

PROFESSIONAL AFFAIRS



The Development of Canada's Competency Profile for Professional Geoscientists at Entry-to-Practice

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SUMMARY

Competency-based assessment approaches to professional registration reflect the move by professions, both in Canada and around the world, away from traditional credentials-based assessments centred on a combination of academic achievements and supervised practice time. Entry-to-practice competencies describe the abilities required to enable effective and safe entry-level practice in a profession.

In 2012, Geoscientists Canada received funding from the Government of Canada's Foreign Credentials Recognition Program. A central component of the funding involved the development of a competency profile to assist in assessment for licensing in the geoscience profession. Work concluded with the approval of the *Competency Profile for Professional Geoscientists at Entry to Practice* by Geoscientists Canada in November 2014.

The Competency Profile comprises concise statements in plain language, setting out the skills and abilities that are required to be able to work as a geoscientist, in an effective and safe manner, independent of direct supervision. It covers competencies common to all geoscientists; competencies for the primary subdisciplines of geoscience (geology, environmental geoscience and geophysics); and a generic set of high level competences that can apply in any specific work context in geoscience.

The paper is in two parts. Part 1 puts the concept of competencies in context and describes the approach taken to develop the profile, including: input from Subject Matter Experts (practising geoscientists representing a diverse sampling of the profession); extensive national consultation and refinement; and a validation procedure, including a survey of practising Canadian geoscientists. Part 2 introduces the profile, explains its structure, and provides examples of some of the competencies. The full competency profile can be obtained from the Geoscientists Canada website, www.geoscientistscanada.ca.

Future work will identify specific indicators of proficiency related to each competency and suggest appropriate methodologies to assess such competencies. It will also involve mapping the profile to the existing Canadian reference standard, *Geoscience Knowledge and Experience Requirements for Professional Registration in Canada*.

RÉSUMÉ

Les approches d'évaluation basées sur les compétences en vue de l'inscription professionnelle reflètent l'abandon par les professions, tant au Canada que partout dans le monde, des évaluations classiques basées sur les titres de compétences et axées sur une combinaison de réalisations académiques et de temps de pratique supervisée. Les compétences au niveau débutant sont les capacités requises pour une pratique efficace et en toute sécurité audit niveau dans une profession.

En 2012, Géoscientifiques Canada a reçu un financement du Programme de reconnaissance des titres de compétences étrangers du gouvernement du Canada. Une composante centrale du financement incluait l'élaboration d'un profil des compétences pour faciliter l'évaluation de la délivrance de permis dans la profession de géoscience. Ce travail a été conclu en novembre 2014 avec l'approbation par Géoscientifiques Canada du *Profil des compétences pour les géoscientifiques professionnels au niveau débutant*.

Le profil des compétences comprend des déclarations concises dans un langage clair, définissant les compétences et les capacités requises pour exercer efficacement, en toute sécurité et indépendamment de toute supervision directe, en tant que géoscientifique. Il couvre les compétences communes à tous les géoscientifiques; les compétences pour les sous-disciplines primaires de la géoscience (géologie, géoscience environnementale et géophysique); et un ensemble générique de compétences de haut niveau pouvant s'appliquer dans tout contexte de travail spécifique en géoscience.

Le document comporte deux parties. La 1ère partie met en contexte le concept de compétences et décrit l'approche adoptée pour élaborer le profil, y compris: les contributions d'experts dans le domaine (géoscientifiques professionnels représentant un échantillonnage diversifié de la profession); de vastes consultations et perfectionnements à l'échelle nationale; et une procédure de validation, incluant une enquête auprès des géoscientifiques professionnels canadiens. La 2ème partie présente le profil, explique sa structure et fournit des exemples pour certaines des compétences. Le profil des compétences complet est disponible sur le site web de Géoscientifiques Canada www.geoscientistscanada.ca.

Les travaux futurs identifieront des indicateurs spécifiques d'aptitude liés à chaque compétence et suggéreront des méthodologies appropriées pour leur évaluation. Ils comprendront également la mise en correspondance du profil avec la norme de référence canadienne existante et les exigences en matière de *Connaissances et expérience des géosciences requises pour l'inscription à titre professionnel au Canada*.

INTRODUCTION

In September 2012, Geoscientists Canada received funding from the Government of Canada's Foreign Credentials Recognition Program for a 30-month project to conduct four inter-related initiatives on behalf of its members, namely, the provincial/territorial professional bodies that regulate geoscience practice and professional licensing in Canada. The central and largest initiative involved the development of a competency profile to assist member associations in assessment for

licensing a geoscientist as a professional, details of which were announced in a Government of Canada press release, with backgrounder, on 19 February 2013 (Government of Canada 2013). In November 2014, Geoscientists Canada approved its *Competency Profile for Professional Geoscientists at Entry to Practice*, (Geoscientists Canada 2014).

The paper is based on a talk given by the first author at the 35th International Geology Congress, in Cape Town, South Africa, on 30 August, 2016. The talk built on previous interim presentations on this project as the work progressed, given by several of the authors.

PART 1: CONTEXT

Canada sits at the midpoint of the spectrum of models for the regulation/self-regulation of professions in the classification scheme set out by the Council on Licensure, Enforcement and Regulation (CLEAR 2006), interpreted in the context of geoscience (Tepel 2010). The provinces and territories follow the Semi-Privatized Self-Regulatory Model where licensing associations are enabled by their own legislative act. The acts provide statutory powers so that each association operates independently, i.e. they are self-administered and self-financed by the member practitioners, and not by government. This is in contrast to the Government Agency Model used by individual states in the United States, at one extreme, and the Voluntary Self-Regulatory Model commonly used in the United Kingdom and other commonwealth countries, where there is little or no connection with government, at the other. There are 10 professional geoscience associations in Canada. The Northwest Territories and Nunavut are served by one association which administers two separate acts and there are no associations in either Prince Edward Island or Yukon.

Requirements for registration in Canada generally require: a four-year Bachelor of Science (B.Sc.) degree in one of the Earth Sciences; 48 months of geoscience work experience (at least 12 months of which is in a Canadian or equivalent work setting); three or more professional references; good character and conduct; and writing and passing a specific law and ethics examination.

These requirements are summarized in *Geoscience Knowledge and Experience Requirements for Professional Registration in Canada*, commonly referred to as 'the GKE.' The GKE was originally approved and published by Geoscientists Canada in 2008, revised and reprinted in 2011, and reprinted again in 2014 (Geoscientists Canada 2008). The GKE details the academic university coursework requirements to become registered and sets guiding principles for obtaining, and for assessing, practice experience in geoscience needed to be eligible for the Professional Geologist (P.Geo.) designation. It should be noted that each association has its own specific legal requirements and the requirements differ slightly between associations.

The GKE is generally accepted as the national document of reference on requirements for entry to the geoscience profession in Canada and most, but not all, associations have adopted it completely. In addition to the professional associations, the GKE is used extensively by students, faculty and advisors at universities; it is used by geoscientists migrating to

Canada, as well as global practitioners undertaking geoscientific work in the country. The GKE serves as an important reference for policy makers and other regulators, employers, users of geoscience services, and the general public. This document alone serves as the single most important benchmark for admissions to the profession in Canada.

However, the GKE is not specific to workplace activities, which is the primary purpose of the self-regulation of a profession. The GKE is not expressed in terms of academic outcomes from university study courses; nor is it appropriate for all types of applicants. Because it is credentials-based and not competency-based, the GKE is dependent on past achievements, rather than measuring current abilities. Competence, or current abilities, for workplace activities are the focus and the purview of the licensing associations.

WHAT ARE COMPETENCIES AND WHAT IS A COMPETENCY PROFILE?

The concept of competencies is not new in professional affairs and the admission of individuals to professional organizations; nor is it new to science or geoscience. For example, in 2004 the National Association of State Boards of Geology in the United States published *Tasks of the Professional Geologist* (ASBOG 2004). The Science Council in the United Kingdom (Science Council 2010) sets out the competencies that an applicant must demonstrate in order to be eligible for the Chartered Scientist (CSci) designation. The Science Council divides competence into five broad areas. In area A, entitled *Application of Knowledge & Understanding*, one of the specified skills is to be able to “*Demonstrate critical evaluation of relevant scientific information and concepts to propose solutions to problems;*” another is to “*Exercise sound judgement in the absence of complete information and in complex or unpredictable situations*” (Science Council 2010).

One of the earliest definitions of an occupational competency was “*a measurable pattern of knowledge, skills, abilities, behaviors, and other characteristics that an individual needs to perform work roles or occupational functions successfully*” which was introduced by the Office of Personnel Management in 1992, where it is still used today (Office of Personnel Management 2017). Since 1992, there have been many variations on the understanding of competencies, including some which have considered competencies to be the knowledge, skills, and attributes required to perform in the workplace, while others have considered competencies to be the workplace outcomes that result from the application of knowledge, skills and attributes.

More recent attention has focused on competencies as abilities. Kaslow et al. (2007) noted “*It is essential that competencies be conceptualized as generic, wholistic (sic) and developmental abilities.*” The Canadian physician competency framework defines a competency as “*An observable ability of a health care professional that develops through stages of expertise from novice to master clinician*” (Royal College of Physicians and Surgeons of Canada 2015).

From a regulatory perspective, we suggest that a competency profile is most useful when it refers to actual workplace abilities rather than only to the underlying knowledge, skills, and attributes. Workplace abilities are directly in the public interest; articulating desired workplace outcomes engenders professional accountability.

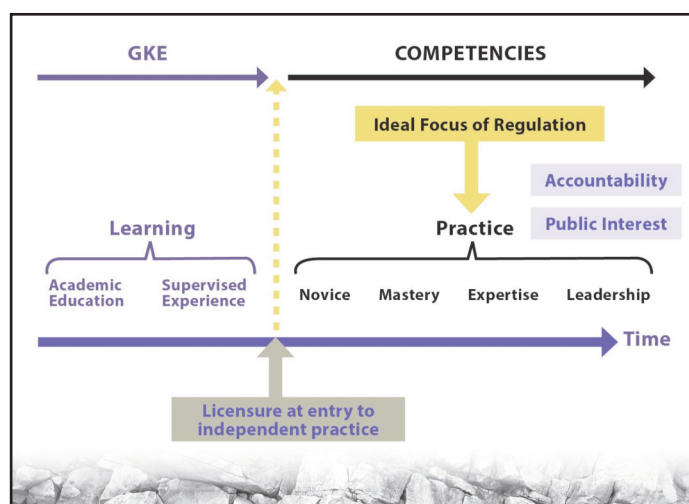


Figure 1. The focus of competencies in a regulated profession is towards practice, accountability and the public interest; while the focus of the *Geoscience Knowledge and Experience Requirements for Professional Registration in Canada* (GKE) is towards education and learning. The profile describes competencies expected at entry to independent practice; the point an individual geoscientist commences work as a stand-alone scientist at the novice level.

Whereas, in principle, competencies can be articulated for any specific workplace and for any stage of career development of a professional, entry-to-practice competencies are of particular importance to regulators since they speak to the requirements for admission to the profession. In this paper, we define an entry-to-practice competency profile as “*the integrated array of abilities that the newly-qualified professional brings to the workplace to enable effective and safe independent entry-level practice in common practice settings.*”

Competency profiles are seminal documents for any profession, with multiple uses. The profile can be used to explain the work of the profession and, in our case the work of the geoscientist, the profile enables competency-based assessment of candidates for registration, it creates a direct and strong link between education and practice, and it informs decision-making on continuing competence, practice guidance, and disciplinary matters.

Figure 1 sets the frame for competencies in a regulated profession. Competencies relate directly to practice which is the ideal focus of regulation, as it is where the public interest is served, and where accountability on the part of the individual geoscientist occurs. With time, as with other professions, geoscientists progress in their career, moving through different phases of increasing ability from novice to mastery and then on, perhaps, to expertise and/or a leadership role. The focus of competencies is not education. The GKE, on the other hand, is a description of a model-learning process. It describes the course work which must be completed at an academic institution and it sets out the duration of supervised experience that must be obtained. The purpose of a competency profile is not to describe a learning process, but to document the workplace-based outcomes of that learning, without reference as to where, when or how it occurred.



APPROACH AND METHODOLOGY

Construction of the profile involved three phases: Phase 1, research and development of a draft profile; Phase 2, consultation and validation; and Phase 3, refinement and completion (Fig. 2). While the three phases followed each other in a linear fashion, there was much iteration with back-checking, adjustments and improvements as work progressed. For example, the expert team whose primary work was mostly in Phase 1 also assisted in phases 2 and 3.

Phase 1 – Research and Development of a Draft Profile

To lead the development of the profile, Geoscientists Canada engaged the services of consultant David Cane of Catalysis Consulting (a co-author), a specialist in occupational competencies for regulated professions. Nine geoscientists from across Canada were chosen as Subject Matter Experts (SMEs) to work as a group directly with the consultant. The SMEs included: two geologists with backgrounds in mineral resources and/or ‘hard rock’ settings and methodologies; two geologists with backgrounds in energy resources and/or ‘soft rock’ settings and methodologies; three environmental geoscientists working in hydrogeology, subsurface contamination and geohazards; and two geophysicists – one practising in energy and the other in mineral exploration and mining.

The SME team worked closely with the consultant over a 14-month period building the occupational profile in full draft form, from the bottom up. The key question examined was, “*What are the job tasks that we would expect, as a minimum, all geoscientists to be able to perform at entry to independent practice?*” The SMEs were tasked to focus specifically on that point in time (Fig. 1) when an individual geoscientist commences work as an independent standalone scientist at the novice level.

Guidance on the structure and phraseology for the profile was provided by referencing occupational profiles for other professions and occupations, such as physicians (Royal College of Physicians and Surgeons of Canada 2015), counselling therapists (Federation of Associations for Counselling Therapists in British Columbia 2007) and dietitians (Partnership for Dietetic Education and Practice 2013). Examples of resource material on occupational competencies specific to science in general and the geosciences in particular include: *The Tasks of A Professional Geologist* (ASBOG 2004); *A Competency Concept Study* (Geoscientists Canada 2007); *Guidance Note for Validation as a Chartered Geologist or Chartered Scientist*, The Geological Society, (Science Council 2011); *Qualification Framework and Accreditation Criteria for Geology Study-Programmes in Europe* described in part by Rieck (2010); and *Initial Competencies Compendium for Geologists from Quebec* (Ordre des géologues du Québec 2012, unpublished). The GKE was also frequently used for back-checking purposes. However, these sources were used more for subsequent cross-checking purposes than as initial primary sources to ensure the profile was developed by the group independently and ‘from the bottom up.’ Initial drafting took eight months and involved face-to-face meetings, distance-based communication, and document sharing. The work drew directly on the geoscientific knowledge and workplace experience of the SMEs.

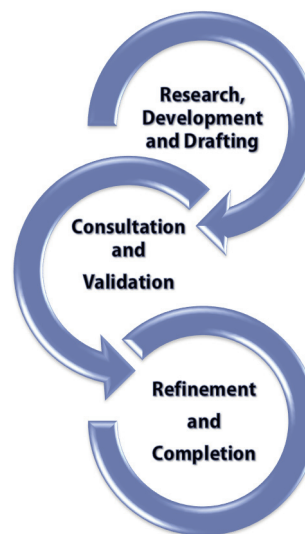


Figure 2. Three-phase iterative process of Competency Profile Development.

Phase 2 – Consultation and Validation

A period of consultation and validation followed completion of an initial draft competency profile. Each of the regulatory bodies, the constituent associations of Geoscientists Canada, was introduced to the draft document through participation in an association-specific orientation session. Also, geoscience-related technical and learned societies in Canada and a range of professional geoscience organizations in other countries were sent copies for comment. The period of consultation concluded after receipt of feedback, further changes incorporated into a revised draft profile, and a revision process further involving the SME group.

The revised draft profile comprising 122 competency statements was then the subject of a national survey (in both English and French), whereby all registered Professional Geoscientists across Canada were invited to view and comment on the draft profile in its entirety. With respect to each competency statement, geoscientists were asked three questions: How important is this task in your practice of geoscience?; How frequently do you personally perform this task?; In your opinion should proficiency in this task be an expectation of a P.Geo. at entry to practice?

A total of 1,042 geoscientists responded to the survey – representing approximately 10% of the P.Geo. population nationally. This sample size provides a margin of error on any numerical conclusions drawn from survey data of better than $\pm 3\%$ (at a 95% confidence level). From the survey response data, each proposed competency was ranked as receiving a High (H), Medium (M) or Low (L) level of support for each of importance, and entry-to-practice expectation. In terms of importance, 109 of the 122 proposed competencies were ranked as high, 11 as medium, and only 2 as low. In terms of entry-to-practice expectation, 114 were ranked as high and only 8 as medium. None of the proposed competencies were ranked as low in terms of expectation.

The SME team discussed in depth every competency that received a ranking of Medium or Low. Two competencies were



removed; others were modified or left unchanged. As expected, rankings for frequency of use were variable, being highly dependent upon the nature of the competency. Other than verifying that Medium and Low rankings were as anticipated, such rankings did not generate further discussion.

Phase 3 – Refinement and Completion

The revised profile was then the subject of a two-day facilitated workshop whose participants, from almost all of the regulatory bodies and represented by geoscientist members and senior admission staff, were those most involved in admissions decision-making across Canada. The purpose was to allow time for careful consideration of, and suggested refinements to, the revised profile. The workshop resulted in several minor adjustments to competency statements and some combination of competencies in order to simplify and shorten the profile. Final changes were incorporated to the satisfaction of the workshop participants.

Shortly thereafter, at a full meeting of the Canadian Geoscience Standards Board (CGSB) in June 2014, a few minor adjustments were made and the final competency profile was approved. The CGSB-approved document was put forward in turn to Geoscientists Canada for consideration of formal acceptance. This took place in November 2014, with Geoscientists Canada adopting the profile as its reference document describing entry-to-practice competencies.

PART 2: THE COMPETENCY PROFILE

The competency profile, which can be obtained in full from the Geoscientists Canada website (www.geoscientists-canada.ca), contains five sections (see Table 1). The following is a summary, with examples of competencies from each section. Sections 1 and 5 apply to all geoscientists. Sections 2, 3 and 4 are parallel sections, one applying to each of the three main subdisciplines of geoscience: geology, environmental geoscience and geophysics.

Section 1 emphasizes competencies applicable to all geoscientists. The 68 competencies in Section 1 are organized under eight headings: 1) Scientific method; 2) General geoscience, 3) Communication and reporting, 4) Information technology, 5) Organization and management, 6) Professionalism, 7) Professional development, and 8) Ethics. These competencies apply to all geoscientists irrespective of subdiscipline and area of practice.

Section 2 emphasizes competencies applicable to geoscientists working in the discipline of geology. There are 16 competencies specific to geology set out under four headings: 1) Planning; 2) Acquisition; 3) Interpretation; and 4) Integration.

Section 3 emphasizes competencies applicable to geoscientists working in the discipline of environmental geoscience. The 19 competencies specific to environmental geoscience fall under the same four headings: 1) Planning; 2) Acquisition; 3) Interpretation; and 4) Integration.

Section 4 emphasizes competencies applicable to geoscientists working in the discipline of geophysics. There are 14 competencies specific to geophysics. These fall under five headings: 1) Planning; 2) Acquisition; 3) Processing; 4) Interpretation; and 5) Integration.

Table 1. Sections of Competency Profile.

1. Generic competencies applicable to all geoscientists
2. Competencies applicable to geoscientists working within the discipline of geology
3. Competencies applicable to geoscientists working within the discipline of environmental geoscience
4. Competencies applicable to geoscientists working within the discipline of geophysics
5. Specialized competencies applicable to all geoscientists but referring to a specific area of practice 'Area of practice' = an established area of practice within a discipline (e.g. survey mapping; mineral exploration; groundwater assessment; oil and gas exploration geophysics)

Section 5 emphasizes competencies applicable to the geoscientist's area of practice. At point of commencement of independent work, geoscientists will normally be engaged in a particular area of geoscience activity or geoscience specialty, such that they are fully familiar with that particular area of practice. In other words, they demonstrate competence at a professional level in that area of practice. There are numerous areas of practice within the geosciences. Some common examples within geology are: mineral exploration, petroleum geology, survey mapping; within environmental geosciences are: groundwater assessment, geohazards investigation; within geophysics: oil and gas exploration geophysics, mineral exploration geophysics.

Section 5 takes a generic approach to accommodate this diversity. It addresses any area of practice or geoscientific endeavour, from common examples such as those above, to less frequent specialties such as geochronology, palynology, or forensic geology. There are five competencies in Section 5 and they are demanding and they reflect the expectation that, at entry to practice, a geoscientist should have advanced abilities in the particular area of practice in which they are active, in addition to their general geoscientist abilities.

Tables 2, 3 and 4 are sample pages from the profile, to illustrate its structure and the composition of individual competency statements. A key element of every statement is the verb or action word used to dictate the level of proficiency implied. Furthermore, each is a statement describing ability. Statements do not specify what indicators might be sought to illustrate that a person possesses the ability or how such indicators might be assessed. The development of indicators has yet to be undertaken.

In Section 1.1 Scientific method (Table 2), the action word 'apply' is used in 1.1.1 "Apply scientific methodologies" and in 1.1.6 "Apply principles of quality assurance and quality control (QA/QC)." These imply a geoscientist, individually, can actively utilize these specified skills effectively and safely in a real work situation. This can be compared to the verb 'recognize,' as in 1.1.5 "Recognize uncertainty, ambiguity and limits of knowledge," which is a more passive, but no less important action.

In Section 2.2 Acquisition (Table 3) for geologists, we see the verbs 'implement' and 'select' as in 2.2.3 "Implement sam-

Table 2. Extract from Competency Profile – Section 1. Competencies applicable to all geoscientists.

1. Competencies applicable to all geoscientists
 - 1.1 Scientific method
 - 1.1.1 Apply scientific methodologies.
 - 1.1.2 Apply concepts and principles of mathematics and statistics.
 - 1.1.3 Apply concepts and principles of physics and chemistry.
 - 1.1.4 Access and search scientific literature.
 - 1.1.5 Recognize uncertainty, ambiguity and limits to knowledge.
 - 1.1.6 Apply principles of quality assurance and quality control (QA/QC).
 - 1.1.7 Undertake reasonable investigation and due diligence.
 - 1.1.8 Use peer review processes.

Table 3. Extract from Competency Profile – Section 2. Competencies applicable to geoscientists working in the discipline of geology.

2. Competencies applicable to geoscientists working in the discipline of geology
 - 2.1 Planning
 - 2.1.1 Compile and incorporate existing geoscience information.
 - 2.1.2 Design field programs applicable to purpose of investigation and site conditions.
 - 2.2 Acquisition
 - 2.2.1 Implement mapping programs.
 - 2.2.2 Incorporate geophysical and remote sensing methods.
 - 2.2.3 Implement sampling programs.
 - 2.2.4 Incorporate drilling programs.
 - 2.2.5 Implement logging programs.
 - 2.2.6 Select appropriate laboratory analyses.
 - 2.2.7 Address uncertainties and limitations in data.

pling programs” and 2.2.6 “Select appropriate laboratory analyses.” These imply that a geologist can design and undertake a sampling program. However, beyond determining the appropriate laboratory and analytical method to use, the geologist may not be doing the laboratory analysis.

Table 4 indicates all of the practice-specific competencies in Section 5. As mentioned above, these are demanding competencies, but they are written in general terms so they can be utilized across the full range of practice areas that comprise geoscience. Competencies such as 5.1 “Apply a comprehensive and systematic understanding of current knowledge to practice activities,” or 5.3 “Critically evaluate models,” could apply equally to an oil and gas exploration geophysicist or to a groundwater hydrogeologist.

Figure 3 illustrates the relationship between the sections of the profile and the breadth of work and activity that all of geoscience entails. The individual profile of every geoscientist who has achieved competency is going to plot as a different radius somewhere around this large circle, and no two individuals will necessarily plot the same.

Table 4. Extract from Competency Profile — Section 5. Competencies applicable to the geoscientist’s area of practice.

5. Competencies applicable to the geoscientist’s area of practice
 - 5.1 Apply a comprehensive and systematic understanding of current knowledge to practice activities.
 - 5.2 Apply a comprehensive knowledge of current methods used to undertake investigation.
 - 5.3 Critically evaluate models.
 - 5.4 Seek and apply knowledge to address multifaceted problems in familiar and unfamiliar contexts.
 - 5.5 Recognize the complexity of knowledge, as well as contributions from other geoscience areas of practice and other professions.

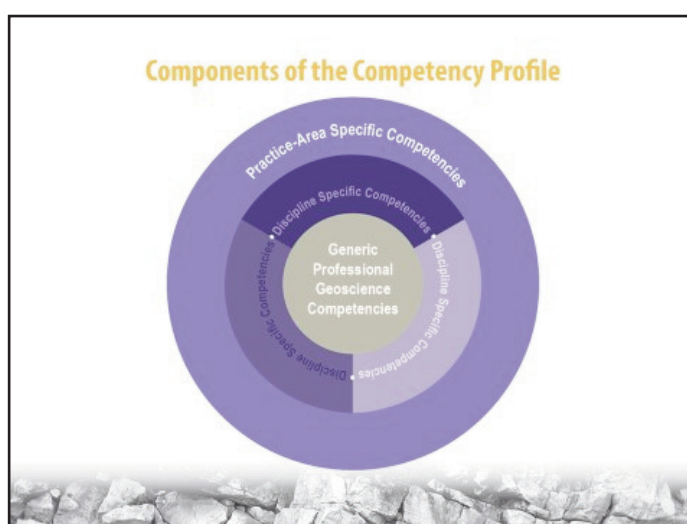


Figure 3. The relationships between the components of the competency profile and breadth of work and activity of geoscience. Every geoscientist who has achieved competency is going to plot as a different radius somewhere around this large circle, and no two individuals will necessarily plot the same.

DISCUSSION

The primary reason for developing the competency profile was to create a current and comprehensive reference that would serve as the foundation for a move to competency-based assessment for admission to the profession. Developing a competency profile is a complex process for any occupation and is a valuable standalone, reflective exercise, separate from any direct admissions considerations.

An entry-to-practice competency profile can serve many needs because it states, in plain language, the abilities that are required to be able to work independent of direct supervision in an effective and safe manner. As such, it is valuable for employers around realistic expectations for entry-level professional employees and it provides a launch point for further development across the geoscientist’s career.

Although each competency appears as a standalone statement, they should be viewed as an interdependent, integrated array; each one informing and qualifying the others. This form of construction avoids the need to use conditional language or

circumstantial cross-referencing. The competencies are a set of abilities and must be applied by the geoscientist when relevant, and in context. Geoscientists will not use all of the competencies all of the time; in fact, most geoscientists will likely only use their own particular subsets of competencies frequently, while other competencies may be drawn upon less frequently, seldom, or hardly ever. However, possession of the entire profile of competencies for one of the three subdisciplines is envisaged for registration at entry to practice, so as to adequately serve the public interest and to enable the geoscientist to undertake safe and effective entry-level practice in common work settings and also that geoscientists will know their own limitations.

NEXT STEPS

As far as Geoscientists Canada is concerned, the next step in utilizing the competency profile to facilitate competency-based admissions is to determine appropriate indicators through which each competency can be assessed. Indicators are the evidence factors that one would seek, within chosen assessment vehicles, to demonstrate that the competency is possessed. Once indicators are developed for each individual competency or a combination of competencies, it will be appropriate to assign appropriate assessment approaches that should apply. For example, directly designing and implementing a QA/QC control protocol for a sampling program (under supervision), might be chosen as a suitable indicator for the competency “Apply principles of quality assurance and quality control (QA/QC)” (Table 2). An assessment process for that indicator might be for the individual to provide a summary account describing the protocol they designed and implemented, so that it can be validated by the supervisor who was in charge and then can be examined to the satisfaction of a designated assessor.

Geoscientists Canada intends to start indicator development and associated assessment approaches shortly, on behalf of, and in close collaboration with, its member organizations. Work is planned to map the profile to the *Geoscience Knowledge and Experience Requirements for Professional Registration in Canada* – the existing Canadian reference standard

CONCLUSION

The development of the Competency Profile is a significant achievement for geoscience in Canada. The profile states, in plain language, the workplace abilities that are required to undertake entry-level work as a geoscientist, independent of direct supervision, and in an effective and safe manner.

The profile is a seminal document that can be used to explain the work of geoscientists. It will enable competency-based assessment of candidates for registration. It creates a direct and strong link between education and practice, and it facilitates decision-making on continuing competence, practice guidance and disciplinary matters.

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REFERENCES

- ASBOG. National Association of State Boards of Geology, USA, 2004, Tasks of a Professional Geologist: National Association of State Boards of Geology, 2 p. Available at: http://asbog.org/documents/ASBOG_tasks_of_geologist.pdf.
- CLEAR. Council on Licensure, Enforcement and Regulation, 2006, Framework for developing consistent descriptions of regulatory models: Canada: International Relations Committee of the Council on Licensure, Enforcement and Regulation, 5 p. Available at: http://www.clearhq.org/resources/Regulatory_Model_Canada.pdf.
- Federation of Associations for Counselling Therapists in British Columbia, 2007, National entry-to-practice competency profile for counselling therapists: British Columbia Association of Clinical Counsellors. Retrieved March 15, 2017: <http://www.factbc.org/wp-content/uploads/2012/10/CP-May-2007.pdf>.
- *Geoscientists Canada, 2007, Entry-to-practice competencies for geoscience in Canada? – A concept study: Canadian Council of Professional Geoscientist, Report by Bonham, O., and Cane, D., 30 p.
- Geoscientists Canada, 2008, Geoscience knowledge and experience requirements for professional registration in Canada (reprint 2014): Geoscientists Canada. Available at: <https://geoscientistscanada.ca/wp-content/uploads/2014/11/GC-Knowledge-Requ.BKLT-REV-EN-web-final.pdf>.
- Geoscientists Canada, 2014, Competency profile for professional geoscientists at entry to practice (online): Geoscientists Canada, 14 p. Available at: <https://geoscientistscanada.ca/wp-content/uploads/2015/07/Competency-Profile-for-Professional-Geoscientists-Entry-to-Practice-Combined-Doc.pdf>.
- Government of Canada, 2013, Government of Canada helps internationally trained geoscientists get jobs in their fields faster (Press Release): Government of Canada. Available at: <https://www.canada.ca/en/news/archive/2013/02/government-canada-helps-internationally-trained-geoscientists-get-jobs-their-fields-faster.html>.
- Kaslow N.J., Rubin, N.J., Bebeau, M.J., Leigh, I.W., Lichtenberg, J.W., Nelson, P.D., Portnoy, S.M., and Smith, I.L., 2007, Guiding principles and recommendations for the assessment of competence: Professional Psychology: Research and Practice, v. 38, p. 441–451, <https://doi.org/10.1037/0735-7028.38.5.441>.
- Office of Personnel Management, United States Government, 2017, Assessment and selection competencies: U.S. Office of Personnel Management. Accessed March 15, 2017: <https://www.opm.gov/policy-data-oversight/assessment-and-selection/competencies/>.
- Ordre des géologues du Québec, 2012, Initial Competencies Compendium for Geologists from Quebec: Unpublished, Ordre des géologues du Québec (English translation).
- Partnership for Dietetic Education and Practice, 2013, The integrated competencies for dietetic education and practice (ICDEP): PDEP – PFPN, Partnership for Dietetic Education and Practice. Accessed March 15, 2017: <http://www.pdep.ca/de.aspx?id=300>.
- Rieck, A., 2010, Euro-Ages - A leap towards transparency, comparability and mobility in geology in higher education across Europe: European Geologist, 30, p. 5–8, http://eurogeologists.eu/wp-content/uploads/2015/09/a_Magazine-Dec2010.pdf.
- Royal College of Physicians and Surgeons of Canada, 2015, Can MEDS 2015 Physician Competency Framework (online), Frank, J.R., Snell, L., and Sherbino, J., eds. Available at: <http://www.royalcollege.ca/rcsite/canmeds/about-canmeds-e>.
- Science Council (UK), 2010, CSci Competencies. [Now incorporated, with changes, into: Science Council (UK), 2016, Chartered Scientist (CSci) The Standard for Professional Scientists, 8 p.] Available at: <http://www.acb.org.uk/docs/default-source/csci/Csci-standards.pdf?sfvrsn=0>.
- Science Council (UK), 2011, Guidance note for validation as a chartered geologist or chartered scientist. [Now incorporated into Geological Society of London, 2017, Criteria and procedure for validation as a chartered scientist: The Geological Society, 12 p.] Available at: https://www.geolsoc.org.uk/~media/shared/documents/Society/Regulations/updates/RFP11_Criteria_Procedure_for_Chartered_Scientist.pdf.



tered Scientist Agreed 25 Nov 2015.pdf?la=en.

Tepel, R., 2010, Licensure administration models: Would self-regulation work for geology licensure in the United States?: Association of Environmental and Engineering Geologists, AEG NEWS, v. 53, p. 23–28.

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