Surgeons of Canada, is widely used throughout the world as a basis for establishing medical education and continuing professional development.

One important aspect of a professional's career addresses a natural progression of proficiency/ mastery/ maturity in the performance of professional activities. This progression is inherently associated to different titles assigned by professional bodies that might be associated to the profession and the attention given to this progression depends on the maturity of the profession and its accreditation/evaluation bodies. For instance, figure below illustrates a view of the medical career within the CanMEDS framework.
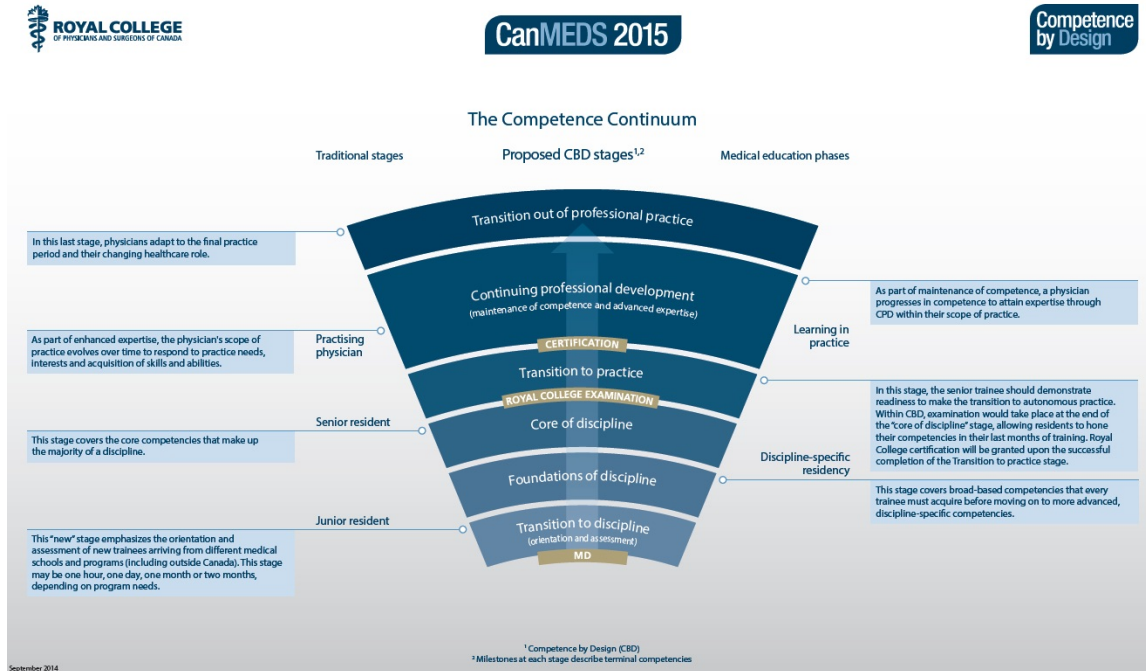

Figure 6. CanMEDS 2015 Competence Continuum.

8   Expected Graduate Competences

Identifying expected graduate competences for MSIS graduates forms an essential foundational element underlying the entire model curriculum. This is based on a strong conceptual foundation (Bowden 2004), and it builds an important link between this curriculum recommendation and the emerging competence frameworks developed for the IS/IT profession discussed above in the section on the competence-based approach to building curricula. The degree-level expected competences will be the basis for learning unit (course, seminar, etc.) level learning objectives and, ultimately, the entire curriculum (including topics and pedagogy). They will be communicated to various stakeholders, including forthcoming students, program/degree directors, teaching professors, course administrators, course accreditation agencies, student recruiters and university marketing staff, as well as future employers who are hiring IS/IT graduates. The expected competences will define the foundational characteristics of the degree programs and reflect the entire identity of the field of IS.

What competences graduates can be expected to have depends significantly on the positioning of the MSIS degree. As discussed above in the section on "Principles Underlying the MSIS Degree,"

the task force proposes that this curriculum recommendation is specifically targeted at pre-experience MSIS degree programs, intended for students with little or no IS/IT related work experience (including those continuing directly from their undergraduate degree and career changes without IS/IT-related work experience).

The expected graduate competences would be very different for an MSIS degree targeted at experienced IS/IT professionals seeking a degree that would allow the graduates to move to more senior technical IS roles or to a high(er) level managerial IS/IT role. The task force has specifically decided to not consider these types of degrees as part of this curriculum recommendation. In addition, this document will not provide guidance for MBA concentrations or Executive Master's degrees that have the explicit goal of preparing the students for high-level senior IT management roles. Specifying shared expected graduate competences for all of these degree types would simply not be possible.

Finally, the task force also recognizes that there is an increasing number of master's degrees offered by IS and related departments that are highly specialized, such as, for example, Master of Science in Business Analytics or Master of Science in Cybersecurity. These are important degree types that serve their graduates and the employers recruiting the graduates very well, but we are forced to consider them to reside outside the scope of this document. The reason is, again, the same: their expected graduate competences would be very different from those specified for the MSIS.

8.1   Tentative List of Core Expected Graduate Competences

When identifying the expected graduate competences, we have to consider the following factors:

- We are expecting the incoming students to have or develop a foundation in IS (or another computing discipline) and in the domain of practice (as specified above in the section on Principles) prior to the degree program.
- The competences should be at a materially higher level than those offered by an undergraduate degree in Information Systems (such as IS 2010).
- The competences will be built on the significant earlier work on IS/IT/e-competences, such as e-CF and SFIA.
- The competences should cover the four dimensions of the MSIS degree outlined above in the Principles section:
    - computing/information technology (IT),
    - domain of practice (such as business, health care, legal, government, or education),
    - management and organizational practices related to the organization and operation of computing/IT, and
    - individual foundational competences (such as written and oral communication, critical thinking, ethical analysis, teamwork, leadership, etc.)

To be used only as an example and a foundation for comments, this section describes the results of the task force's own initial internal analysis of the expected graduate competences using the e-competences specified in the e-CF framework. Based on this evaluation, the competences included in Table 2a were deemed to be included in the first priority group for MSIS graduates. They include capabilities from three of the five e-CF e-competence areas: PLAN, ENABLE, and MANAGE.

Table 2a. Most important expected MSIS graduate competences	
PLAN	A.1. IS and Business Strategy Alignment
	A.2. Service Level Management
	A.5. Architecture Design
	A.9. Innovating
ENABLE	D.1. Information Security Strategy Development
	D.10. Information and Knowledge Management
	D.11. Needs Identification
MANAGE	E.2. Project and Portfolio Management
	E.3. Risk Management
	E.5. Process Improvement
	E.8. Information Security Management
	E.9. IS Governance

It is interesting to see how well these match to the high-level IS capabilities that were identified in IS 2010 (Topi et al. 2010):

- Improving Organizational Processes (E.5. above)
- Exploiting Opportunities Created by Technology Innovations (A.1. and A.9. above)
- Understanding and Addressing Information Requirements (D.10. above)
- Designing and Managing Enterprise Architecture (A.5. above)
- Identifying and Evaluating Solution and Sourcing Alternatives (partially A.2. above)
- Securing Data and Infrastructure (D.1. and E.8. above)
- Understanding, Managing, and Controlling IT Risks (E.3. above)

The second group of high-level competences included in Table 2b was considered important but not as critical those included in Table 2a. The same three e-Competence areas continued to be dominant.

In addition, the high-level competences presented in Table 2c were also considered essential but they should be gained during pre-program studies (undergraduate degree or bridge courses). Interestingly, several of these belong to the BUILD e-competence area.

It is obvious that these labels alone are not sufficient for understanding and specifying what the required competences are. The e-CF document includes a generic description and detailed knowledge and skills examples for each of the e-Competences. In addition, building on the European Qualifications Framework for Lifelong Learning (EQF), e-CF explicitly acknowledges that there are different proficiency levels associated with each of the competences. Specifying appropriate proficiency levels for each of the competences has to be done before they can be used for developing characteristics of educational experiences.

Table 2b. Second group of expected MSIS graduate competences.	
PLAN	A.3. Business Plan Development
	A.4. Product / Service Planning
	A.7. Technology Trend Monitoring
ENABLE	D.2. ICT Quality Strategy Development
	D.4. Purchasing
	D.8. Contract Management
	D.9. Personnel Development
MANAGE	E.4. Relationship Management
	E.6. ICT Quality Management
	E.7. Business Change Management

Table 2c. Competences Required for MSIS Program Entry	
PLAN	A.6. Application Design
BUILD	B.1. Application Development
	B.2. Component Integration
	B.3. Testing

9 Initial Thoughts Regarding the Curriculum Direction

Although past ACM/AIS curriculum development efforts have largely adopted a content-driven approach using important and emerging topics as a starting point, the current curriculum development effort adopts a competence-driven approach where identified competences will guide the choice of topics to be included and pedagogies to be used. This approach is enabled by the availability of rigorously development competence frameworks in recent years (e.g., the European e-Competence Framework, the CEPIS e-Competence Benchmark, and comparable frameworks from the British Computer Society and the Australian Computer Society). Choosing topics and pedagogies based on the identified competences can help to ensure that graduates would have skills that are truly valued by their prospective employers. In addition, this approach is fully compatible with the model(s) adopted by accreditor(s) in many parts of the world (such as AACSB and ABET based in the U.S. but operating globally and many national or regional accreditors). To facilitate implementation, courses can be provided as exemplars to illustrate how topics and pedagogies may be combined to bring about learning outcomes that are aligned with the identified competences.

The newest version of the MSIS curriculum will have to recognize that the range of possible master's degrees under the Information Systems umbrella has become significantly broader. Therefore, MSIS 2016 will be specifically defined as a pre-experience curriculum, building directly on suitable undergraduate-level educational background. Applicants without the standard pre-requisite of a bachelor's degree from a related discipline can also be admitted with appropriate bridge courses. The scope of MSIS 2016 does not, however, include advanced post-

experience programs targeting experienced IS professionals. Neither does it cover executive master's programs or MBA concentrations. Both degree types will be described, but not specified at a detailed level.

Moving forward, core and elective topics in the curriculum may be determined based on the importance of the associated competences within the competence framework. Collection of elective topics that correspond to specific career tracks can be identified and made known to students. Such arrangements have to be reviewed periodically to keep updated with changing competences (reflecting changing needs of the industry). To craft an international curriculum, national/regional differences would have to be accounted for. For example, the competences needed in developing countries tend to be more technical and less business in nature.

Core topics in the curriculum will need to be determined carefully. While past curriculum development efforts have typically included traditional core topics (e.g., systems analysis and design, data management, infrastructure management, project management, IT strategy etc.) without question, this effort will have to re-evaluate such traditional core topics in light of the identified competences. It may be necessary to accommodate different core topics so as to account for national/regional differences.

Future IT professionals will need to constantly upgrade themselves to keep up-to-date with emerging needs of the industry (i.e., new competences will emerge from time to time). They will not have the luxury to take time off from work every now and then to upgrade themselves. Therefore, they are likely to have to upgrade themselves through various forms of on-line learning. There have been reports which conjecture that an increasing number of IT professionals may opt for "just in time" upgrading (i.e., pursue flipped classes or MOOCs to acquire specific competences needed for their jobs) rather than enroll in master's programs (i.e., pursue master's program to acquire a broad set of competences, some of which may not be immediately needed). Therefore, in the longer term, it may be necessary to develop an accreditation arrangement where students can accumulate course credits to get competence certificates and then accumulate competence certificates to get masters degrees.

The next steps in the MSIS 2016 curriculum development process are as follows:

1. Using various forms of data collection (including surveys, interviews, and panel presentations) to determine a much deeper understanding of the expected competences of the MSIS graduates, including the relative importance and level of each of the expected competences.
2. Identifying relevant inventories of possible curriculum topics (including prior curriculum documents, various competence specifications described earlier in this document, and bodies of knowledge specified in other computing curricula).
3. Creating a mapping between the expected competences and high-level curriculum topics.
4. Using the mapping developed in #3 to determine the high-level curriculum topics to be included in MSIS 2016.
5. Expanding the high-level curriculum topics into more detailed topic specifications building on #2 above.
6. Organizing the curriculum topics into a coherent conceptual curriculum structure.
7. Writing/inviting others to write/provide course exemplars that fit with the proposed curriculum structure.

Throughout this process, various stakeholders of the IS community will be invited to provide feedback to the task force. We would encourage the readers of this document to visit msis2016.org, provide comments regarding this document, and take a MSIS stakeholder survey.

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