideas based on implicit information in the text. Reading written instructional texts allows employees to complete work accurately to specific standards, an attribute that was repeated in the data set and made explicit by one manager:

> Operations crews must read and understand work orders or design drawings or daily crew assignments to understand field tasks for the day, then do them. This is critical – do the wrong work and we don't get paid. (Manager, Professional, scientific, and technical services)

Finally, functional knowledge of written instructional texts is required to infer implied meaning within a text. This may require the use of prior knowledge, sociocultural knowledge, and sociolinguistic knowledge within the domain. Ranjbaran and Alavi (2017) and Kim (2015) define this attribute as inferring ideas or the meaning of a text by using prior knowledge or understanding the writer's purpose of the text. By identifying implied meaning, connections may be made to previously read workplace materials and background knowledge, or thoughtful questions can be asked about the purpose of the text before actions are undertaken.

In sum, attributes of reading abilities in both language knowledge and strategic competence are required for workplace reading in a broad range of sectors. It appears that reading information to assess its importance (i.e., expeditious reading) and then carefully reading texts to perform work to a certain standard are important attributes for workplace reading in various technological sectors.

Discussion and Limitations

Within the ECD framework, the domain analysis is an important early piece in assessment development and "builds validity into assessment outcomes from the start" (Risconscente et al., 2016, p. 47). From the domain analysis, which includes domain task and domain language analyses, an assessment argument can become part of the "validity mosaic" (Douglas, 2000, p. 257). The assessment argument, outlined in narrative form, connects the observations and results found in the workplace to inferences about test takers' strengths and weaknesses based on their assessment performance. From the domain modelling layer, which in this case was developed through the collection of information from domain experts, an assessment argument was developed for our purposes. The assessment argument focuses on the TLU situation based on domain tasks and language required for successful reading in technical college programs that prepare students for the workplace.

Therefore, the assessment argument for the present reading diagnostic assessment is as follows: Students in one- to two-year college programs engage in hands-on applied tasks in engineering, energy, environment, computing, business, and construction that prepare them for the workplace. To complete applied tasks, students are required to independently read and follow written instructional texts. Reading abilities that are used in the classroom to follow written instructions are transferable to the workplace and interface between classroom and workplace settings. In the workplace, employees are required to

independently read written instructional texts and accurately perform applied tasks based on these texts. Written instructional texts can come in many forms, such as technical instructions, job tickets, work orders, design documents, technical manuals, and other step-by-step instructions. This result corresponds with Oliveri and McCulla (2019), who argue that reading comprehension skills are important for the workplace, and for some lower-level jobs there is a need to have reading comprehension levels "similar to the ability to read 'step-by-step' instructions" (p. 7). The purpose of our reading assessment, therefore, is to support first-year students in college programs as they prepare for reading instructional texts in the workplace.

Two categories and six attributes for reading in the workplace were identified to become the focus for further diagnostic reading assessment development (see Table 4). For diagnostic assessment development purposes, it should be a goal of the test developer to get as fine-grained as possible to offer specific feedback to students on their strengths and weakness; identifying important reading attributes can help developers create fine-grained tests. According to Kim (2015), reading attributes are defined as "knowledge, skills, and strategies, which are involved in comprehending texts" (p. 228). Several studies have explored various reading attributes using a cognitive diagnostic assessment framework (Jang, 2009; Kim, 2015; Ranjbaran & Alavi, 2017; Toprak & Cakir, 2021).

The types and attributes are based on Urquhart and Weir (1998), Jang (2009), Kim (2015), Toprak and Cakir (2021), and Ranjbaran and Alavi (2017). Although all reading attributes are important for successful reading, these attributes were chosen based on their abilities to support students in preparing for written instructional texts in the workplace: first, by expeditiously reading a text to quickly respond, ask questions, or take some action; and second, by reading carefully to perform a domain-specific task to a certain standard. Naturally, more validity evidence needs to be gathered to confirm the assumptions about these attributes for reading in the technical workplace.

Table 4

Reading Types and Attributes for Reading in the Technical Workplace

Reading type	*Reading attributes*
Expeditious	Skimming the entire text or a large portion of the text to comprehend the main point
	Scanning the text to search for specific information (e.g., words, phrases, figures, percentages, names, dates)
Careful	Deducing the meaning of unknown words (i.e., low-frequency words, or common words used in a novel way) from context
	Identifying the main point of a text or section of text
	Identifying explicit details in the text
	Identifying implied meanings in the text

To develop test tasks based on these attributes and the assessment argument, topics were extracted from different sources (e.g., websites, textbooks, web documents) that fit within the "workplace community repertoire" (Knoch & Macqueen, 2020, p. 61). Within this sphere of Knoch and Macqueen's (2020) codes of relevance for assessment for professional purposes, laypersons can still participate in communication, as language is more general and professional knowledge is less precise. Therefore, because PELAs are often

administered pre-term and the target audience of our assessment is first-term students in multiple college programs, the knowledge of discipline-specific domains remains low to moderate. Topics may be similar to those of entry-level jobs in business, engineering, or computing, or cover first-year assignments in communication or other subject-matter courses. Topics are applied in nature; that is, they are instructional texts that require readers to apply knowledge to create an "end product."

Nickl (2018) offers characteristics for what the genre of written instructional texts should comprise. These include (1) a directive focus, with the goal of completing a specific applied task, (2) a comparatively rigid and predictable structure, often visualized through numbered or bulleted lists, and (3) a strong reader orientation. The register of instructional texts is often formal and controlled, which might even be considered simplified technical English (van der Eijk, 1998). Possible written instructional task topics for the assessment are displayed in Table 5.

The results of this study are limited for several reasons. First, by using convenience sampling, there are limits to how much we can generalize the results to other workplace settings. The findings are, therefore, exploratory, and fleshing out reading requirements for specific disciplines should be undertaken. Second, and related to the first, is that the topic of reading for the workplace is broad, and the use of a task survey is limited in its ability to collect comprehensive data on the topic. Including data-collection methods for needs analyses mentioned by Knoch and Macqueen (2020) (e.g., workplace observations, interviews, bodies of texts, and journals) would enrich the validity of assessment and curriculum development. For example, more details about indigenous assessment criteria for reading in the workplace could be uncovered. Other methods of data analysis, such as discourse analysis and corpus analysis, could offer deeper and more fine-grained insights into the TLU domain. These could be used to inform the more nuanced language use expectations and task requirements to develop mastery/non-mastery matrices for diagnostic language assessment development and interpretation. Finally, it is unclear how "diagnostic" the testing of higher-level reading skills actually is (Harding et al., 2015). The reading attributes identified in this study "do not exist in isolation but are involved in various combinations in reading any particular text or even answering any particular question" (Harding et al., 2015, p. 322). Attempts to isolate these attributes and place them in stages of language acquisition to offer laddered language instruction have not yet been successful (Harding et al., 2015).

Table 5

Possible Task Topics for Reading Written Instructional Texts

- Completing a lab assignment
- Following a procedure
- Completing training materials (e.g., safety training)
- Completing onboarding materials
- Setting up software/equipment
- Testing equipment/software
- Submitting a claim (e.g., expense claim, insurance claim, reimbursement)
- Requesting accommodations
- Booking an appointment
- Creating a work account
- Using an instruction manual for equipment/software
- Pulling data from a system
- Requesting leave (e.g., sick day, professional development, parental leave)
- Uploading files to a system
- Creating an online form, survey, collaborative document

Conclusion

Canada relies heavily on college programs for career preparation. Many college programs require students to be prepared for their careers within two years, including having job-ready English communication skills. Institutions that offer college programs often have lower entry requirements yet demanding schedules. Therefore, students for whom English is an additional language may struggle with language expectations and reading domain-specific content in technical programs. In addition, the rapid transition from graduation to workplace readiness in two-year college programs may hinder some students from developing appropriate communication skills to successfully land a job and thrive in the workplace.

The institution where this study took place offers post-admission language support classes to help students in their English communication skills development. However, little research has been done on post-admission language support at the college level in Canada. Therefore, to support students with their reading skills in this setting, a diagnostic reading assessment using Evidence-Centred Design (ECD) was developed. A domain analysis using domain experts was conducted to uncover what reading attributes may be required in the workplace to help employees succeed there. Based on the results of a task survey from 12 professionals in different technological sectors that hire from college programs, it was discovered that tasks which involve reading and understanding written instructional texts may be important for both school and workplace success. The task features include the ability to read a text quickly for its relative importance, followed by the ability to understand task instructions and take action. Guiding questions for employees reading for work appear to be "Do I need to do anything about this, or is this just 'nice to know' information?," "If something needs to get done, what questions might I have before I get started?," and "Do I have all the information I need to perform the task to the expected standards?" Although this study focuses on supporting multilingual students for whom English is an additional language with their reading skills, its findings and any pedagogical interventions could also be applied to students who may have weak L1 literacy.

With this knowledge in hand, reading attributes were defined for further test development, with items created to assess each of the attributes. These attributes are based on Bachman and Palmer's (1996) model of language abilities and research on reading diagnostic assessment by Kim (2015), Jang (2019), Ranjbaran and Alavi (2017), and Toprak and Cakir (2021). These strengthened the assessment argument for the chosen attributes and communicative task requirements for understanding written instructional texts. Topics were chosen and based on a genre analysis of written instructional texts for workplace scenarios, sampling from what Knoch and Macqueen (2020) consider the second sphere in their codes of relevance model (i.e., workplace community repertoire). These boundary objects also cross over with written instructional texts in vocationally focused applied tasks. From these findings, a first iteration of a diagnostic reading assessment is being developed and piloted for further analysis.

The Author

Nathan Devos is a faculty member at the British Columbia Institute of Technology, where he has spearheaded post-admission assessment and support initiatives in the Communication Department. His publications include post-admission assessment, language support models, and content and language-integrated learning.

References

Alderson, J. C. (2007). The challenge of (diagnostic) testing: Do we know what we are measuring? In J. Fox, M. Wesche, D. Bayliss, L. Cheng, C. Turner, & C. Doe, *Language testing reconsidered* (pp. 21 39). Actexpress and University of Ottawa Press.

Alderson, J. C., & Huhta, A. (2005). The development of a suite of computer-based diagnostic tests based on the Common European Framework. *Language Testing*, *3*, 301–320. https://doi.org/10.1191/0265532205lt310oa

Alderson, J. C., Brunfaut, T., & Harding, L. (2015). Towards a theory of diagnosis in second and foreign language assessment: Insights from professional practice across diverse fields. *Applied Linguistics*, *36*(2), 236–260. https://doi.org/10.1093/applin/amt046

Arkoudis, S., Baik, C., & Richardson, S. (2012). *English language standards in higher education: From entry to exit.* ACER Press.

Atkinson, R. (1993). *Building workplace vocabulary for E & I: Structural analysis.* Office of Vocational and Adult Education (ED), Washington, DC. https://files.eric.ed.gov/fulltext/ED374292.pdf

Bachman, L. F., & Palmer, A. S. (1996). *Language testing in practice.* Oxford University Press.

Banta, T. W., & Palomba, C. A. (2015). *Assessment essentials: Planning, implementing, and improving assessment in higher education* (2nd ed.). Jossey-Bass.

Barbayannis, G., Bandari, M., Zheng, X., Baquerizo, H., Pecor, K. W., & Ming, X. (2022). Academic stress and mental well-being in college students: correlations, affected groups, and COVID-19. *Frontiers in Psychology*, *13*, 1–10. https://doi.org/10.3389/fpsyg.2022.886344

Canadian Council on Rehabilitation and Work (CCRW). (2023, March 16). *The importance of reading skills in the workplace*. https://ccrw.org/reading-skills/

Conference Board of Canada. (2022, August 3). *Beyond blue and white collar: A skills-based approach to Canadian job groupings.* https://fsc-ccf.ca/research/beyond-blue-and-white-collar-a-skills-based-approach-to-canadian-job-groupings/

Crossman, E., Choi, Y., Lu, Y., & Hou, F. (2022, March 23). *International students as a source of labour supply: A summary of recent trends*. https://doi.org/10.25318/36280001202200300001-eng

Darics, E., & Koller, V. (2018). *Language in business, language at work.* Bloomsbury.

Devos, N. J. (2016). *Peer interactions in new content and language integrated settings.* Springer International. https://doi.org/10.1007/978-3-319-22219-6

Douglas, D. (2000). *Assessing languages for specific purposes.* Cambridge University Press.

Fox, J., Haggarty, J., & Artemeva, N. (2016). Mitigating risk: The impact of a diagnostic assessment procedure on the first-year experience in engineering. In J. Read, *Post-admission language assessment of university students* (pp. 43–65). Springer.

Fox, J., von Randow, J., & Volkov, A. (2016). Identifying students at-risk through post-entry diagnostic assessment. In *Trends in language assessment research and practice: The view from the Middle East and the Pacific Rim* (pp. 266–285). Cambridge Scholars Publishing.

Govender, S. C, & Jaffer, T. (2021). Designing instructional texts. In J. K. McDonald, & R. E. West, *Design for learning: Principles, processes, and praxis.* EdTeach Books. https://edtechbooks.org/id/designing_text

Government of Canada. (2021, December 23). *Canada welcomes the most immigrants in a single year in its history*. https://www.canada.ca/en/immigration-refugees-citizenship/news/2021/12/canada-welcomes-the-most-immigrants-in-a-single-year-in-its-history.html

Government of Canada. (2022, January 18). *Newcomers to Canada*. https://www.canada.ca/en/revenue-agency/services/forms-publications/publications/t4055/t4055-newcomers-canada.html

Grabe, W. (2009). *Reading in a second language: Moving from theory to practice.* Cambridge University Press.

Harding, L., Alderson, J. C., & Brunfaut, T. (2015). Diagnostic assessment of reading and listening in a second or foreign language: Elaborating on diagnostic principles. *Language Testing*, *32*(3), 317–336. https://doi.org/10.1177/0265532214564505

Hashemi, M. (2011). Language stress and anxiety amoung the English language learners. *Procedia - Social and Behavioral Sciences*, *30*, 1811–1816. https://doi.org/10.1016/j.sbspro.2011.10.349

Heeren, J., Speelman, D., & De Wachter, L. (2021). A practical academic reading and vocabulary screening test as a predictor of achievement in first-year university students: Implications for test purpose and use. *International Journal of Bilingual Education and Bilingualism*, *24*(10), 1458–1473. https://doi.org/10.1080/13670050.2019.1709411

Hsu, W. (2014). Measuring the vocabulary load of engineering textbooks for EFL undergraduates. *English for Specific Purposes*, *33*, 54–65. https://doi.org/10.1016/j.esp.2013.07.001

Jain, Y., & Sidhu, G. K. (2013). Relationship between anxiety, attitude and motivation of tertiary students in learning English as a second language. *Procedia - Social and Behavioral Sciences*, *90*, 114–123. https://doi.org/10.1016/j.sbspro.2013.07.072

Jang, E. E. (2009). Cognitive diagnostic assessment of L2 reading comprehension ability: Validity argument for Fusion Model application to *LanguEdge* assessment. *Language Testing*, *26*(1), 31–73. https://doi.org/10.1177/0265532208097336

Kim, A.-Y. (2015). Exploring ways to provide diagnostic feedback with an ESL placement test: Cognitive diagnostic assessment of L2 reading ability. *Language Testing*, *32*(2), 227–258. https://doi.org/10.1177/0265532214558457

Kintsch, W. (2012). Psychological models of reading comprehension and their implications for assessment. In J. P. Sabatini, E. R. Albro, & T. O'Reilly, *Measuring up: Advances on how to assess reading ability* (pp. 21–38). Rowman & Littlefield.

Knoch, U., & Macqueen, S. (2020). *Assessing English for professional purposes.* Routledge.

Lannon, J. M., Klepp, D., & Kelly, S. (2018). *Technical communication* (7th ed.). Pearson.

Ledbetter, A. M. (2018). Chronemic cues and sex differences in relational e-mail: Perceiving immediacy and supportive message quality. *Social Science Computer Review*, *26*(4), 466–482. https://doi.org/10.1177/0894439308314812

Lopez, I. Y., & Bui, N. H. (2014). Acculturation and linguistic factors on international students' self-esteem and language confidence. *Journal of International Students*, *4*(4), 314–329. https://www.ojed.org/index.php/jis/article/view/451/367

MacKey, A., & Gass, S. M. (2005). *Second language research: Methodology and design.* Lawrence Erlbaum.

Middleton, M. (1996). *An analysis of an office technology curriculum at the college level* [Doctoral dissertation, University of Alberta]. https://eric.ed.gov/?id=ED430656

Mislevy, R. J., Steinberg, L. S., & Almond, R. G. (2003). On the structure of educational assessments. *Measurement: Interdisciplinary Research and Perspectives*, *1*(1), 3–62. https://doi.org/10.1207/S15366359MEA0101_02

Mudraya, O. (2006). Engineering English: A lexical frequency instructional model. *English for Specific Purposes*, *25*, 235–256. https://doi.org/10.1016/j.esp.2005.05.002

Nesi, H., & Gardner, S. (2012). *Genres across the disciplines: Student writing in higher education.* Cambridge University Press.

Nickl, M. (2018). Instructional texts: Learn how to get things done. In J. Humbley, G. Budin, & C. Laurén, *Languages for special purposes: An international handbook* (pp. 321–342). De Gruyter Mouton.

Oliveira, M., Bitencourt, C., Santos, A. C., & Teixeira, E. K. (2013). Thematic content analysis: Is there a difference between the support provided by the MAXQDA® and NVivo® software packages. *Revista de Administração da UFSM*, *9*(1), 72–82. https://doi.org/10.5902/1983465911213

Oliveri, M. E., & McCulla, L. (2019). Using the occupational network database to assess and omprove English language communication for the workplace. *ETS Research Report Series*, *2019*(1), 1–17. https://doi.org/10.1002/ets2.12265

Ranjbaran, F., & Alavi, S. M. (2017). Developing a reading comprehension test for cognitive diagnostic assessment: A RUM analysis. *Studies in Educational Evaluation*, *55*, 167–179. https://doi.org/10.1016/j.stueduc.2017.10.007

Read, J. (2015). *Assessing English proficiency for university study*. Palgrave Macmillan.

Read, J. (Ed.). (2016). *Post-admission language assessment of university students*. Springer International.

Risconscente, M. M., Mislevy, R. J., & Corrigan, S. (2016). Evidence-centered design. In S. Lane, M. R. Raymond, & T. M. Haladyna, *Handbook of Test Development* (2nd ed., pp. 40–63). Routledge.

Sandrini, P. (2018). Terminology work in different domains: Legal terminology. In J. Humbley, G. Budin, & C. Lauren, *Language for special purposes: An international handbook* (pp. 509–521). De Gruyter Mouton.

Shapiro, S., Farrelly, R., & Tomaš, Z. (2014). *Fostering international student success in higher education.* TESOL Press.

Skolnik, M. L. (2021). Canada's high rate of short-cycle tertiary education attainment: A reflection of the role of its community colleges in vocational education and training. *Journal of Vocational Education & Training*, *73*(4), 543–565. https://doi.org/10.1080/13636820.2020.1744692

Statistics Canada. (2021, November 24). *Postsecondary program enrolments and graduates: Interactive tool.* https://www150.statcan.gc.ca/n1/pub/71-607-x/71-607-x2020019-eng.htm

Statistics Canada. (2022a, November 30). *Canada leads the G7 for the most educated workforce, thanks to immigrants, young adults and a strong college sector, but is experiencing significant losses in apprenticeship certificate holders in key trades*. https://www150.statcan.gc.ca/n1/daily-quotidien/221130/dq221130a-eng.htm

Statistics Canada. (2022b, November 22). *Postsecondary enrolments, by International Standard Classification of Education, institution type, Classification of Instructional Programs, STEM and BHASE groupings, status of student in Canada, age group and gender*. https://doi.org/10.25318/3710016301-eng

Swales, J. M. (1990). *Genre analysis.* Cambridge University Press.

Toprak, T. E., & Cakir, A. (2021). Examining the L2 reading comprehension ability of adult ELLs: Developing a diagnostic test within the cognitive diagnostic assessment framework. *Language Testing*, *38*(1), 106–131. https://doi.org/10.1177/0265532220941470

Urmston, A., Raquel, M., & Tsang, C. (2013). Diagnostic testing of Hong Kong tertiary students' English language proficiency: The development and validation of DELTA. *Hong Kong Journal of Applied Linguistics*, *14*(2), 60–82.

Urquhart, A. H., & Weir, C. J. (1998). *Reading in a second language: Process, product, and practice.* Longman.

van der Eijk, P. (1998). Controlled languages in technical documentation. *Computational Linguistics in the Netherlands Journal*, (pp. 187-203). Nijmegen. https://www.clinjournal.org/CLIN_proceedings/VIII/vandereijk.pdf

Wang, W., Kingston, N. M., Davis, M. H., Tiemann, G. C., Tonks, S., & Hock, M. (2021). Applying evidence-centered design in the development of a multidimensional adaptive reading motivation measure. *Educational Measurement: Issues and Practice*, *40*(4), 91–100. https://doi.org/10.1111/emip.12468

Ward, J. (2009). A basic engineering English word list for less proficient foundation engineering undergraduates. *English for Specific Purposes*, *28*(3), 170–182. https://doi.org/10.1016/j.esp.2009.04.001

Wiese, I. (2018). Terminology work in different domains: Medical terminology. In J. Humbley, G. Budin, & C. Lauren, *Language for special purposes: An international handbook* (pp. 522–534). De Gruyter Mouton.

Xu, W., & Zammit, K. (2020). Applying thematic analysis to education: A hybrid approach to interpreting data in practitioner research. *International Journal of Qualitative Methods*, *19*, 1–9.
Zhang, S., Xu, H., & Zhang, X. (2021). The effects of dictionary use on second language acquistion: A meta-analysis. *International Journal of Lexicography*, *34*(1), 1–38. https://doi.org/10.1093/ijl/ecaa010