

SENATE AGENDA

Friday, May 11, 2018  
10:30 a.m. – F210

1. APPROVAL OF THE AGENDA

2. ADOPTION OF THE MINUTES OF THE SENATE MEETING OF: April 13, 2018

3. BUSINESS ARISING FROM THE MINUTES

MOTION 1: Moved that Senate approves the proposal to recommend to the Board of Governors a temporary (12-month) restructuring of the Applied and Professional Studies Faculty that will allow the School of Business to report to the Dean of Education, the School of Nursing to report to the Provost, and the remaining programs in the Faculty report to the Dean of Arts and Science.

Announcement – re: Senate Budget Advisory Committee

4. READING and DISPOSING of COMMUNICATIONS

5. REPORTS FROM OTHER BODIES

- A. (1) President
- (2) Provost and Vice-President Academic and Research
- (3) Vice-President Finance and Administration
- (4) Board of Governors
- (5) Alumni Advisory Board
- (6) Council of Ontario Universities (Academic Colleague)
- (7) Joint Board/Senate Committee on Governance
- (8) NUSU
- (9) Indigenization Steering Committee
- (10) Others

B. Reports from Senate members

6. QUESTION PERIOD

Would the PVPAR provide the background and rationale for the creation of two (2) new teaching chairs?

7. REPORTS of STANDING COMMITTEES and FACULTY or UNIVERSITY COUNCILS

SENATE EXECUTIVE COMMITTEE

MOTION 1: That the Report of the Senate Executive Committee dated April 5, 2018 be received.

**BY-LAWS AND ELECTIONS SUBCOMMITTEE MEETING**

MOTION 1: That the Report of the By-Laws and Elections Subcommittee Meeting, dated April 24, 2018 be received.

MOTION 2: That Senate approve Article 9.1 Senate Executive Committee be amended as outlined below:

## 9.1 Senate Executive Committee (EXEC)

(a) *Ex Officio Members:*

- (i) the President, ~~who shall be~~ (Chair);
- (ii) the PVPAR, or designate, ~~who shall be~~ (Vice-Chair);
- (iii) the ~~Academic~~-Deans, or their designates;
- (iv) the Speaker; and
- (v) the Deputy Speaker.

(b) *Members Elected by Faculty Council:*

- (i) one (1) tenured or tenure-track faculty Senator\*, from each faculty; and
  - (ii) one (1) student Senator from the NUSU Executive.
- \*tenured faculty preferred

(c) *Terms of Reference:*

- (i) to call Senate meetings and prepare the agendas of Senate;
- (ii) to approve Senate minutes for circulation prior to adoption;
- (iii) to manage the workflow of Senate and its committee/subcommittees in order that business is carried out in an expeditious and timely fashion;
- (iv) to ensure that Senate By-Laws are followed and that Senate decisions are properly recorded, transmitted and implemented;
- (v) to consider, for approval and conveyance to Senate, reports and recommendations of the By-Laws & Elections Subcommittee and Honorary Degree Subcommittee;
- (vi) when required to exercise Senate's authority and act on Senate's behalf during the Senate summer recess period, with the understanding that all such actions shall be reported at the September meeting of Senate;
- (vii) the Senate Executive may act on behalf of Senate when quorum of Senate cannot be established, or when the regularly scheduled Senate meeting is delayed, to deal with any urgent matter that is within the responsibility of Senate, with the understanding that all such actions will be reported at the next meeting of Senate;
- (viii) to approve degree audits for all undergraduate students who have applied to graduate, and to recommend all candidates to Senate for the conferring of undergraduate degrees, diplomas and certificates;
- (ix) meetings at which candidates for honorary degrees are discussed shall be conducted *in camera* and considered strictly confidential; and
- (x) to deal with such other matters as may be assigned from time to time by Senate.

MOTION 3: That Senate approve the revisions to the membership of the Joint Standing Committee of the Board and Senate on Governance, as outlined below.

(a) *Ex Officio Members:*

- (i) the President of the Nipissing University Student Union (NUSU) or Designate

## (b) Members Elected by Senate:

- (i) ~~three (3) non-Senators Elected by Senate, with at least one being a Senator~~
- (i) three (3) **faculty** Senators ~~or non-Senators Elected by Senate, with at least one being a Senator~~
- (c) Members Elected by Board:
- (i) three (3) **non-constituent** members of the Board of Governors, ~~Elected by the Board~~
- (d) Terms of Reference:
- (i) to periodically review on an at least an annual basis the governance structures and practices of the University to foster bicameral communication and collegiality and to recommend amendments to by-laws, practices or policies as may be advisable;
- (ii) to establish and oversee a procedure for providing a joint orientation to new members of the Senate and Board as a means of promoting the effective governance of the university;
- (iii) to establish and oversee a statement on the importance of collegial governance at Nipissing;
- (iv) to address issues that may arise concerning a lack of civility and decorum in the conduct of the interaction of the Senate or Board and which cannot be satisfactorily addressed under the existing policies and bylaws of each, and to recommend amendments to by-laws, practices or policies as may be advisable; and
- (v) to oversee the implementation of the recommendations of the Special Governance Commission Report of October 27, 2016.

NOTICE OF MOTION: That the Senate approve the reordering of the Senate agenda to place “Reports from Other Bodies” ahead of “Question Period”

### **ACADEMIC QUALITY ASSURANCE AND PLANNING COMMITTEE**

MOTION 1: That the Report of the Academic Quality Assurance and Planning Committee, dated April 27, 2018, be received.

MOTION 2: Moved that Senate grant approval for Stage 2 BSc Honours Specialization and Specialization in Data Science, and BA Honours Specialization and Specialization in Data Science

### **GRADUATE STUDIES COMMITTEE (GSC)**

MOTION 1: That the Report of the Graduate Studies Committee Meeting, dated April 23, 2018 be received.

## **8. OTHER BUSINESS**

## **9. ELECTIONS**

Note of appreciation to the Faculties and Deans for the election of new Senators for the 2018-2021 term.

- Speaker of Senate – 2018-2020 (2 year term)
- Deputy Speaker of Senate – 2018-2020 (2 year term)
- Alternate Academic Colleague (1 year term to cover sabbatical)

**10. NEW BUSINESS**

MOTION 1: That Senate approve and adopt the Nipissing Celebration Anthem dated May 3, 2018.

**11. IN-CAMERA**

MOTION 1: Motion to go in-camera

MOTION 2: That Senate grant approval to award a Certificate of Academic Achievement - in Memoriam

MOTION 3: Motion to leave in-camera

**12. ADJOURNMENT**

***DRAFT***

Nipissing University  
Minutes of the Academic Senate Meeting  
April 13, 2018  
2:30 p.m. – Room F210

MEMBERS PRESENT:

M. DeGagné (Chair), C. Sutton, J. McAuliffe, M. Tuncali, R. Vanderlee, D. Iafrate, N. Black  
A. Armenakyan, L. Chen, L. Manankil-Rankin, P. Millar  
R. Breton, A. Burk, N. Colborne, S. Connor, R. Gendron, A. Hatef, B. Kelly, L. Kruk, E. Mattson, S. Renshaw, K. Srigley, D. Tabachnick, H. Teixeira, T. Vassilev, A. Weeks  
J. Allison, C. Hachkowski, B. Hatt, T. Horton, M. Parr, C. Peltier, C. Ricci, W. Richardson, G. Sharpe, T. Sibbald  
C. Cho  
N. Allaire  
O. Pokorny, L. Rossi  
J. Zimbalatti  
S. Dunstall, J. Brunet, A. Higgins

ABSENT WITH REGRETS:

Arja Vainio-Mattila  
C. Richardson  
M. Sullivan  
A. Karassev, G. McCann, P. Nosko, T. Parkes  
G. Rickwood  
T. Curry  
S. McArthur  
S. Lamorea, T. Somerville, K. Walker, C. Tremblay, T. Mein

APPROVAL OF THE AGENDA OF THE SENATE MEETING OF: April 13, 2018

MOTION 1: Moved by K. Srigley, seconded by G. Sharpe that the agenda of the Senate meeting of April 13, 2018 be approved.  
CARRIED

ADOPTION OF THE MINUTES OF THE SENATE MEETING OF: March 9, 2018

MOTION 2: Moved by R. Gendron, seconded by L. Kruk that the minutes of the Senate meeting of March 9, 2018, be adopted.  
CARRIED

BUSINESS ARISING FROM THE MINUTES

There was no business arising from the minutes of March 9, 2018.

READING and DISPOSING of COMMUNICATIONS

*Statement on the Importance of Collegial Governance at Nipissing:*

Collegiality is essential to the structure and practice of university governance. Given the diversity of its constituent groups and its mission of advancing truth and knowledge, the university is best served by the open expression of ideas and opinions; encouraging thoughtful dissenting views. Successful collegial governance depends on all participants acting in good faith and having access to relevant information to offer sound opinions. In the same spirit, decision-making must ensure inclusiveness, equality, transparency, and board participation.

Recognizing the obligations, responsibilities and jurisdictions of the Senate and the Board of Governors, collegial governance requires interdependence, mutual respect and good relationships. The primary mission of the University is academic and is served by responsible resource allocation and planning.

All of us must do our part to uphold the ideals of academic freedom and democratic practice inherent in our system of collegial governance.

QUESTION PERIOD

A lengthy discussion ensued regarding the proposal to restructure the Applied and Professional Studies faculty which resulted in the following motion:

MOTION 1: Moved that Senate approves the proposal to recommend to the Board of Governors a temporary (12-month) restructuring of the Applied and Professional Studies Faculty that will allow the School of Business to report to the Dean of Education, the School of Nursing to report to the Provost, and the remaining programs in the Faculty report to the Dean of Arts and Science.

REPORTS of STANDING COMMITTEES and FACULTY or UNIVERSITY COUNCILS

SENATE EXECUTIVE COMMITTEE

MOTION 3: Moved by M. DeGagné, seconded by A. Weeks that Senate receive the Report of the Senate Executive Committee dated April 5, 2018.  
CARRIED

**ACADEMIC QUALITY ASSURANCE AND PLANNING COMMITTEE**

MOTION 4: Moved by M. Tuncali, seconded by A. Armenakyan that the Report of the Academic Quality Assurance and Planning Committee dated March 23, 2018, be received.  
CARRIED

**GRADUATE STUDIES COMMITTEE**

MOTION 5: Moved by J. McAuliffe, seconded by M. Tuncali that the Report of the Graduate Studies Committee dated February 26, 2018, be received.  
CARRIED

MOTION 6: Moved by J. McAuliffe, seconded by R. Gendron, that Senate approves that the History program requirement changes are made to clearly represent the program as listed.  
CARRIED

MOTION 7: Moved by J. McAuliffe, seconded by M. Tuncali, that Senate approves that the prerequisites of EDUC 5157 AND EDUC 6116 for EDUC 5676 Qualitative Approaches to Educational Research be changed to EDUC 5157 OR EDUC 6116 and that the prerequisites of EDUC 5157 and EDUC 6116 for EDUC 5677 Quantitative Approaches to Educational Research be changed to EDUC 5157 OR EDUC 6116.  
CARRIED

**AMENDMENT OF BY-LAWS**

MOTION 1: Moved by N. Colborne, seconded by R. Gendron, that Senate approve that the terms of reference of Article 9.2 Academic Quality Assurance and Planning Committee (AQAPC) be amended as outlined below:

9.2 Academic Quality Assurance and Planning Committee (AQAPC)

(c) Terms of Reference:

- (i) to engage in an on-going process of long-range academic planning in accordance with the overall academic objectives of the University, and to make recommendations to Senate as necessary and appropriate;
- (ii) as a part of (i) to review and update on an annual basis for Senate approval, the Nipissing University Strategic Academic Plan, which includes the setting of priorities related to the introduction of new programs or adjustments to current offerings and associated recommendations for appropriate resources;
- (iii) AQAPC is responsible for review of new academic programs and has the authority to recommend new programs for Senate approval;
- (iv) AQAPC is responsible for reviewing and providing Senate the substantive outcomes of cyclical review of existing academic programs;
- (v) AQAPC is responsible for reporting to Senate the recommendations resulting from program reviews;
- (vi) to direct to Senate or its relevant committees/subcommittees, as necessary, any issues which arise from the Committee's planning discussions regarding physical facilities or other aspects of the educational environment;
- (vii) to deal with such other matters as may be assigned from time to time by Senate.

MOTION 2: Moved by N. Colborne, seconded by D. Iafrate, that Senate approve that the *Ex Officio* membership of the Senate Committees, Subcommittees and Council be amended as outlined below:

CARRIED

9.1 Senate Executive Committee (EXEC)

(a) *Ex Officio* Members:

- (i) the President, ~~who shall be~~ (Chair);
- (ii) the PVPAR, or designate, ~~who shall be~~ (Vice-Chair);
- (iii) the Deans, or their designate;
- (iv) the Speaker; and
- (v) the Deputy Speaker.

9.1.1 By-Laws & Elections Subcommittee (B&E)

(a) *Ex Officio* Members:

- (i) the Speaker, ~~who shall be~~ (Chair);
- (ii) the Deputy Speaker, ~~who shall be~~ (Vice-Chair);
- (iii) the PVPAR, or ~~their~~ designate; and
- (iv) the Senate Secretary (non-voting).

9.1.2 Honorary Degrees Subcommittee (HON)

(a) *Ex Officio* Members:

- (i) the President, ~~who shall be~~ (Chair);
- (ii) the PVPAR, or designate, ~~who shall be~~ (Vice-Chair);
- (iii) one (1) Dean, or designate, chosen by the Senate Executive Committee;
- (iv) one (1) representative chosen by and from the Board of Governors; and
- (v) one (1) representative chosen by and from the Alumni Advisory Board.

9.2 Academic Quality Assurance and Planning Committee (AQAPC)

(a) *Ex Officio* Members:

- (i) the PVPAR, or designate, (Chair);
- (ii) the Dean of Graduate Studies and Research;
- (iii) the Dean of each Faculty, or their designate;
- (iv) the Registrar;
- (v) the Executive Director of Library Services, or designate;
- (vi) the Director of Institutional Research and Planning;
- (vii) one (1) representative chosen by and from the Board of Governors.

9.3. Undergraduate Studies Committee (USC)

(a) *Ex Officio* Members:

- (i) the PVPAR or designate, (Chair)
- (ii) one (1) Academic Dean, or their designate, ~~who shall be~~ (Vice-Chair); and
- (iii) the Registrar, or designate.

9.3.1 Undergraduate Standing & Petitions Subcommittee (S&P)

(a) *Ex Officio* Members:

- (i) the Registrar, (~~non-voting~~) or designate, ~~who shall be~~ (Chair); and
- (ii) one (1) Academic Dean, or ~~their~~ designate.

9.3.2 Undergraduate Services & Awards Subcommittee (S&A)

(a) *Ex Officio* Members:

- (i) the Vice-Chair of USC, ~~who shall be~~ (Chair);



- (ii) one (1) representative chosen by and from the Aboriginal Council on Education;
- (iii) the Financial Aid Manager (non-voting);
- (iv) a representative from Development named by the PVPAR (non-voting);
- (v) the Assistant Vice-President, Students; and
- (vi) Registrar, or designate.

#### 9.4 Student Appeals Committee (SAC)

- (a) *Ex Officio* Member:
  - (i) the Registrar, ~~who shall be~~ (Chair).

#### 9.5 Teaching & Learning Committee (T&L)

- (a) *Ex Officio* Members:
  - (i) one (1) Dean, or ~~their~~ designate, ~~whom shall be~~ (Chair); and
  - (ii) the Executive Director of Library Services, or designate.

#### 9.5.1 Library Advisory Subcommittee (LIB)

- (a) *Ex Officio* Member:
  - (i) the Executive Director, Library Services, who shall be Chair.

#### 9.6 Technology & Infrastructure Committee (T&I)

- (a) *Ex Officio* Members:
  - (i) the Vice-President responsible for Finance and Administration, or designate (non-voting);
  - (ii) the Executive Director, Library Services, or designate; and
  - (iii) the Director of Technology Services, or designate.

#### 10.2 Research Council (RC)

- (a) Membership: Voting Members:
  - (i) the Dean of Graduate Studies and Research ~~who shall be~~ (Chair);
  - (ii) one (1) other Academic Dean, or ~~their~~ designate;
  - (iii) six (6) faculty members, elected by Senate for a minimum two (2) year term, to include:
    - one (1) faculty member from each Faculty representing the Tri-Council disciplines as follows: 1 CIHR, 1 NSERC, 1 SSHRC, two (2) remaining faculty, and one (1) Canada Research Chair or Indigenous Education Chair;
  - (iv) one (1) student representative from a Graduate program;
  - (v) the PVPAR or designate; and
  - (vi) the Executive Director of Library Services, or designate.

#### 10.3 Graduate Studies Committee (GSC):

- (a) Members:
  - (i) the Dean of Graduate Studies and Research, or designate, ~~who shall be~~ (Chair);
  - (ii) the PVPAR, or designate;
  - (iii) the Registrar, or designate;
  - (iv) the Executive Director of Library Services, or designate;
  - (v) one (1) Academic Dean, or ~~their~~ designate;
  - (vi) Graduate Coordinators/Graduate Chairs from each graduate program, or designate;
  - (vii) one Graduate student from each level of graduate studies; and
  - (viii) one Graduate student Senator (non-voting).

**•Notice of Motion that Senate approve the proposed revisions to the membership of the Joint Standing Committee of the Board and Senate on Governance as outlined below:**

- (a) Ex Officio Members:
  - (i) the President of the Nipissing University Student Union (NUSU) or designate
- (b) Members Elected by Senate:
  - (i) three (3) Senators or non-Senators elected by Senate, **with at least one being a Senator**
- (c) Members Elected by the Board:
  - (i) three (3) **non-constituent** members of the Board of Governors elected by the Board
- (d) Terms of Reference:
  - (i) to periodically review on an at least an annual basis the governance structures and practices of the University to foster bicameral communication and collegiality and to recommend amendments to by-laws, practices or policies as may be advisable;
  - (i) to establish and oversee a procedure for providing a joint orientation to new members of the Senate and Board as a means of promoting the effective governance of the university;
  - (ii) to establish and oversee a statement on the importance of collegial governance at Nipissing;
  - (iv) to address issues that may arise concerning a lack of civility and decorum in the conduct of the interaction of the Senate or Board and which cannot be satisfactorily addressed under the existing policies and bylaws of each, and to recommend amendments to by-laws, practices or policies as may be advisable; and
  - (v) to oversee the implementation of the recommendations of the Special Governance Commission Report of October 27, 2016.

### ELECTIONS

MOTION 1: Moved by S. Renshaw, seconded by J. Allison that A. Burk replace D. Tabachnick on the Chancellor's Award for Excellence in Teaching selection committee. **ACCLAIMED.**

### REPORTS FROM OTHER BODIES

The President provided an electronic report that will be included as an attachment.

The Provost and Vice-President Academic and Research provided an electronic report that will be included as an attachment.

The Joint Board/Senate Committee on Governance advised that the joint budget report is in the works and will be available for May meeting. They will meet one more time this academic year.

NUSU Executive, J'aime Brunet reported that they are continuing with Wellness Wednesdays. Student of the week and Sugar Daddies will also continue. If you are aware of any deserving students, please nominate. There is a job fair on April 26<sup>th</sup> at 10:00 a.m. to 2:00 p.m at the Grand Event Centre, please advise students. Free grilled cheese sandwiches were handed out to students on National Grilled Cheese

Day. Valedictorians will be announced in the near future. The theme for FROSH this year will be Disney. We hope to grow the green initiative in the future. New directors are starting May 1.

No reports were provided by:

- The Vice-President, Finance and Administration
- Board of Governors
- Alumni Advisory Board
- Council of Ontario Universities (Academic Colleague)
- Indigenization Steering Committee

NEW BUSINESS

MOTION 1: Moved by M. DeGagné, seconded by M. Tuncali, that Senate move in-camera.  
CARRIED.

*Senate moved in camera*

MOTION 2: Moved by M. DeGagné, seconded by W. Richardson, that Senate grant approval to award the PhD in Education in Memoriam.  
CARRIED.

MOTION 3: Moved by M. DeGagné, seconded by T. Horton, that Senate consider five (5) Honorary Degree recipients. CARRIED

MOTION 4: Moved by M. DeGagné, seconded by M. Tuncali, that Senate move out of camera.  
CARRIED

ANNOUNCEMENTS

ADJOURNMENT

Senate was adjourned at 3:55 p.m.

*Original signed by:*

.....  
M. DeGagné (Chair)

.....  
S. Landriault (Senate Secretary)

#### Campus

- Dave Marshall Student Leadership Awards
  - 25 Student Leaders – Academic / Campus / Community
- World Social Work Day Talk – Future of Social Work in the context of Reconciliation and Efforts to Indigenize Education
- Undergraduate Research Conference – Closing Awards Ceremony
- IMNP (Indigenous Mentorship Network Program) Webinar filming with Cindy Peltier
- Met with BFA Graduating Class & toured their exhibit – WKP Kennedy Gallery
  - Bachelor of Fine Arts = BFA
- Nipissing Lakers Athletes Banquet

#### Meetings

- Indigenization Steering Committee
- Universities Canada – Education Committee Meeting – Toronto Sheraton Hotel
  - Topic: Indigenous Education

#### Community

- Smart Cities – Interview for the City of North Bay
- Opening Ceremony / Dinner – Ford World Women's Curling Championships
- Opening Remarks / Closing Remarks – FIRST Robotics District Competition
  - 33 Teams from across Ontario, including a team from Afghanistan (Afghan Dreamers)
- Reconciliation North Bay Meeting
- Career Ready Funding Proposal – Meeting with Chamber President, Peter Chirico, and Patti Carr

#### Collaboration

- Meeting with OCAD University
- Bimose Tribal Council Graduation Ceremony in Kenora

#### Research / Other

- Interim Board of the National Council on Reconciliation
  - Meeting in Vancouver
  - Conference Call – pre-workshop planning
  - Workshop / Meeting in Ottawa
- FEDTalk – Indigenizing the Academy
- Canadian Association of Nurses – Presentation to the Board of Directors – Reconciliation
- Inspire Awards in Winnipeg – Public Service

Senate report 13<sup>th</sup> April 2018  
Arja Vainio-Mattila

I respectfully submit to Senate the following report:

- Quality assurance:
  - o The internal IQAP processes are ongoing.
  - o The committee to review the Institutional Quality Assurance Protocol is hoping to complete a draft by early June. We will be joined by a COU consultant to support this process later in May.
- Academic Planning:
  - o The Provost's Council has been developing a template for academic planning. I will be introducing it at Faculty Councils in May/June.
- Nipissing Teaching Chairs Program
  - o The programme was launched in early March. The call is attached in Appendix 2.
- Nipissing Conversations
  - o NU Conversations 2 on Teaching and Learning took place March 8<sup>th</sup> and 9<sup>th</sup> (notes in Appendix 1)
  - o NU Conversations 3 on Indigenization took place on April 12<sup>th</sup>. Notes forthcoming

I have also attached to this report my letter sent out to the University on April 12<sup>th</sup> so that it can be a matter of Senate record.

Appendices to this report:

- 1) NU Conversations 2 on Teaching and Learning
- 2) Nipissing Teaching Chairs Program
- 3) My letter to Nipissing University on April 12<sup>th</sup>

Appendix 1 NU Conversations 2 on Teaching and Learning

Hallmarks of effective teaching

- Diversify presentations
- Recognizing that learning is a feeling
- Linking telling, showing, and doing in the learning sequence
- Encourage students to think outside the box, challenging connections, engaging in discord and dialogue
- Probing
- Abstract thinking, challenging the personal and public as socio-cultural constructs
- Challenge learners to be uncomfortable and pursue the critical quest in their learning
- Recognizing and adapting to varied learning styles, challenge all to participate in the process
- Challenge learners to think outside the box
- Teaching and learning are everything we do here. Do we need a tech support unit for it? There are a couple of units already in existence, but if a committee is tasked w/ a

specific goal or goals, such as internationalization, indigenization, online learning etc teachers can be directly involved.

Decolonizing teaching and learning; what does it look like?

- Teach 11 strategies that characterize culturally responsive teaching
- Openness in class and creating space for students to share respectfully
- Challenging without conforming
- This can involve risky strategies so requires a safe context to take risks
- Allowing/facilitating students to theorize experience
- Creating space for marginalized, radicalized, gendered voices
- Challenging our ideas of what a classroom looks, sounds, feels like
- Learning on land
- Learning in relation to community

10 Commandments of Team teaching (Stanford University)

1. Thou shalt plan everything with thy neighbor.
2. Thou shalt attend thy neighbor's lectures.
3. Thou shalt refer to thy neighbor's ideas.
4. Thou shalt model debate with thy neighbor.
5. Thou shalt have something to say, even when thou art not in charge.
6. Ye shall apply common grading standards.
7. Thou shalt attend all staff meetings.
8. Thou shalt ask open questions.
9. Thou shalt let thy students speak.
10. Thou shalt be willing to be surprised.
  - Consider surveying or consulting to see what did/didn't work from CFTL
  - 11 Thou shalt include the library
  - embed the concept in workload language
  - encourage, reconcile + record
  - allow for chosen, not forced partnerships
  - set standards for recognizing when its working and when it is not
  - look for shared interest in methods not only content
  - workload reconceptualization
  - more supports > teaching and learning, research time, experiential learning

Nipissing is planning to launch a centre to support teaching and learning. What should its priorities be?

- Disseminating knowledge/best practice to faculty
- PD courses or ongoing consultation, or both
- Safe space to take risks and fail
- Collaboration with libraries
- Leadership be several faculty
- Rotating & recurring foci
- Professional "explain research" discussions that mix faculty from different departments and require laymen explanations
- Support for all delivery methods
- Input from faculty on "fair dealing" of copyright

- Media creation and support
- Indigenous learning circles (+ decolonizing methods)
- Learning sessions for faculty on adult learning
- Indigenous knowledge and pedagogy
- Innovation
- Introduce seminars, learning commons/circles which are mandatory, and 0-credit
- Grad. Student/new faculty prep
- Sharing of all at times (not just indigenous) a space where people can learn about different learning styles and pathways, sharing of experiences
- Understand practice principles of adult learning
- Mentoring program (voluntary) to allow sharing of best practices (intra/inter disciplinary)
- Expertise in online course development/blended course delivery
- Limitations: support co-teaching in interd. Courses designed with IT
- Workshops to develop/improve teaching skills

What are the strengths, weaknesses, opportunities, and limitations of interdisciplinary engagements?

- Asking profound questions of our time and allowing the questions to lead the work, disciplines can become silos
- Limitations > always time
- Limitation> how interdisciplinary team teaching is covered
- Opportunities> our colleagues have much to teach us
- INTD courses are a real strength
- In education literacy gets funding, numeracy does not
- Cross disciplinary thinking encourages production of new methodologies
- when recruiting students are very excited about interdisciplinary courses, i.e. White
- they often have many interests and it allows them to explore other courses and disciplines they may not have tried
- funding challenges (still!)
- if one subject is integrated into another it is vulnerable, it could be swallowed and disappear
- Bring back Common Book Program!

We recognize the varied levels of preparation with which our students arrive at university.

What do all 1<sup>st</sup> year students need to know/have learned in order to succeed in their degree?

(Non-disciplinary learning outcomes)

- How to come to class having already done the prep. Work (reading/organized notes etc)
- How to evaluate and sort information
- Essay skills?> argument, comparison, expository, thesis, evidence
- Less fear of public speaking
- Open-mindedness, independent mindedness, tolerance for ambiguity
- Consumption vs. creation of media
- Speed of terms
- How we apply knowledge to real scenarios they will encounter in workforce
- How to engage w/ public, media, different groups of people

- Writing in ways that are understandable in the workforce
- Critical thinking is 'engaged' thinking
- How to get support
- Basic foundations
- How well do 1s year profs understand variations in the high school curricula for different places students are from? How up to date are they on curriculum renewals in Ontario?
- How to read critically, they can't write critically before they read critically
- Being prepared for class
- Being ready for independent study

#### Blooms taxonomy

- Use revised taxonomy
- Revised puts creative thought at the apex
- Bloom's is a fairly low level aspiration as a framework for assessment, let's go deeper
- Broader need to understand authentic assessment + good testing
- Teach topic elaboration to move thinking from what to so what and now what > social action

#### Other questions/comments?

- Growth for all > not just remedial teaching growth when things aren't going well
- Make teaching excellence on par with research excellence
- Revision and school specific
- Adaptation of the SOS (Student Opinion Survey) forms x2
- Professional development for all sectors
- Results/next steps following sessions
- A forum whereby ideas are discussed with deans. Where are they in this process
- Is team teaching an opportunity (interdisciplinary) that we should explore
- Pub nights
- Faculty arrive w/ varying degrees of teaching experience
- Experiential learning
  - o How to do it
  - o Learning in these environments
  - o Assessing in these environments
- Let's have an annual learning and teaching day
- Development of learning outcomes and assessing based on these
- Establishing a certificate in learning and teaching in higher ed
- Establishing internal grants for research specific to learning and teaching



## Appendix 2 Nipissing Teaching Chairs

Nipissing University is launching a Nipissing University Teaching Chairs Programme starting July 1<sup>st</sup>, 2018. At this time, we seek TWO Chairs in any two of the following areas:

- Teaching Chair in Supporting On-Line/Blended Teaching and Learning in Universities
- Teaching Chair in Experiential Education
- Teaching Chair in Inclusion and Equity in University Teaching and Learning
- Open theme: the committee will consider submissions in areas not already identified in the first three themes.

**TERM:** Two-year term appointment to commence July 2018.

**APPLICATION SUBMISSION DEADLINE:** April 20<sup>th</sup>, 2018

**DECISION:** By mid-May, 2018.

### PROGRAM DETAILS

Teaching Chairs are tenured, tenure-track or continuing faculty who have demonstrated teaching excellence and a desire to advocate and support evidence-based university-wide teaching excellence.

The goal of these Chairs is three-fold: to provide faculty leadership in the development of a community of practice in the area of teaching and learning; to provide peer support to faculty members who wish to develop their research and practice in the area of pedagogy; and to engage in and share scholarship of teaching and learning research and best-practices across the university community and beyond.

### ROLES AND RESPONSIBILITIES INCLUDE

- ✓ Fostering the culture of teaching and learning excellence at Nipissing University.
- ✓ Championing teaching & learning best practices in on-campus, online, and community classroom spaces.
- ✓ Contributing to the scholarship of teaching and learning across the Faculties, Schools and Departments.

As identified by the Provost and the Deans, and in consultation with the appointed Chair, specific duties can include tasks such as\*:

- Developing strategic plans for the implementation of teaching excellence at Nipissing University.
- Organizing and assisting in the delivery of teaching and learning workshops, talks, retreats and programs.
- Assisting with individual consultation and classroom observations with faculty members.
- Providing mentorship for individuals and small groups of faculty.
- Engaging in teaching and learning research (including action research) and disseminating such research to the Nipissing University community as well as at Teaching and Learning conferences.
- Representing Nipissing University on university, regional and national, and international teaching and learning committees and associations (e.g. Society for Teaching and Learning in Higher Education, Ontario Universities Council etc.).
- Contribute to the development of structures and processes that support Teaching and Learning at Nipissing.
- *\*These are intended to be examples of the types of duties. No one Chair would be expected to take on all these duties.*

## **CHAIR AREAS**

Calls for Chairs are based on particular themes that are determined by the Provost and the Deans.

## **TERMS OF APPOINTMENT**

2 years: July 1, 2018-June 30, 2020:

## **COURSE RELEASE**

Two (2) Three-credit course release per year (1 per term) determined in consultation with School Dean and VPA.

## **RESEARCH GRANT**

Annual research grant of \$2500 for the duration of the Chair to conduct and disseminate Scholarship of Teaching & Learning research (total; \$5000).

## **APPLICATION PROCESS**

Applicants will submit the following **documents collated into ONE electronic file.**

1) An outline of an activity plan to be carried out through the duration of the chair with evidence of alignment with the particular theme identified in the call and potential long term impacts for the

Nipissing teaching culture, and strategy for sharing information/knowledge with faculty colleagues. (2 pages)

2) Philosophy of teaching. (1-2 pages)

2) Evidence of teaching excellence with examples of innovative practices (sample course outlines activities, assessment materials should be included as appendices). (1-2 pages)

3) Course evaluations (past 3 years). In the case of new faculty with less than three years of course evaluations, submit what is available including evaluations from other institutions.

4) Examples of participation, contribution and leadership in teaching and learning development. (1 page)

5) Curriculum Vitae. (CV can be abridged to include information relevant to this call)

#### **SUBMISSION PROCESS:**

Applications will be submitted by applicants to [VPA@nipissingu.ca](mailto:VPA@nipissingu.ca).

#### **APPLICATION REVIEW:**

The applications will be assessed by a committee made up of:

- Provost, VPAR
- Academic Deans
- One current University Teaching Chair (if their availability allows)

#### **Appendix 3 A My letter to Nipissing University on April 12<sup>th</sup>**

Dear Colleagues,

As most of you are aware the second term of the current Dean of the School of Applied and Professional Studies (APS) will end in June. This gives the University an opportunity to consider what organization might best support our current programmes as well as new programme development. In order to take advantage of this opportunity to have a university-wide, collegial conversation about the future of its organization, Nipissing will enter an interim phase of consultation described below. First, I want to share some of my thinking which hopefully will clarify the intent for the interim period.

At its best, the administrative structures of a university support the core activities of teaching and learning. They are not intended as an additional fortification of programmes within departments within faculties, but rather the structures need to be organized in such a manner that they respond to the operational needs of the university. All that to say, that whereas programmes based on (inter)disciplines are the heartbeat of the academy, departments and faculties as structures are not. I would like to emphasize that this is not a discussion about programme prioritization, nor will it change the existence of structures per se. The focus is on how you organize the structures to best support current and future programmes.

One of the aspects that sets a University apart from other types of institutions, is its “first among equals” type of leadership reflected in the academic leadership positions of Chair/Dean/Provost. The opportunity here is to consider which parts of Nipissing would benefit from decanal leadership, as opposed to other types of managers.

If I were to speculate the conversation could end up with, for example:

- 1) The current model of three faculty deans, and a dean of research and graduate studies with or without some changes to where programmes reside
- 2) Two faculty deans, and a dean of research and graduate studies
- 3) Two faculty deans, a dean of research and graduate studies, and a dean in an area related to programme innovation/teaching and learning

In order to have conversations about the structure, the following will take place in the interim period (which will in length most likely be 1 year).

#### Interim Structure

- Programmes in APS will report as follows:
  - o School of Business to Carole Richardson
  - o Nursing to Arja Vainio-Mattila
  - o All other programmes to Murat Tuncali
- Dr. John Nadeau will serve as an Interim Associate Dean of APS in order to respond to students’ issues, faculty communications, and to support Deans Tuncali and Richardson
- Staff currently supporting APS will report to Dr. Nadeau

#### Structuring conversation

- During May and June, I will attend Faculty Council meetings to hear concerns and further clarify the process
- During July and August, I will flesh out alternative structures, based on suggestions, which will be made available on-line for University community members to provide their feedback
- The Senate will then have a discussion to determine its recommendation to the Board as to the organizational structure going forward

I am hoping that as much as our focus will be on the organization, and the debates that will surely ensue, we will also take the opportunity to consider what types of programmes may be developed that would rely on strengths of multiple disciplines.

NIPISSING UNIVERSITY

REPORT OF THE SENATE EXECUTIVE COMMITTEE

May 3, 2018

There was a meeting of the Senate Executive on May 3, 2018.

The following members participated:

M. DeGagné, C. Richardson, M. Tuncali, R. Vanderlee, B. Hatt, N. Colborne, P. Millar, A. Weeks, J. Allison, T. Somerville ,

Regrets:

A. Vainio-Mattila, J. McAuliffe

Guests:

C. Dowdall, M. Storms

Recording Secretary: M. Daniel (Administrative Assistant, Office of the President)

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The purpose of the meeting was to set the agenda for the May 11, 2018, Senate meeting.

There was a discussion on the motion that was put forward at the April 11, 2018, Senate meeting for Senate to approve the recommendation for the proposed restructuring of the Applied and Professional Studies faculty. It was decided that the motion would be included under Business Arising from the Minutes.

The Academic Quality Assurance and Planning Committee report, dated April 27, 2018, was received.

The Report of the Graduate Studies Committee report, dated April 23, 2018, was received.

The By-Laws and Elections Subcommittee report, dated April 24, 2018, was received. It includes amendments to the *Ex Officio* membership of the Senate Committee, Subcommittees and Council. The By-Laws and Elections Subcommittee moved to send Article 9.1.(c)(vii) back to Senate in its original form to be voted on by Senate:

- (vii) the Senate Executive may act on behalf of Senate when quorum of Senate cannot be established, or when the regularly scheduled Senate meeting is delayed, to deal with any urgent matter that is within the responsibility of Senate, with the understanding that all such actions will be reported at the next meeting of Senate;

A Certificate of Academic Achievement – In Memoriam will be brought forward during the in-camera session of the Senate meeting on May 11, 2018.

It was suggested to have the Speaker of Senate acknowledge that the University is situated on traditional territory at the beginning of every Senate meeting.

Respectfully submitted,

*Original signed by:*



M. DeGagné  
Chair  
Senate Executive Committee

MOTION 1: That Senate receive the Report of the Senate Executive dated May 3, 2018.

## Nipissing University

### Report of the By-Laws and Elections Subcommittee

There was a meeting of the By-Laws and Elections Subcommittee on Tuesday, April 24, 2018 at 10:30 a.m. in F307.

Present: B. Hatt, N. Colborne, D. Davis, D. Tabachnick, S. Lamorea

Regrets: A. Vainio-Mattila and Janet Zimbalatti

The Agenda of the April 24, 2018 By-Laws and Elections Subcommittee meeting was approved.

MOTION 1: That the Report of the By-Laws and Elections Subcommittee Meeting, dated March 27, 2018 be received.

MOTION 2: That Senate approve Article 9.1 Senate Executive Committee be amended as outlined below:

#### 9.1 Senate Executive Committee (EXEC)

a. *Ex Officio Members:*

- (i) the President, ~~who shall be~~ (Chair);
- (ii) the PVPAR, or designate, ~~who shall be~~ (Vice-Chair);
- (iii) the ~~Academic~~ Deans, or their designates;
- (iv) the Speaker; and
- (v) the Deputy Speaker.

b. *Members Elected by Faculty Council:*

- (i) one (1) tenured or tenure-track faculty Senator\*, from each faculty; and
- (ii) one (1) student Senator from the NUSU Executive.  
\*tenured faculty preferred

a. *Terms of Reference:*

- (i) to call Senate meetings and prepare the agendas of Senate;
- (ii) to approve Senate minutes for circulation prior to adoption;
- (iii) to manage the workflow of Senate and its committee/subcommittees in order that business is carried out in an expeditious and timely fashion;
- (iv) to ensure that Senate By-Laws are followed and that Senate decisions are properly recorded, transmitted and implemented;
- (v) to consider, for approval and conveyance to Senate, reports and recommendations of the By-Laws & Elections Subcommittee and Honorary Degree Subcommittee;
- (vi) when required to exercise Senate's authority and act on Senate's behalf during the Senate summer recess period, with the understanding that all such actions shall be reported at the September meeting of Senate;
- (vii) the Senate Executive may act on behalf of Senate when quorum of Senate cannot be established, or when the regularly scheduled Senate meeting is delayed, to deal with any urgent matter that is within the responsibility of Senate, with the understanding that all such actions will be reported at the next meeting of Senate;

- (viii) to approve degree audits for all undergraduate students who have applied to graduate, and to recommend all candidates to Senate for the conferring of undergraduate degrees, diplomas and certificates;
- (ix) meetings at which candidates for honorary degrees are discussed shall be conducted *in camera* and considered strictly confidential; and
- (x) to deal with such other matters as may be assigned from time to time by Senate.

A discussion was held and the original motion was sent back to Senate for discussion and ratification.

MOTION 3: That Senate approve the revisions to the membership of the Joint Standing Committee of the Board and Senate on Governance, as outlined below:

a. *Ex Officio Members:*

- i. the President of the Nipissing University Student Union (NUSU) or Designate

(b) Members Elected by Senate:

- (i) three (3) **faculty** Senators ~~or non-Senators Elected by Senate, with at least one being a Senator~~

(c) Members Elected by Board:

- (i) three (3) **non-constituent** members of the Board of Governors, ~~Elected by the Board~~

(d) Terms of Reference:

- (i) to periodically review on an at least an annual basis the governance structures and practices of the University to foster bicameral communication and collegiality and to recommend amendments to by-laws, practices or policies as may be advisable;
- (ii) to establish and oversee a procedure for providing a joint orientation to new members of the Senate and Board as a means of promoting the effective governance of the university;
- (iii) to establish and oversee a statement on the importance of collegial governance at Nipissing;
- (iv) to address issues that may arise concerning a lack of civility and decorum in the conduct of the interaction of the Senate or Board and which cannot be satisfactorily addressed under the existing policies and bylaws of each, and to recommend amendments to by-laws, practices or policies as may be advisable; and
- (v) to oversee the implementation of the recommendations of the Special Governance Commission Report of October 27, 2016.

NOTICE OF MOTION: That the Senate approve the reordering of the Senate agenda to place “Reports from Other Bodies” ahead of “Question Period”

Respectfully submitted,

Dr. Blaine Hatt,  
Chair  
By-Laws and Elections Subcommittee



**Report of the  
ACADEMIC QUALITY ASSURANCE AND PLANNING COMMITTEE**

**Friday, April 27, 2018**

The seventh meeting of the Academic Quality Assurance and Planning Committee was held on Friday, April 27, 2018. The following members were in attendance:

**COMMITTEE MEMBERS:**

Blain Hatt (Vice-Chair)  
Carole Richardson  
Murat Tuncali  
Steven Cairns (Zoom)

Adam Higgins  
Alex Karashev  
Kristina Karvinen  
Sydney Lamorea  
Tysina Mein

Reehan Mirza  
Carlo Ricci (Zoom)  
Crystal Pigeau  
John Vitale (Zoom)  
Kaitlyn Walker

Regrets: Arja Vainio-Mattila, Anahit Armenakyan, Jim McAuliffe, Katrina Srigley, Rick Vanderlee, Debra Iafrate, Nancy Black, Janet Zimbalatti

Recording Secretary: S. Landriault

The committee discussed the new course template and it is currently under review. The Stage 2, BSc and BA Honours Program in Data Science was considered and the following motion was approved.

**MOTION:** That Senate approve Stage 2 BSc Honours Specialization and Specialization in Data Science, and BA Honours Specialization and Specialization in Data Science.

Respectfully submitted,

*Original signed by:*

Blaine Hatt, PhD  
Vice- Chair, Planning and Priorities Committee

Motion 1: That the Report of the Academic Quality Assurance and Planning Committee dated April 27, 2018, be received.

Motion 2: That Senate approve Stage 2 BSc Honours Specialization and Specialization in Data Science, and BA Honours Specialization and Specialization in Data Science.

**New Program Proposal**

**Data Science**

**Specialization and Honours Specialization**

**Stage II**

**October 2016**

**Revised April 2018**

**STAGE II BA/BSc in Data Science**

**A. Resource and Planning Information:**

**1. OBJECTIVES**

*a) Consistency:*

“Big Data”, or data that are too large, heterogeneous, or complex to be processed by standard techniques, has emerged due to virtualization of information and computation, the rapid growth of social networks, the increased flow of data from mobile devices, and other developments in information technologies, as well as because of greater computational needs in application fields. There are several challenges associated with this phenomenon, including meaningful interpretation and data analysis, efficient search, visualization, etc. Digital information is stored in a variety of formats, often redundant, often inconsistent, spread over multiple sources, and frequently unstructured, heterogeneous, and unsorted.

Data science is a relatively new field that lies at the intersection of mathematics, computer science, statistics, and other areas. Its primary objective is extracting relevant and applicable information and knowledge from existing data. Based upon recent employment trends, there is a strong demand in business, government, medicine, and industry for specialists in data science. It is predicted that this demand will grow in the immediate future.

The proposed program in data science will combine courses from mathematics, statistics, computer science, and application areas, preparing students to solve complex problems in science, technology, the humanities, business, and economics. Thus, the program is truly interdisciplinary. Critical thinking and analytical skills are essential for mathematics and computer science, and are equally essential for solving present-day challenges. Therefore, the proposed program fits well within the Nipissing University Strategic Plan and Strategic Management Agreement that emphasize student-centeredness, the highest standards in research and teaching, creativity, lifelong learning, and interdisciplinary focus.

The proposed program will also prepare students to enter graduate programs and to conduct their own research. The program also emphasizes skills and knowledge that can be applied to solve real-world problems, while simultaneously providing a solid foundation in mathematics and computer science.

*b) Learning Outcomes:*

The successful graduate of this program will be able to:

- read, understand, and analyze the literature and other materials in main areas of data science
- apply computational and mathematical knowledge to real-life problems related to big data, and to create solutions for such problems, particularly in the form of mathematical models, algorithms, and software
- use standard problem-solving ideas and techniques of data science
- evaluate the efficacy of different approaches to solve problems using well established ideas, techniques, and algorithms

## New Program Proposal - Data Science

- apply problem-solving and programming ideas and techniques in various contexts
- design and implement algorithms, and assess and prove the correctness of these solutions and algorithms
- gather, comprehend, and analyze new scientific knowledge from various sources, and apply it in various contexts
- pose scientific application questions and problems, and evaluate the appropriateness of approaches to solve them
- think independently
- communicate and disseminate information, arguments, and analyses to diverse audiences, both orally and in writing
- communicate scientific ideas, algorithms, questions, solutions, both orally and in writing, in a concise, clear, logical, and correct way
- collaborate effectively and collegially with others

Please refer to Appendix C for detailed Program-Level Expectations and Staged Level Expectations.

### c) *Student Outcomes and Their Relevance*

#### (i) Learning Outcomes

As the students progress through this program, they will acquire the following valuable skills and outcomes:

- a general knowledge and understanding of fundamental concepts, methodologies, and theoretical and practical approaches in data science, with some knowledge of historic development and current advances
- a broad understanding of the relevant topics in mathematics and computer science which are foundational for data science, including calculus, discrete mathematics, linear algebra, probability and statistics, algorithms, programming languages, machine learning, artificial neural networks, and their practical importance in data science
- an interdisciplinary outlook that will allow them to apply their skills to diverse fields
- critical thinking and analytical, problem-solving, and programming skills that can be used in the context of data science
- an understanding of the limits of their own knowledge and an awareness of how these limits may affect their analyses and interpretations
- enhanced communication, presentation, and writing skills

#### (ii) Graduate outcomes:

Graduates of the program will work in all areas where large volumes of data are acquired, analyzed, processed, or interpreted, including, but not limited, to information technology, finance, industry, medical and allied fields, management, government, etc. They will also be well-prepared to continue their studies in graduate programs in Data Science and related areas.

#### (iii) Other Outcomes:

- the exercise of good judgment, initiative, personal responsibility, and accountability in personal, professional, and collaborative contexts

## New Program Proposal - Data Science

- an ability to identify their own learning needs, including seeking assistance to identify and address weaknesses; an ability to identify their goals for their degree and beyond, including selecting an appropriate program for further study
- ability to work in teams as well as to accept and succeed in leadership roles

### 2. Admission Requirements:

BSc: English; Calculus & Vectors; Advanced Functions; one of Biology, Chemistry or Physics

BA: English; Calculus and Vectors; Advanced Functions

### 3. Degree Structure:

a) *The program will be structured as follows:*

#### Year 1

DATA 1XXX Intro to Data Science (new course)

MATH 1036 Calculus I

MATH 1037 Calculus II

MATH 1046 Introduction to Linear Algebra

MATH 1056 Discrete Mathematics I

9 credits electives

COSC 1557 Introduction to Computer Science

COSC 1567 Programming in C++

#### Year 2

MATH 2036 Advanced Calculus I

MATH 2037 Advanced Calculus II

MATH 2076 Probability and Statistics I

COSC 2006 Data Structures I

COSC 2007 Data Structures II

15 credits electives

#### Year 3

MATH 3276 Probability and Statistics II

DATA 3XXX Data Science Practicum II

COSC 3606 Databases and Data Management

COSC 3007 Artificial Intelligence

COSC 2116 Artificial Neural Network Computing

18 credits electives

#### Year 4

DATA 4XXX Data Analytics (new course)

24 credits electives

In addition, the following research project-based individualized study courses are required for Honors specialization:

## New Program Proposal - Data Science

DATA 4496 Research Project I and DATA 4997 Research Project II (new courses – directed study)

### **Breadth Requirements:**

ACAD 1601

3 cr. of Humanities

6 cr. *Social Sciences/Professional Studies*

### **Other Science Requirements (BSc):**

*6 credits from the following:*

BIOL 1006 Introduction to Molecular and Cell Biology

BIOL 1007 Introduction to Organismal and Evolutionary Biology

CHEM 1006 General Chemistry I

CHEM 1007 General Chemistry II

PHYS 1006 General Physics I: Mechanics

PHYS 1007 General Physics II: Mechanical Wave, Fluid Mechanics and Thermodynamics

*Additional 6 credits from the following science disciplines:*

Biology, Chemistry, Physical Geography, Geology, Physics

### **Minor in Data Science**

DATA 1XXX Intro to Data Science (new course)

MATH 1036 Calculus I

COSC 1557 Introduction to Computer Science

COSC 1567 Programming in C++

DATA 2XXX Data Science Practicum I

DATA 3XXX Data Science Practicum II

## New Program Proposal - Data Science

- b) Mathematics and Computer Science are main components of the proposed program. To achieve an adequate level of skills and knowledge in these subjects required for successful application of them in problem-solving, a four year program is essential. In addition, students will be expected to cover stream-specific courses as well as to fulfill all other Nipissing University academic requirements. These factors further justify the length of the program.
- c) The curriculum is designed to provide students with a high level of technical expertise in mathematics, statistics, and computer science, as well as knowledge in and awareness of areas of application. The courses selected for the core of the program ensure that successful students will have strong abilities in calculus, linear algebra, probability and statistics, as well as in programming, databases, machine learning, artificial neural networks, and other artificial/computational intelligence approaches. These courses set the foundation for applied core courses and electives and, especially, for the capstone research courses in fourth year. The selection of courses and general structure of the program will be helpful to successful graduates in obtaining employment in many areas that require proficiency in data science and the ability to work with “big data”.
- d) The proposed program is innovative as currently there are no undergraduate programs in Data Science in Canada, and only a handful of such programs worldwide. Data science and analysis of big data is becoming increasingly important, and therefore the graduates of the program will have unique career opportunities in the future. The program combines foundations from Computer Science and Mathematics with topics from other fields and thus will be a solidly interdisciplinary program with clearly defined expectations and outcomes.

#### **4. Research:**

Specialization in the Data Science program does not have special research requirements. Students in the Honours Specialization program will be expected to complete two (2) individualized study research courses, with final reports and presentations as part of the requirements.

No funds for research equipment, labs, or other research-related resources will be required for implementation of the proposed program.

#### **5. Delivery Mode:**

No changes to delivery are anticipated.

#### **6. Assessment of Teaching and Learning:**

The proposed program is mostly based on existing courses in Mathematics, Computer Science, and other disciplines. No changes in the current methods of assessment and evaluation of intended learning outcomes are anticipated.

## New Program Proposal - Data Science

There are only four new courses and two new practicum courses planned (two in-class, two individualized study courses, and two individualized study practicum courses), and those are likely to have similar methods of assessment, adjusted to the unique learning outcomes in those courses.

### 7. Resources for all programs:

- a) The program, at least in the initial several years of its implementation, will be based on existing faculty, facilities, labs, library resources etc. Any additional resources will be subject to levels of enrollment in the program.

The full financial forecast for this program was drafted by Jamie Graham and is attached here as Appendix B.

- b) As noted above, the program is mostly based on the existing courses offered by the Department of Computer Science and Mathematics. Existing faculty will be used initially. Any new hires will go through the standard search process and to the extent that any new hire has a significant role in the new program, their competence and fitness to the needs of the program will be part of the search requirements.
- c) None, except possibly for library additions

### 8. Resources for Undergraduate Programs Only:

- a) *List of the faculty who will offer courses used for this new program:*

#### **Computer Science:**

**Dr. Boguslaw Schreyer**

Faculty of Arts & Science – Computer Science, Associate Professor

**Dr. Mark Wachowiak**

Faculty of Arts & Science – Computer Science, Associate Professor

**Dr. Haibin Zhu**

Faculty of Arts & Science – Computer Science, Professor

#### **Mathematics:**

**Dr. Ali Hatf**

Faculty of Arts & Science – Physics, Assistant Professor

**Dr. Logan Hoehn**

Faculty of Arts & Science – Mathematics, Associate Professor

**Dr. Alexandre Karassev**

Faculty of Arts & Science – Mathematics, Professor



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**Dr. Ihor Stasyuk**

Faculty of Arts & Science – Mathematics, Assistant Professor

**Dr. Murat Tuncali**

Faculty of Arts & Science – Dean, Professor of Mathematics

**Dr. Vesko Valov**

Faculty of Arts & Science – Mathematics, Professor

**Dr. Tzvetalin Vassilev**

Faculty of Arts & Science – Mathematics, Associate Professor

- b) *Please see the staged (annual) resource plan in Appendix B.*
- c) *Please see Appendix B for an estimate of class sizes and expected enrolment growth over the first four years of the program.*
- d) *None*
- e) *None*

**9. Quality and Other Indicators:**

All faculty involved in the delivery of the main components of the proposed program have completed Ph.D. degrees, and most are tenured. Moreover, all are active researchers, and majority hold external research grants. Many of these faculty members have research interests in data science and closely-related fields. Faculty members are very active in attending and organizing workshops and conferences, as well as in participating in various outreach activities.

We believe that the library facilities are currently adequate for beginning this program. Current resources include access to several data science and analytics journals from the library's research databases, as well as a large collection of books and texts in the field. However, a reasonable small investment may be required to add some books and subscriptions in specific areas. In terms of Nipissing University's facilities, classrooms, and administration, we believe that they are all satisfactory for the delivery of this program. Given the nature of this program, it is not dependent upon the acquisition of new resources.

**B. Impact on Home and Related Units:**

The program is primarily based on exiting courses taught by the Computer Science and Mathematics Faculty. A moderate increase in the number of students in these classes should not affect their delivery nor require additional resources. If the program becomes very popular, then it will attract sufficient revenues to cover the addition of extra sections of certain courses, as well as the introduction of new courses.

## New Program Proposal - Data Science

The proposed program will not interfere with the normal governance and administration of the Department of Computer Science and Mathematics.

### **C. Long-Term Costs (Budget):**

Please see attached worksheet produced by Jamie Graham in October, 2016.

### **D. Immediate Costs:**

Please see attached worksheet produced by Jamie Graham in October, 2016.

**Appendix A: Library Report Relating to the Proposed Data Science Program**

## **Library Review for New Program Proposal**

**Program:** Data Science

**Department:** Computer Science and Mathematics

**Faculty:** Arts and Science

**Institution:** Nipissing University

**Liaison Librarian:** Laura Sinclair, MLIS

**Date:** September 2016

### **Library Collection**

#### **Overview**

The library collection includes print and e-books, films and other audiovisual materials, kits, and journals in both print and online formats. Liaison librarians work with faculty to select resources for the collection to support coursework and research activities. Many resources are available online through the library website, <http://www.eclibrary.ca/library/>

Data Science is a proposed new program; however, many of the courses comprising the curriculum are currently offered at Nipissing University, and supported by the library collection. The library subscribes to several databases with content relevant to the proposed Data Science program, including MathSciNet, ACM Digital Library, Computer Database and IEEE Xplore. There is also some related content in databases with broader subject coverage, such as Science Citation Index Expanded and Annual Reviews, as well as some multidisciplinary databases including Academic Search Premier, Scholars Portal Journals and Academic OneFile. It is essential to maintain access to this variety of resources in order to offer a broad scope of content.

There are other collections that could be considered for acquisition in support of the Data Science program such as the Society for Industrial and Applied Mathematics (SIAM) Journals and Project Euclid: Mathematics and Statistics Online; however, these subscriptions are costly. Adding these resources may only be considered with faculty consultation and a corresponding increase to library funding.

Similarly, there are no essential journal additions required at this time; however, individual faculty members may suggest specific journal titles related to their areas of specialty. These requests would be considered on a case-by-case basis, with a major consideration being cost.

Although the library's print monograph collection is somewhat dated in the areas of Mathematics and Computer Science, there is an ebook collection, Safari Tech Books Online, that partially addresses that gap. This collection of several thousand titles contains current publications in the field of technology, ranging in coverage from general surveys of broad topics, to specific guides for specialized software. Data Science has not been a focus of library collection development to date; consequently, acquisition of some newer content such as handbooks and theoretical material

## New Program Proposal - Data Science

specific to the discipline would complement the more practical content in Safari Tech Books Online.

The library also offers Nipissing University users access to various datasets through online resources such as <odesi> and Scholars GeoPortal.

### **Budget**

The allocations below are for the acquisition of print and e-books, multimedia, and serials purchased outside of database subscription packages. These figures do not include database purchases, as those come from a central budget.

Please note that Physics is included in the budget for Computer Science and Math, so the budget numbers represent allocations for combined departments.

<b>Budget Year</b>	<b>Total Allocation–Computer Science, Physics &amp; Math combined</b>
2015-16	\$ 5322
2014-15	\$ 5639
2013-14	\$ 6769
2012-13	\$ 4799
2011-12	\$ 4908

### **Recommendations**

It is recommended that at a minimum, start-up funding of \$1,000 be provided for the purchase of new books specific to Data Science, with \$500 per year for future additions to the monograph collection to maintain currency. If courses will be offered online, then e-books would be the preferred format for purchase. Academic titles in e-book format tend to be more expensive than their print counterparts, so allowance would need to be made for this in budgetary decisions.

This program should be well supported with the current suite of databases; however, it is essential to maintain access to these resources. Typically databases increase in cost by 3-5 % per year.

Other resources may be required, depending on course curricula and instructor methodology, and requests would be considered on a case-by-case basis, with library budget being one of the determining factors. Also, the fluctuating value of the Canadian dollar has an impact on the acquisitions budget and should be accounted for in funding decisions.

**Start-up Costs: \$1,000 for monographs**

**Ongoing Costs: \$500/year for monographs**

## New Program Proposal - Data Science

New Program Proposal - Data Science

<b>Collections Snapshot</b>						<b>Library Instruction, Services and Spaces</b>					
<b>Library Collections</b>						<b>Teaching and Learning</b>					
	<b>2014-15</b>	<b>2013-14</b>	<b>2012-13</b>	<b>2011-12</b>	<b>2010-11</b>		<b>2014-15</b>	<b>2013-14</b>	<b>2012-13</b>	<b>2011-12</b>	<b>2010-11</b>
# print volumes	179,947	174,986	173,120	199,979	197,756	# reference questions	11,972	10,240	10,631	14,212	10,965
# print books	179,159	173,606	171,750	184,981	183,312	# instruction sessions	195	222	150	197	222
# e-books	261,657	296,095	112,368	344,673	317,829	# students in instruction sessions	7,098	5,906	3,574	3,940	5,550
# print journals	202	301	210	318	236						
# e-journals	70,346	70,331	70,342	49,820	44,564						
<b>Expenditures</b>						<b>Spaces for Learning and Research (Harris Learning Library)</b>					
	<b>2014-15</b>	<b>2013-14</b>	<b>2012-13</b>	<b>2011-12</b>	<b>2010-11</b>	Seating capacity: 537					
Print books	\$73,853	\$68,679	\$73,199	\$74,646	\$91,354	# group rooms: 12					
E-books	\$46,559	\$33,483	\$37,233	\$47,159	\$46,598	# individual study rooms: 7					
One-off serials	\$55,253	\$34,281	\$50,941	\$46,449	\$52,633	Turnstile count (sample day)	<b>2014-15</b>	<b>2013-14</b>	<b>2012-13</b>	<b>2011-12</b>	<b>2010-11</b>
Electronic serials	\$536,740	\$595,564	\$492,364	\$448,799	\$391,950		1,312	1,405	1,764	1,638	2,380
Total budget	\$762,756	\$756,078	\$672,680	\$789,621	\$733,404						
<b>Use of Collections</b>						<b>Services</b>					
	<b>2014-15</b>	<b>2013-14</b>	<b>2012-13</b>	<b>2011-12</b>	<b>2010-11</b>	Hours during academic year: 8:00 am to 10:30 pm (Mon.-Thurs.), 8:00 am to 6 pm (Fri.), and 10:00 am to 5:30 pm (Sat., Sun.)					
Circulation	27,289	32,713	28,162	31,727	38,634	Info Desk hours: same as building hours					
Reserves circulation	4,783	3,422	2,762	3,982	3,993	Research appointments					
COUNTER full-text journal requests (calendar year)	TBD	TBD	TBD	TBD	194,462	24/7 access via proxy					
Library web site visits (calendar year)	188,419	216,615	236,854	221,408	195,829	URL resolver					
						Free interlibrary loan					
<b>Use of other Collections</b>											
	<b>2014-15</b>	<b>2013-14</b>	<b>2012-13</b>	<b>2011-12</b>	<b>2010-11</b>						
Books borrowed via interlibrary loan	877	559	1,373	1,604	2,024						
Articles (electronic or photocopy) via interlibrary loan	280	1,703	259	311	223						

## New Program Proposal - Data Science

**Appendix B:** Business Plan for Data Science program.

**Business Plan for Data Science, Modest Growth Model (Assume a fall 2017-2018 Start)**

	Year 1 Hours	Year 1 Weeks	Year 1 Terms	Year 2 Hours	Year 2 Weeks	Year 2 Terms	Year 3 Hours	Year 3 Weeks	Year 3 Terms	Year 4 Hours	Year 4 Weeks	Year 4 Terms	Year 5 Hours	Year 5 Weeks	Year 5 Terms
<b>Program Enrollment</b>															
New Enrollment			10				12			14			16		
Continuing Enrollment							9			19			30		
<b>Total Enrollment</b>			10				21			33			46		

Revenue	Rate	# students	Total	Rate	# students	Total	Rate	# students	Total	Rate	# students	Total	Rate	# students	Total
Tuition	6236	10	62,360	6423	21	134,885	6616	33	218,320	6814	46	313,455	7019	58	407,083
Tuition -Returning Students						0			0			0			0
Other Fees															
Co-op fees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Donation/endowments															
Govt operating grant (\$*BIU) 1/1.5 BIU	5300	10	53,000	5300	26	135,150	5300	43	225,250	5300	61	323,300	5300	78	413,400
Less Formula Fees	2386	10	(23,860)	2386	21	(50,106)	2386	33	(78,738)	2386	46	(109,756)	2386	58	(138,388)
Other revenues															
<b>Total Revenues</b>			91,500			219,929			364,832			526,999			682,095

<b>Expenses</b>															
<i>Salaries for new faculty &amp; staff</i>															
Faculty Mid Range for Assoc Prof	0.2	110,000	22,000	0.2	115,500	23,100	0.4	121,275	48,510	1.0	127,339	127,339	1.2	133,706	160,447
Faculty Supervision Thesis/MRP	0	10,000	0	0	11,000	0	0	11,550	0	0	12,128	0	0	12,734	0
PD (for instructors)	1900	0.2	380	1900	0.2	380	1900	0.4	760	1900	1.0	1,900	1900	1.2	2,280
Student teaching assistants	1	5,000	5,000	1	5,250	5,250	1	5,512	5,512	1	5,788	5,788	1	6,077	6,077
Student research assistants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Curriculum development	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benefits			4,840			5,082			10,672			28,015			35,298
<b>Total Salary Expense</b>			32,220			33,812			65,454			163,041			204,102

<b>Other Expenses</b>															
Materials and supplies			500			520			541			562			585
Faculty Office			1,500			1,500			3,000			3,000			3,000
Capital equipment															
Library resources			5,000			2,500			2,575			2,652			2,732
Research support (start up grants)			0			0			0			0			0
Information technology															
Printing			1,000			1,040			1,082			1,125			1,170
Advertising, marketing and promotion			1,000			1,040			1,082			1,125			1,170
Travel			0			0			0			0			0
Recruiting costs			2,500			0			2,500			0			0
Grad Financial Support - RA			0			0			0			0			0
Grad Financial Support - TA															
Student Access Guarantee			4,365			9,442			15,282			21,942			28,496
Professional Fees - Accreditation			0			0			0			0			0
Other admin costs															
<b>Total other expenses</b>			15,865			16,042			26,062			30,406			37,152

Total Expenses			48,085			49,854			91,516			193,448			241,255
Contribution Before Overhead			43,415			170,075			273,316			333,552			440,840
<b>Admin Overhead</b>			19,234			19,942			36,606			77,379			96,502
<b>Surplus/ (Deficit)</b>			24,181			150,133			236,710			256,173			344,339



**Input Factors**

Benefits as a percentage of salary	22%
Tuition increase - First Year	3%
Tuition Increase - Second Year	3%
Factor new student enrollment	100%
Average change faculty salary/ben	5%
Admin overhead	40%
Ratio scholarship	10%
Rate of annual fee increase	3%
Student Access Guarantee	7.00%

**Appendix C: Program-Level Expectations for Data Science Program**

Program-Level Expectations for  
**DATA SCIENCE**  
**at Nipissing University**

**October 2016**

**I. OVERALL PROGRAM EXPECTATIONS**

PROGRAM EXPECTATIONS	BACHELOR'S DEGREE <i>This degree is awarded to students who have demonstrated the following qualities and abilities:</i>	BACHELOR'S DEGREE HONOURS <i>This degree is awarded to students who have demonstrated the following qualities and abilities:</i>
<b>1. DEPTH AND BREADTH OF KNOWLEDGE</b>	<p>a) a general knowledge and understanding of fundamental concepts, methodologies, and theoretical and practical approaches in data science, with some understanding of current advances</p> <p>b) a broad understanding of some topics in mathematics and computer science, foundational for data science, including calculus, discrete mathematics, linear algebra, probability and statistics, algorithms, programming languages, machine learning, artificial neural networks, and their practical importance for data science</p> <p>c) an ability to read, understand, and analyze the literature, including textbooks and other learning materials, in main areas of computer science, mathematics, and data science</p> <p>d) knowledge of foundations of data science</p>	<p>a) a developed knowledge and critical understanding of the key concepts, methodologies, theoretical and practical approaches in data science, and understanding of current advances</p> <p>b) a developed understanding of main topics in mathematics and computer science, foundational for science and technology, including calculus, discrete mathematics, linear algebra, probability and statistics, algorithms, programming languages, machine learning, artificial neural networks, and their practical importance and application in data science</p> <p>c) a developed ability to read, understand, and analyze literature related to data science, including books and research papers</p> <p>d) knowledge of foundations of data science, in-depth knowledge of a particular topic in data science, and experience in research in this topic in the form of supervised research projects, which include presentations and written reports</p>

	<p>e) ability to apply computational and mathematical knowledge to real-life problems related to big data and to data analytics, and to create solutions for such problems, in particular in the form of mathematical models and software applications</p> <p>f) critical thinking and analytical, problem-solving, and programming skills that can be used in the context of data science</p>	<p>e) ability to apply computational and mathematical knowledge to real-life problems related to big data and to data analytics, and to create solutions for such problems, in particular in the form of mathematical models and software applications</p> <p>f) developed critical thinking and advanced analytical, problem-solving, and programming skills, that can be used in the context of data science</p>
<b>2. KNOWLEDGE OF METHODOLOGIES</b>	<p>a) an understanding of standard problem-solving ideas and techniques used in data science</p> <p>b) ability to evaluate the appropriateness of different approaches to solve problems using well established ideas, techniques, and algorithms</p> <p>c) ability to apply problem-solving and programming ideas and techniques in various contexts</p> <p>d) some understanding of historical development of data science and its present structure</p>	<p>a) an understanding of standard problem-solving ideas and techniques used in data science, and some understanding of “leading-edge” approaches, and how new areas of data science emerge</p> <p>b) ability to evaluate the appropriateness of different approaches to solve problems using well-established ideas, techniques, and algorithms</p> <p>c) developed ability to apply problem-solving and programming ideas and techniques in various contexts</p> <p>d) understanding of historical development of data science and its present structure</p> <p>e) some understanding of current trends in data science</p>
<b>3. APPLICATION OF KNOWLEDGE</b>	<p>a) ability to design and to implement algorithms in a suitable programming language</p>	<p>a) developed ability to design and to implement algorithms in a suitable programming language</p>

	<p>b) an ability to assess and prove correctness of solutions and algorithms</p> <p>c) an ability to gather, comprehend, and analyze new scientific knowledge from various sources and apply it to solve a given problem</p> <p>d) an ability to pose their own scientific and applied-type questions and problems and evaluate the appropriateness of approaches to solve them</p> <p>e) ability to think independently</p>	<p>b) an ability to assess and prove correctness of solutions and algorithms</p> <p>c) an ability to gather, comprehend, and analyze new scientific knowledge from various sources and apply it to solve a given problem</p> <p>d) an ability to pose their own scientific and applied-type questions and problems and evaluate the appropriateness of approaches to solve them</p> <p>e) developed ability to think independently, and ability to formulate appropriate projects for research and study independently</p>
<b>4. COMMUNICATION SKILLS</b>	<p>a) an ability to communicate information, arguments, and analyses, both orally and in writing, to a range of audiences</p> <p>b) an ability to communicate scientific ideas, algorithms, questions, solutions, both orally and in writing, in a concise, clear, logical, and correct way</p>	<p>a) a developed ability to communicate information, arguments, and analyses, both orally and in writing, to a range of audiences</p> <p>b) a developed ability to communicate scientific ideas, algorithms, questions, solutions, both orally and in writing, in a concise, clear, logical, and correct way</p> <p>c) an ability to participate in discussions of advanced topics in data science</p> <p>d) a general understanding of principles of writing of research papers in science and engineering, including format, style, and citations</p>

<b>5. AWARENESS OF LIMITS OF KNOWLEDGE</b>	a) an understanding of the limits of their own knowledge and an awareness of how these might affect their own analyses and interpretations	a) an understanding of the limits of their own knowledge and an awareness of how these might affect their own analyses and interpretations  b) an understanding of the limits of scientific knowledge
<b>6. AUTONOMY AND PROFESSIONAL CAPACITY</b>	a) the exercise of good judgment, initiative, personal responsibility and accountability in both personal and group contexts  b) an ability to apply problem-solving skills  c) an ability to work effectively and collegially with others  d) an ability to identify their own learning needs, including seeking assistance to identify and address weaknesses; an ability to identify goals for their degree and beyond, including selecting an appropriate program for further study  e) behaviour consistent with academic integrity and social responsibility	a) the exercise of good judgement, initiative, personal responsibility and accountability in both personal and group contexts  b) an ability to apply problem-solving skills and make decisions in complex contexts  c) an ability to work effectively and collegially with others  c) an ability to identify their own learning needs, including seeking assistance to identify and address weaknesses; an ability to identify goals for their degree and beyond, including selecting an appropriate program for further study  e) behaviour consistent with academic integrity and social responsibility

## II. STAGED PROGRAM EXPECTATIONS

a) At the completion of **1000-level courses**, successful students will have demonstrated the following abilities:

- a general knowledge and critical understanding of key concepts, methodologies, theoretical approaches in data science;
- a general understanding of the main topics in mathematics and computer science that are foundational for data science, including calculus, discrete mathematics, linear algebra, algorithms, programming languages, and the practical importance of these topics;
- ability to read, understand, and analyze introductory texts in computer science and mathematics;

- an understanding of some standard problem-solving ideas and techniques in mathematics, computer science, and data science;
- initial ability to evaluate the appropriateness of different approaches to solve problems using well established ideas, techniques, and algorithms;
- initial ability to design and to create algorithms and to implement and test them in programming code;
- initial ability to assess the correctness of solutions and algorithms and to analyze programming code;
- some understanding of the historical development of data science and its present structure;
- ability to think independently;
- an initial ability to communicate scientific ideas, algorithms, questions, solutions, both orally and in writing.

b) At the completion of **2000-level courses**, successful students will have demonstrated the following abilities:

- understanding of the main topics in mathematics and computer science, foundational for data science, including calculus, probability and statistics, and other stream-specific topics, and the practical importance and applications of these topics;
- initial ability to apply computational and mathematical knowledge to real-life problems involving big data and data analytics, and to design or propose solutions for such problems, in particular in the form mathematical models and software applications
- understanding of standard problem-solving ideas and techniques used in data science;
- ability to evaluate the appropriateness of different approaches to solve problems using well-established ideas, techniques, and algorithms
- ability to design, create, implement, and test algorithms in programming code;
- an ability to assess and prove correctness of solutions and algorithms;
- initial ability to gather, comprehend, and analyze new scientific knowledge from various sources;
- initial ability to pose their own scientific and applied-type questions and problems and evaluate the appropriateness of approaches to solve them;
- ability to think independently;
- ability to communicate scientific ideas, algorithms, questions, solutions, both orally and in writing, in a concise, clear, logical, and correct way.

c) At the completion of **3000-level courses**, successful students will have demonstrated the following abilities:

- a general knowledge and critical understanding of the key concepts, methodologies, theoretical and practical approaches in data science, with some understanding of current advances;
- a broad understanding of the main topics in mathematics and computer science, foundational for data science, including calculus, discrete mathematics, linear algebra, probability and statistics, algorithms, programming languages, machine learning, artificial neural networks, and the practical importance and applications of these topics;
- ability to read, understand, and analyze the literature related to data science, including books and research papers;

- ability to apply computational and mathematical knowledge to real-life problems involving big data and to create solutions for such problems, in particular in the form mathematical models and software applications;
- critical thinking and advanced analytical, problem-solving, and programming skills, that can be used in the context of data science;
- basic understanding of how new areas of data science emerge;
- ability to evaluate the appropriateness of different approaches to solve problems using well established ideas, techniques, and algorithms;
- ability to apply problem-solving and programming ideas and techniques in various contexts;
- understanding of the historical development of data science and its present structure;
- ability to design, create, implement, and test algorithms in programming code;
- an ability to gather, comprehend, and analyze new scientific knowledge from various sources and apply it in various contexts
- an ability to pose their own scientific and applied-type questions and problems and evaluate the appropriateness of approaches to solve them;
- developed ability to think independently;
- a developed ability to communicate scientific ideas, algorithms, questions, solutions, both orally and in writing, in a concise, clear, logical, and correct way.

d) At the completion of **4000-level courses**, successful students will have demonstrated the following abilities:

- a developed knowledge and critical understanding of the key concepts, methodologies, theoretical and practical approaches in data science, and an understanding of current advances, and in-depth knowledge of a specific area of data science;
- a developed understanding of main topics in mathematics and computer science, foundational for data science, including calculus, discrete mathematics, linear algebra, probability and statistics, algorithms, programming languages, machine learning, artificial neural networks, and the practical importance and applications of these topics;
- developed ability to read, understand, and analyze texts related to data science, including books and research papers;
- an in-depth knowledge of a topic in data science, and experience in supervised research in this topic in the form of research projects, which include presentations and written reports;
- developed critical thinking and advanced analytical, problem-solving, and programming skills, that can be used in the context of data science;
- some understanding of current trends in data science;
- developed ability to design, create, implement, and test algorithms in programming code;
- ability to formulate appropriate projects for research and to study independently;
- developed ability to communicate information, arguments, and analyses, orally and in writing to a range of audiences;
- ability to participate in discussions of advanced topics in data science;
- general understanding of principles of writing of research papers in science and engineering, including format, style, and citations.

**Note:** Expectations listed in part 5 are gradually achieved during the program of study. Components insuring the fulfillment of expectations listed in part 6 are integrated in various courses in the program. Also, the Department of Computer Science and Mathematics insures the fulfillment of expectations listed in part 6 by means of periodic assessment and feedback. The Department expects a consistent demonstration of good judgment, personal responsibility, and academic integrity from all students throughout their program of study.



# Conference Call with Council of Ontario Universities Ontario Council of Academic Vice Presidents

Thursday, March 17<sup>th</sup>, 2016



# Purpose of Call

- The financial services sector, headquartered in Toronto region, has identified a critical need for talent in financial services technology or fintech, particularly in the areas of cybersecurity, data analytics or data scientists.
- The Centre of Excellence in Financial Services Education (COE), part of the Toronto Financial Services Alliance, wants to explore mutually beneficial solutions to meet these talent gaps and/or mismatches.
- Given your role in the university community, your advice and feedback would be extremely helpful:
  - What is your perception of the problem?
  - What kind of strategies could be helpful in resolving it?

# Centre of Excellence

***Vision:*** To have a talent base capable of supporting a “top ten” international financial centre.

## ***Mission:***

- Using a human capital framework, conduct primary and secondary research on the talent needs of the industry;
- Work with employers/educators to improve focus, alignment, quality of education programs to meet talent needs;
- Encourage cross-sector dialogue on talent and education-related issues;
- Showcase region’s talent strengths, career opportunities in financial sector.

## ***Mandate:***

- Multi-stakeholder engagement;
- Talent research;
- Talent attraction;
- Education engagement;

# Overall TFSA/COE strategic objectives, strategies

## **1. *Drive growth:***

- Identify industries' talent needs for growth;
- Facilitate integration of newly attracted businesses into the cluster and expansion of existing foreign investors.

## **2. *Build reputation:***

- Market advantages of talent cluster to attract talent;
- Market advantages of talent cluster to attract new investors.

## **3. *Strengthen competitiveness:***

- Maintain and enhance talent competitiveness relative to other hubs;
- Develop and maintain human capital advantage.

# Will financial services be “uberred?”

## Defining fintech disruption

“A stale (historic) answer: Technology that relates to conducting financial services activities, with the end client/user being a financial institution. In 2015, fintech is now more “innovation in financial services” that is technology led and more market disruptive, that serves the clients of financial institutions, covering not only the back and middle offices but also the coveted front office that for so long has been human-driven.”

- Financial Services technology or “fintech” is both the biggest threat and the biggest opportunity for financial companies.
- While new disruptive technologies threaten the companies’ entire business model, new technologies also provide the solutions to many of the industry’s challenges – economic and competitive pressures, regulatory and compliance requirements.

# Will FS be “uberated” (cont)

- New payment methods robo-advisors, crowdfunding, currencies, marketplace lending, security. Every facet of financial services will be affected.
- Fintech investment has more than tripled since 2008 as financial companies seek to adapt.
- As financial services is now the largest private sector employer in the Toronto region, the stakes are high if they cannot do so.
- One of the major determinants of their success in adapting, will be the quality and the availability of the talent.
- What is needed is a new kind of business analyst – the data scientist – a new breed that appears to be in short supply.
- COE researching this issue to assess need and identify solutions: what are the skill sets, where is the talent, how to hire and retain them, developing job profiles, drilling down on cybersecurity.

# What the research says

## Sample Data Scientist Activities:

- Advise the business, make forecasts
- Aggregate data, statistically analyse and interpret
- Analyse customers, customer behaviour, networks of consumers and products
- Analyse patterns, risks, opportunities, risk model
- Ask questions of data not asked before
- Detect fraud
- Develop service offerings
- Perform statistical modeling
- Solve business problems using data and analytics
- Track trends
- Tackle large and difficult problems
- Acquiring, preparing, integrating large and diverse data sets for analysis
- Connecting the results of analyses to business issues

# What the research says (cont)

## Sample Job Titles

- Actuary
- Analyst or business analyst
- Client insight and statistical modeller
- Consultant
- Data modeller
- Data scientist
- Developer
- Financial analyst
- Market research analyst
- Marketing modeller
- Predictive modeller
- Quantitative investment analyst
- Risk analysis architect



# What the research says (cont)

## Critical Capabilities

- Ability to think conceptually; capable of problem identification and resolution;
- Ability to explore and gain insight from data; detail oriented;
- Strong commitment to excellence, personal, professional growth;
- Knowledge of statistical analysis; ability to thrive in fast-paced environment;
- Ability to work in teams, collaboratively, across business lines and functions;
- Ability to translate business objectives into actionable analyses;
- Business acumen; ability to multi-task or to work independently;
- Ability to communicate complex material to non-specialist audience;
- Ability to create high-quality dashboards, reports, data visualization tools;
- Advanced degree in a quantitative field

# What the research says (cont)

## *“Where do you get your data science talent?”*

“We poach from other banks...other insurance companies...other asset management companies...other financial service companies.”

“It’s not a big community...it’s all about who you know.”

“Toronto is an asset...lot of opportunities to hire from others in the industry”

- Colleges and university recent graduates – rapid growth in data science educational opportunities
- But employers say there is a gap between what we they are looking for and what education programs emphasize.
- Schools emphasize statistical analysis, for example. Employers want conceptual thinking and creative problem solving.
- “The distinctive mix of capabilities required by employers of data scientists appears to call for innovative approaches to their education and training.”

# Recommendations

- Technical skills are important, but so are the higher cognitive skills;
- Job seekers need to have a clearer sense of the many different roles and their own strengths;
- More clarity required in job ads about what employers specifically require;
- Challenge of new employees requiring a “ramp up”;
- Would the use of academic-industry consortia be useful to develop data scientist talent more closely aligned with employers’ needs?
- Employers must look to other sectors to source such talent;
- Talent management practices need to evolve to manage this new breed of highly-specialized talent

# Discussion

What is your perception of the problem?

What kind of strategies could be helpful in resolving it?

How do we strengthen the relationship between academia and the industry to respond?

# Thank You

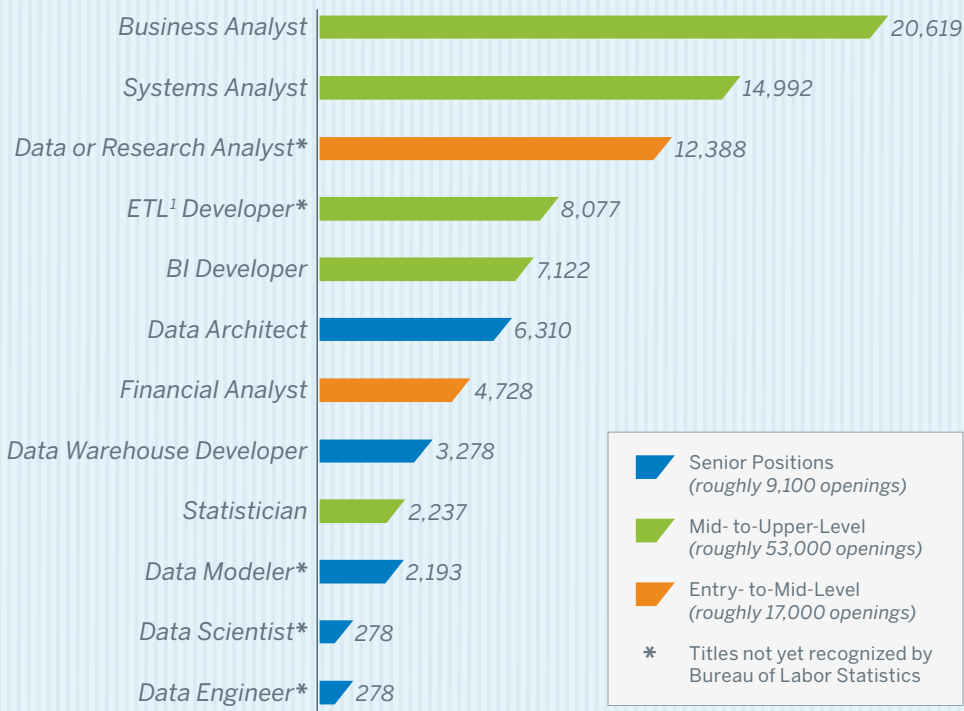


# How Will **BIG DATA** Reshape the Workforce?

BIG DATA—the capture and analysis of information from e-commerce, digital imaging, smartphones, and social media—is expected to be “the next oil,” an asset becoming cheaper and more ubiquitous by the day as it creates new job categories and transforms business models across industries.

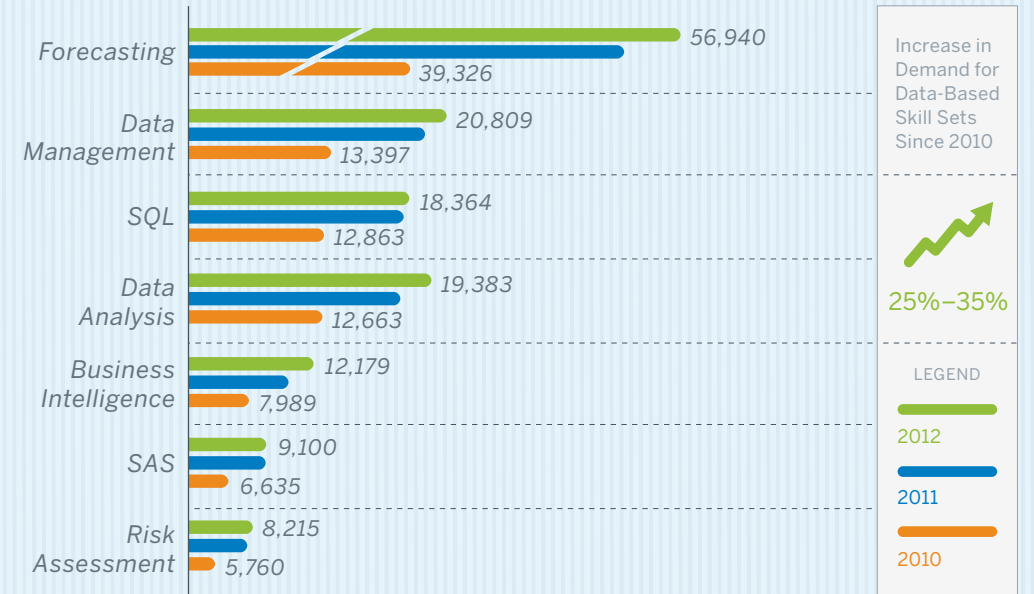
## FASTEST GROWING JOBS

TOP DATA ANALYTICS JOB TITLES, 2012  
Mid-Level Roles Already Prominent; Senior Roles Emerging

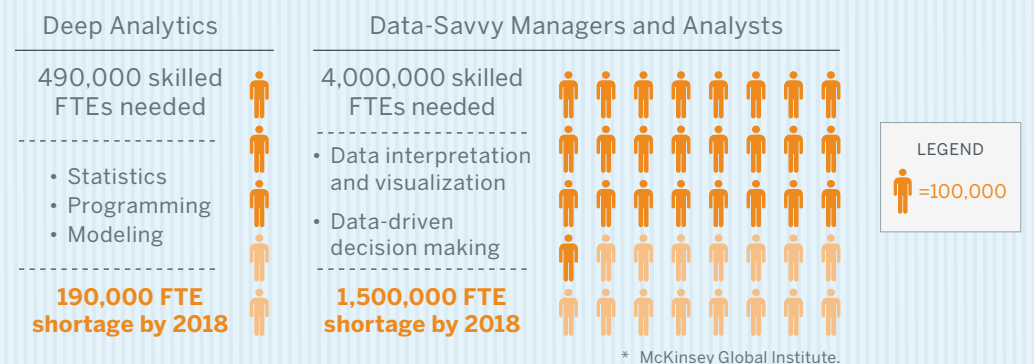


## PROFILE OF THE DATA-SAVVY MANAGER

RIISING DATA SKILLS DEMAND AMONG MANAGEMENT JOB POSTINGS

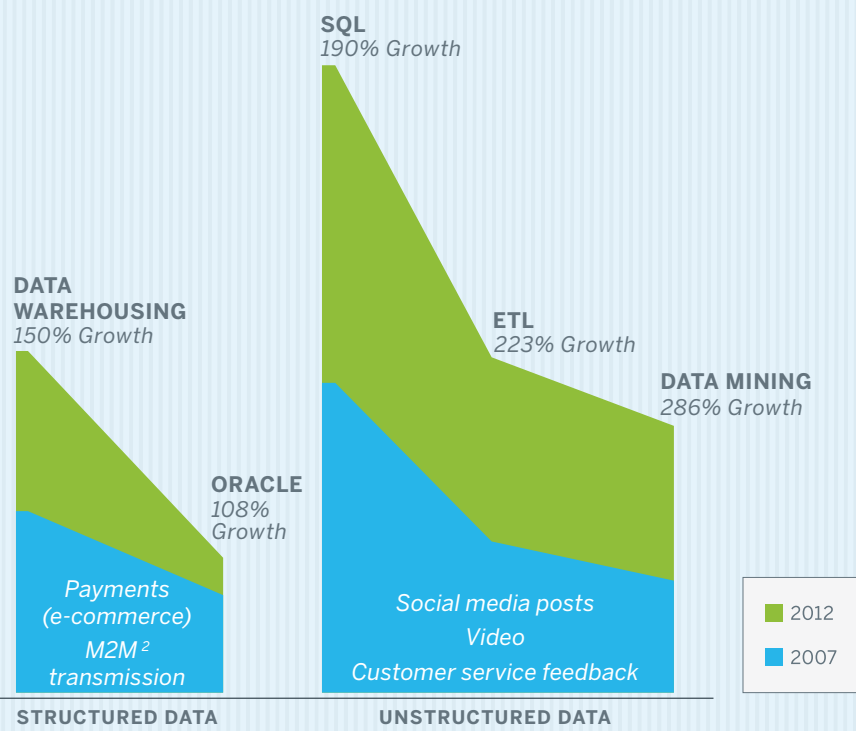


PROJECTED “BIG DATA” SKILLS DEFICIT by 2018\*  
Overwhelming Need for Data-Savvy Managers

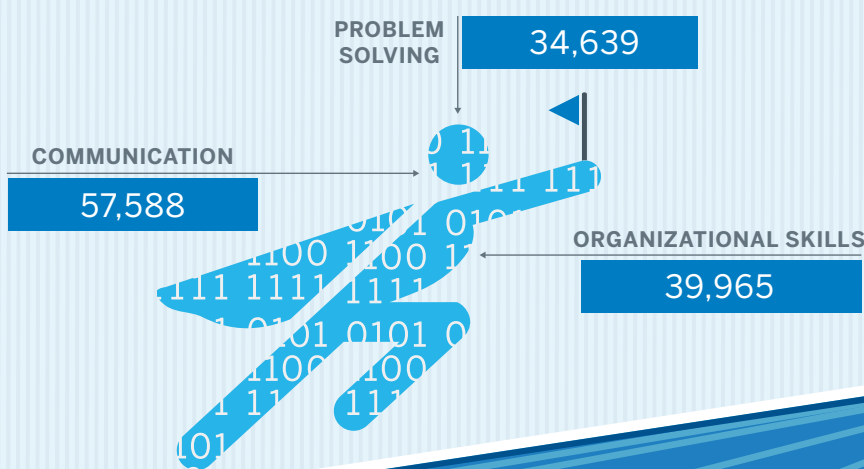


## HOTTEST TECHNICAL SKILLS

FIVE-YEAR DEMAND INCREASE for CRITICAL DATA MINING SKILLS  
Fastest Growth in “Messy” Unstructured Data

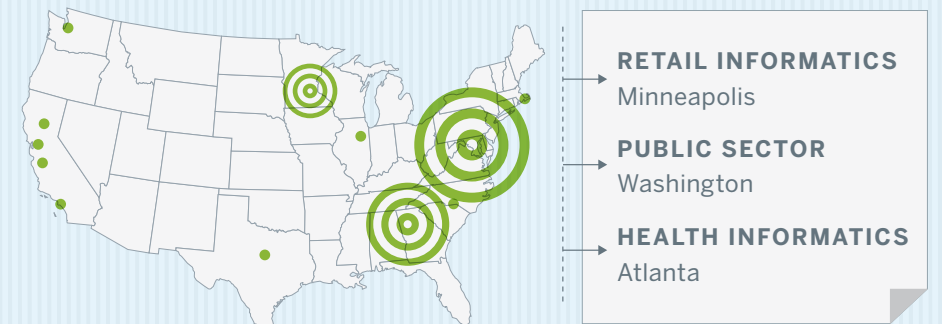


MOST REQUESTED GENERALIST SKILLS in “BIG DATA” JOB POSTINGS

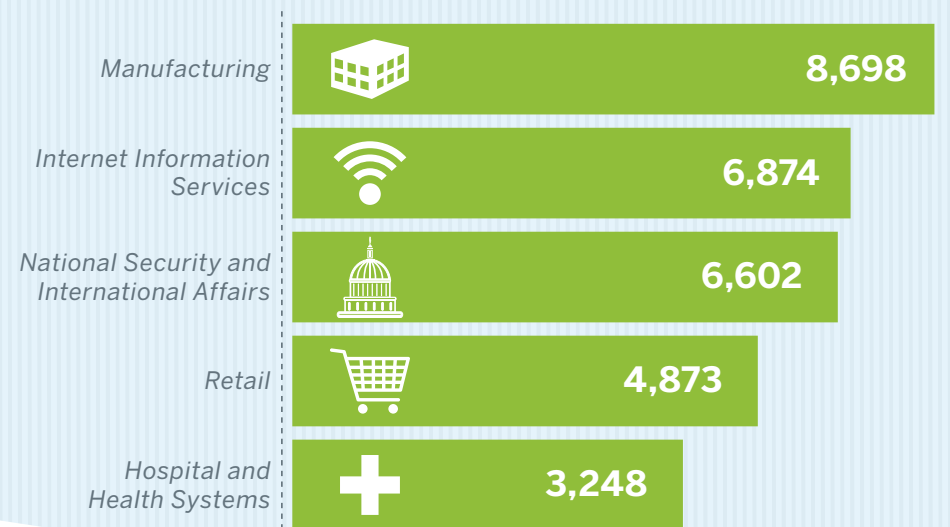


## TRANSFORMING INDUSTRIES

HOTTEST METRO AREAS for DATA ANALYTICS JOBS



BIG DATA JOB POSTINGS by INDUSTRY



# BIG DATA





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## The EAB Daily Briefing

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# 3 academic programs in high demand

Some fields in STEM have more job openings than employees to fill them

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June 06, 2016

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Meris Stansbury of *eCampus News* highlights three fields of study with promising career prospects for students entering the job market.

Stansbury used data from **Glassdoor**, **CareerBuilder**, **Economic Modeling Specialists**, and recent education sector research to compare the value of academic programs for both students and colleges.

### 1. Data science/Data administration

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Data science is an interdisciplinary field incorporating aspects of statistics, data mining, and predictive analytics. Data administration, or data resource management, spans the fields of information systems in managing data resources.

According to Glassdoor, data scientists earn an average base salary of \$105,395 and there are currently more than 3,400 job openings. A similar position, the database administrator, earns an average base salary of \$97,258 and the number of job openings currently exceeds 9,000.

### How COE units can help close the skills gap and prepare students for the workforce

These positions are in high demand and the number of undergraduate students studying statistics has been steadily increasing, according to Stansbury. However, many more students must go into statistics to meet job market demand.

Data science is becoming a popular major, but market demand is so high that colleges still aren't producing enough graduates to fill employer needs, according to the **National Center for Education Statistics** and the **American Statistical Association**. The **Massachusetts Institute of Technology**, **University of Colorado Boulder**, and **Stanford University** have all invested more in

data-related academic programs.

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## 2. IT Management/Network administration

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Information technology (IT) managers govern an organization's IT resources according to its strategic goals. Similarly, network administrators and systems administrators keep organizations' computer networks current and functional.

The average base salary for an IT manager is \$115,725, and the field expanded by more than 42,000 positions between 2010 and 2015. There's a huge gap between the number of jobs posted each month and the number of people hired. CareerBuilder and Economic Modeling Specialists found over 21,000 more postings than hires each month on average.

However, few teenagers and young adults express interest in IT as a career, according to a [report](#) from **CompTIA**. The main reason is that they lack enough information about the field, researchers discovered.

Some institutions are helping bridge that knowledge gap. **Ohio State University** (OSU) has partnered with **Hyland Software** to provide students with internships at the company so that they can take the skills they have learned to work for OSU's Office of the Chief Information Officer. **Georgia Southern University** has partnered with a mobile repair company to teach students about their devices.

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## 3. Cybersecurity management/Security engineering

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Cybersecurity managers protect information systems from theft, damage, and disruption. Security engineers design defenses that protect information systems from potential threats such as hacking or natural disasters.



Click below to access **state dashboards**



**Dashboard: See the hottest jobs, skills, and employers in your state**

Security engineers earn an average base salary of \$102,749, and the field expanded by more than 15,000 positions between 2010 and 2015. Like demand for IT managers, demand for cybersecurity professionals far exceeds the supply. According to CareerBuilder and Economic Modeling Specialists, the gap between monthly job postings and hires for security managers/analysts exceeds 27,000.

**Champlain College** offers degrees and industry certificates in computer forensics, digital investigation, and cybersecurity. **Intel** recently awarded the **Rochester Institute of Technology** a \$25,000 gift to fund initiatives in strategic thinking and cybersecurity (Stansbury, [eCampus News](#), 5/9).

# Closing Canada's Big Data Talent Gap



Canada's Big Data Consortium  
October 2015

We would like to thank the following organizations for their leadership and in-kind contributions to Canada's Big Data Consortium, Canada's Big Data Talent Gap Study, and to this paper, "Closing Canada's Big Data Talent Gap."







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## Executive Summary

Big Data and Analytics<sup>1</sup> are under pressure. Bold promises have been made: exceptional customer insights; better decision-making; improved productivity and performance; and product and service innovation. Positive public and social outcomes have been proposed: improved health care, social services, public safety, and infrastructure; and strengthened research and development, commercialization, and economic growth. Now, it's time to deliver.

But the promise of Big Data and Analytics faces a key constraint: a talent gap that is felt across all of Canada's regions, sectors, and industries. To date, closing this talent gap has posed a significant challenge – in large part because organizations typically have been looking for “unicorns,” those individual candidates with the perfect mix of technical, business, as well as industry and functional knowledge and expertise.

As employers struggle to recruit, retain, and train enough of the right talent to collect, organize, analyze, interpret, and communicate today's unprecedented volumes of data, Big Data and Analytics are at risk of becoming a promise unrealized.

Figure 1. The Promise of Big Data is Constrained by Canada's Big Talent Gap



<sup>1</sup> In this paper, “Big Data and Analytics” may also be referred to as “Big Data,” for brevity.

## What Does Canada's Big Data and Analytics Talent Gap Look Like? What Can Be Done?

In a report published 2011, it was estimated that by 2018 the United States alone faces a talent gap of 140,000 to 190,000 professionals with deep analytical skills, and 1.5 million more to interpret and use findings effectively for decision making<sup>2</sup>. How big is this talent gap in Canada, and what can we do to address it?

This paper, "*Closing Canada's Big Data Talent Gap*," represents the results of the first in-depth examination of the size and nature of Canada's Big Data Talent Gap<sup>3</sup>. Prepared on behalf of Canada's Big Data Consortium, which was formed by Ryerson University in 2014, this study has benefitted from the participation of organizations from coast-to-coast, and across multiple sectors – industry, government, and academia.

Through a two-phased research process, we found that Canada's Big Data Talent Gap is estimated between 10,500 and 19,000 professionals with deep data and analytical skills, such as those required for roles like Chief Data Officer, Data Scientist, and Data Solutions Architect. The gap for professionals with solid data and analytical literacy to make better decisions is estimated at a further 150,000, such as those required for roles like Business Manager and Business Analyst.

We found that Canadian employers across all regions, sectors, and industries are finding it increasingly difficult to recruit, retain, and train Big Data and Analytics professionals. We discovered that Ontario, particularly the Greater Toronto Area, is currently the demand epicentre for Big Data and Analytics talent. And we learned that the industries feeling the most pressure for talent include Finance and Insurance, and Professional, Scientific and Technical Services.

And by all accounts, the situation will worsen unless we take action now. Even when the overall gap is narrowed, we believe a shortage of talent with the right skills will persist unless existing academic and training curriculum are expanded to better meet employers' needs.

Working with senior information technology and information management leaders in Canada, the Consortium has developed six strategies, presented in this paper, to help close this country's Big Data and Analytics talent gap.

But there are no quick-fixes. Constantly changing labour market dynamics mean we will need to remain fluid and adaptable. But we believe the strategies presented in this paper represent solid first steps to help close the talent gap and ensure that Canada is positioned to realize the potential of Big Data and Analytics.

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<sup>2</sup> "Big Data: The Next Frontier for Innovation, Competition, and Productivity," McKinsey & Company, 2011.

<sup>3</sup> In this paper, the "*Big Data and Analytics Talent Gap*" will also be referred to as the "*Big Data Talent Gap*," or the "*Talent Gap*," for brevity.

# Canada's Big Data Talent Gap Study

In 2014, Ryerson University launched Canada's Big Data Consortium to bring industry, government, and academia together to collaborate on key issues related to Big Data and Analytics. The Consortium's founding partners include:



For its inaugural project, the Consortium led the first national, multi-sector study on Canada's Big Data and Analytics Talent Gap. Our objectives were to better understand the breadth and depth of the talent gap, as well as to develop strategies to help close the gap so that Canada can continue to innovate, compete, and grow its economy.

## Phase One: Online Survey and Labour Market Research

From October 2014 to January 2015, a national online survey was conducted. The survey was open to Canadian public and private sector organizations of all sizes, regions, sectors, and industries. A total of 332 survey submissions were received, including 124 completed and 208 partially completed submissions. The findings from the online survey will be published in a subsequent paper.

From February to July 2015, labour market research was conducted, involving an analysis of over 1,700 Big Data and Analytics related jobs posted in 2013 and 2014 from Magnet ([www.magnet.today](http://www.magnet.today)), and over 330 jobs posted in July 2015 from LinkedIn® Corporation ([www.linkedin.com](http://www.linkedin.com)).

## Phase Two: Canada's Big Data Talent Gap Summit

On April 15, 2015, Canada's Big Data Talent Gap Summit was held. Hosted at Deloitte's Greenhouse in Toronto, the Consortium brought together 30 senior information technology and information management executive participants from leading industry, government, and academic organizations across Canada. Our objectives were to discuss the current state of the talent gap, to share strategies and best practices in recruitment and retention, and to collaborate on the development of strategies for closing the talent gap.

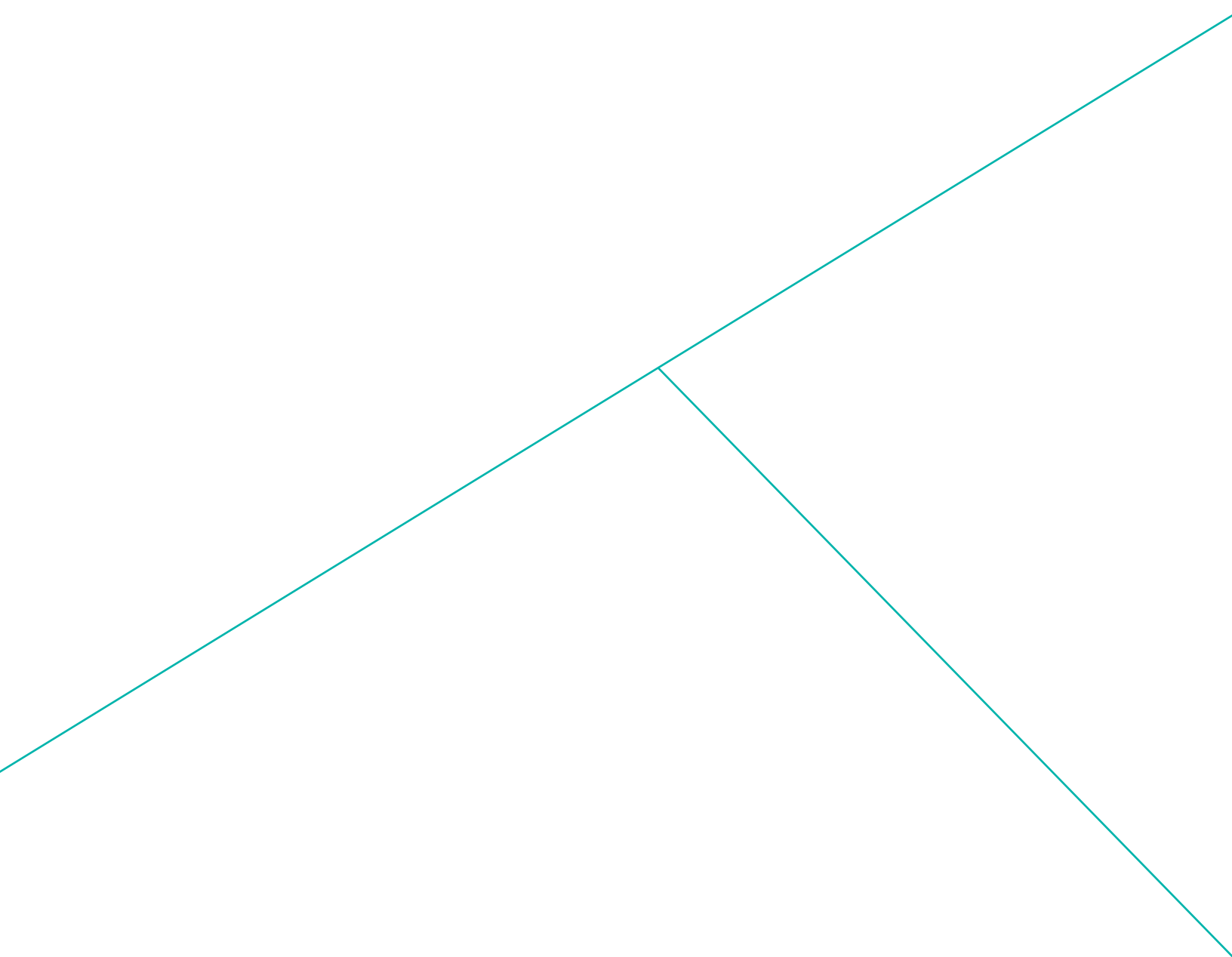
This paper presents the outcomes of our study.

## Part One: Canada's Big Data Talent Gap: A Tale of Two Gaps

In the first portion of Canada's Big Data Talent Gap Summit proceedings, the results of *Phase One: Online Survey and Labour Market Research* were presented.

Our research found that there were two distinct Big Data and Analytics Talent Gaps: (1) an overall shortage of talent to meet employers' demand, "I Need Talent"; and (2) a shortage of the specific type of talent that employers are demanding, "I Need the Right Talent."

This section presents the highlights.





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**Based on our sample of LinkedIn® Jobs, two industries alone accounted for 57% of the demand for Big Data and Analytics talent: (1) Finance and Insurance, representing 29% of relevant job postings; and (2) Professional, Scientific and Technical Services, representing 28% of relevant job postings**

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1,746 Big Data, Analytics Job Postings Analyzed  
(2013-14)



339 Big Data, Analytics Job Postings Analyzed,  
including 71 postings with "Big Data" and "Data  
Scientist" in Title (July 2015.)

## Gap 1: “I Need Talent”

In its 2011 report, *“Big Data: The Next Frontier for Innovation, Competition, and Productivity,”* McKinsey & Company estimated that by 2018 “the United States alone faces a shortage of 140,000 to 190,000 people with deep analytical skills as well as 1.5 million managers and analysts to analyze big data and make decisions based on their findings.”

If Canada’s labour market is approximately 10% the size of our U.S. counterpart<sup>4</sup>, using the U.S. figures above, Canada’s overall shortage of talent can be estimated at between 14,000 to 19,000 professionals with deep analytical skills, and 150,000 data literate managers and analysts.

To test and refine this estimate, we turned to Magnet ([www.magnet.today](http://www.magnet.today)), an online job matching service with over 2.4 million jobs stored from sample years 2013-2014 alone. Setting a series of primary search criteria related to Big Data and Analytics, we found 696 and 1,050 relevant job postings in 2013 and 2014, respectively<sup>5</sup>.

According to some estimates, the hidden job market – where job openings are not publicized – accounts for up to 80-90% of hires. Using a conservative estimate where only 10% of open positions are actually publicized, and Magnet’s data point of 1,050 relevant job postings in 2014, Canada’s estimated demand for professionals with deep analytical skills can be estimated at 10,500.

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**We estimate Canada’s Big Data Talent Gap is between 10,500 and 19,000 professionals with deep data and analytical skills, such as those required for roles like Chief Data Officer, Data Scientist, and Data Solutions Architect.**

**We further estimate the gap for professionals with solid data and analytical literacy to make better decisions at 150,000, such as those required for roles like the Business Manager and Business Analyst.**

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Thus, we estimate Canada’s Big Data Talent Gap is between 10,500 and 19,000 professionals with deep data and analytical skills, such as those required for roles like Chief Data Officer, Data Scientist, and Data Solutions Architect. We further estimate the gap for professionals with solid data and analytical literacy to make better decisions at 150,000, such as those required for roles like the Business Manager and Business Analyst.

These numbers are intimidating, but they only illustrate part of the challenge. To truly tackle the talent gap, we believe that understanding its composition is essential to developing targeted strategies.

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<sup>4</sup> According to Statistics Canada, Canada’s population in 2014 was approximately 35.4 million. According to the United States Census Bureau, the U.S. population in 2015 is approximately 321.5 million. Thus, Canada’s labour market is estimated at approximately 10% of its U.S. counterpart.

<sup>5</sup> Given this targeted sample search criteria, highly relevant jobs with titles that contain terms other than Big Data and Analytics may not have been captured, meaning that actual demand is potentially even greater.

## Gap 2: “I Need the Right Talent”

To better understand the shortage of the specific type of talent that employers are demanding, we turned to LinkedIn<sup>6</sup> (www.linkedin.com). Using LinkedIn<sup>®</sup> Jobs, we identified 339 relevant open and existing job postings across Canada for further analysis. Here are some highlights of what we found.

### *Ontario is the Demand Epicentre for Big Data and Analytics Talent*

Based on our sample of LinkedIn<sup>®</sup> Jobs, Ontario – specifically the Greater Toronto Area – is currently the demand epicentre, accounting for 77% of relevant job postings.

Three other regions showed demand for Big Data and Analytics talent: British Columbia, representing 8% of relevant job postings; and Quebec and Alberta each representing 6% of relevant job postings.

### *Finance and Insurance, and Professional, Scientific and Technical Services Industries are Driving Demand for Big Data and Analytics Talent*

Based on our sample of LinkedIn<sup>®</sup> Jobs, two industries<sup>7</sup> alone accounted for 57% of the demand for Big Data and Analytics talent: (1) Finance and Insurance, representing 29% of relevant job postings; and (2) Professional, Scientific and Technical Services, representing 28% of relevant job postings. Information and Cultural Industries came in third, accounting for 12% of relevant job postings.

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**To truly tackle Canada’s Big Data Talent Gap, we believe that understanding its composition is essential to developing targeted strategies.**

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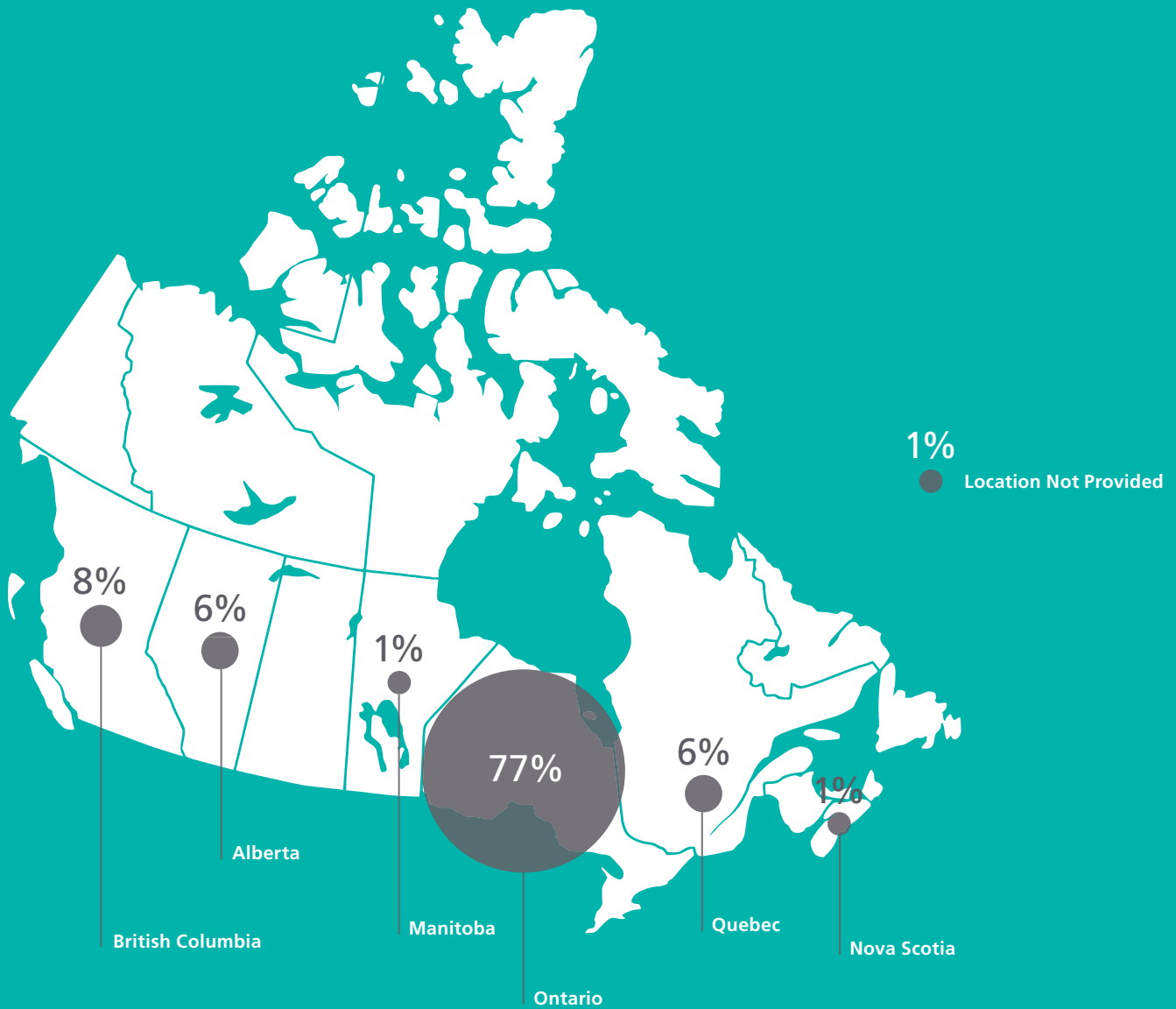
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<sup>6</sup> Using LinkedIn<sup>®</sup> Jobs, 339 relevant and open existing jobs were identified: 39 jobs with “Big Data” in the title; 32 jobs with “Data Scientist” in the title; and 268 jobs with “Analytics” in the title (July 2015).

<sup>7</sup> In this study, the North American Industry Classification System (NAICS) was used for industry classifications.

Figure 2. Ontario is the Demand Epicentre for Big Data and Analytics Talent

Based on our sample of LinkedIn® jobs, Ontario — specifically the Greater Toronto Area — is currently the demand epicentre, accounting for 77% of relevant job postings.



## Employers are Demanding More Than Just Technical Skills

Based on our sample of LinkedIn® Jobs, we found that for all of the 71 open and existing postings with “Data Scientist” and “Big Data” in the job title, project management and consulting-related skills were identified as either a job requirement or a qualification requirement.

Specifically, all of the jobs within this sample set cited project management, or tasks associated with project management (e.g. overseeing the design, development, implementation of Big Data or Analytics solutions or initiatives), as requirements.

Moreover, all of the jobs within this sample set also cited consulting-related skills (e.g. communications, client interviews for business problem assessment, problem definition, as well as solution option development, evaluation, and recommendation) as requirements.

Jobs within this sample set also often cited industry and functional knowledge and experience, but as qualification assets. This will pose a continuous challenge as these skill sets are best gained through on-the-job experience, rather than through curriculum.

While organizations are certainly demanding technical skills such as data mining and data analysis, employers are clearly telling us that their ideal candidates must possess more than just technical skills.

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**Based on our sample of LinkedIn® Jobs, we found that for all of the 71 open and existing postings with “Data Scientist” and “Big Data” in the job title, project management and consulting-related skills were identified as either a job requirement or a qualification requirement.**

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Figure 3. Finance and Insurance, and Professional, Scientific and Technical Services Industries are Driving Demand for Big Data and Analytics Talent



Based on our sample of LinkedIn® jobs, two industries alone accounted for **57%** of the demand for Big Data and Analytics talent.

## Even When the Overall Gap is Narrowed, a Shortage of the Right Talent Will Persist

In *Phase One: Online Survey and Labour Market Research*, a sampling of the offerings currently available in the Greater Toronto Area through universities, colleges, and training companies<sup>8</sup> was analyzed. Here are some highlights of what we found:

- Existing curriculum is typically industry-agnostic. While there are limited industry-specific offerings available (e.g. tailored for Health), our research indicates that other industries, such as Finance and Insurance, and Professional, Scientific and Technical Services, currently represent higher demand for talent, but are not yet addressed by existing curriculum.
- Existing curriculum is typically function-agnostic. While there are limited offerings specific to Sales and Marketing, our research indicates that other functions, such as Corporate Management, Information Technology, and Business Operations, currently represent higher demand for talent, but are not yet addressed by existing curriculum.
- Existing curriculum is typically focused on technical competencies, such as data mining, data analysis, and data solution architecture. Our research indicates limited offerings that cover complementary skills, such as project management and consulting-related skills, which are in demand by employers. This is particularly the case with training companies researched.

Until existing curriculum is expanded to better match employers' needs, even if the overall number of graduates is increased – addressing the “*I Need Talent*” gap – we believe that a shortage of the *right* talent will persist.

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<sup>8</sup> Big Data and Analytics offerings available in the Greater Toronto Area were researched (2014). Ten universities: Athabasca University; Laurier University; McMaster University; Queen's University; Ryerson University; University of Ontario Institute of Technology; University of Toronto; University of Waterloo; University of Western Ontario; and York University. Five colleges: Centennial College; George Brown College; Humber College; Seneca College; and Sheridan College. Three training companies: Learning Tree International, Inc.; Global Knowledge Training LLC; and Simplilearn Solutions.

## Part Two: Six Strategies for Closing Canada's Big Data Talent Gap

In the second portion of Canada's Big Data Talent Gap Summit proceedings, the participants collaboratively explored the question, "*What new strategies should we be considering to help close Canada's Big Data Talent Gap?*"

Participants at the Summit were encouraged to think big, and to develop solutions beyond traditional organizational, industry, sector, and regional boundaries. Six key strategies were proposed. This section presents the highlights.

### 1. Multi-Sector Solution

Canadian organizations across all regions, sectors, and industries are feeling the effects of the Big Data Talent Gap. Even the best efforts to narrow the gap – when done within traditional organizational, industry, sector, and regional boundaries – will have limitations. Canada's Big Data Talent Gap is a multi-sector challenge that requires a multi-sector solution. Ryerson University launched Canada's Big Data Consortium with this in mind, and will continue to facilitate and grow the Consortium to collaboratively tackle key issues related to Big Data and Analytics, including Canada's Big Data Talent Gap.



### 2. Improve Labour Market Clarity

What is a Chief Data Officer, a Data Scientist, a Data Solution Architect, or a Business Manager? And what do they do? In the absence of common professional definitions and career pathways, organizations are struggling to clearly express their Big Data and Analytics talent needs, and prospective talent are finding it difficult to assess their suitability, interest, and candidacy in the field of Big Data and Analytics. Establishing common professional definitions and career pathways would improve labour market clarity; it is a foundational step to tackling Canada's Big Data Talent Gap.




### 3. Better Meet Employer Demands

Canadian organizations are certainly demanding technical skills such as data mining and data analysis, but the employers we researched cited with equal frequency complementary skills, such as project management, and consulting-related skills. To build the next generation of Big Data and Analytics professionals, academia not only needs to increase its supply of curriculum at all levels (i.e. undergraduate, graduate, professional, and executive), it also needs to expand existing curriculum to incorporate these complementary skills. And, as data literacy becomes an imperative for all professionals, academia needs to review its curriculum at all levels – K-12, undergraduate, graduate, professional, and executive – to ensure data skills are embedded at the right level at the right time.






#### 4. Leverage Existing Talent



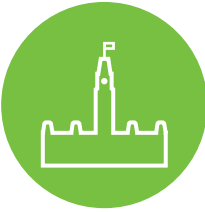
Canadian organizations are relying on recruiting new (external) talent, primarily through traditional recruiting methods to meet Big Data and Analytics requirements. But there are distinct advantages to developing Big Data and Analytics talent from within organizations. Existing (internal) talent possess the deep industry and functional expertise, as well as knowledge of their organization's people, processes, and technologies so essential for extracting value out of data that could potentially take years to acquire. As a complementary strategy to recruiting new talent, organizations should also consider looking in-house to identify additional sources of talent for development.

#### 5. Optimize Talent Utilization



Using shared services models can be an effective strategy to optimize and amplify existing in-house talent to meet an organization's Big Data and Analytics requirements. For organizations that are in the early stages of adoption, such as those looking to complete some proof-of-concepts and pilot projects, a team based model where members collectively fulfill the full spectrum of requirements can be used. As organizations move along the adoption cycle, and Big Data and Analytics often transitions from being a functional resource into an enterprise resource, organizations can begin to build an enterprise-wide Centre of Excellence.

#### 6. Government as Key Enablers



Government is an important advocate of economic growth, competitiveness, and innovation. All levels of government – federal, provincial, and municipal – should collectively assess its strategic levers (e.g. legislation, policies, programs, funding, etc.) to determine which resources could be used to support efforts to close Canada's Big Data Talent Gap, and develop a national talent strategy for Big Data and Analytics accordingly.



# 1. A Multi-Sector Challenge Requires a Multi-Sector Solution

Based on the research conducted in *Phase One: Online Survey and Labour Market Research* and *Phase Two: Canada's Big Data Talent Gap Summit*, Canadian organizations across all regions, sectors, and industries are feeling the effects of the Big Data Talent Gap.

Industry, government, and academia are all struggling to recruit and retain the talent needed to develop and implement Big Data and Analytics strategies and initiatives, and to conduct ground-breaking Big Data and Analytics research and development.

Academia is striving to design and deliver curriculum that will produce enough graduates with the right expertise to meet employers' ever-growing demand for Big Data and Analytics talent. All the while, government is seeking to support the deployment of talent – a critical national resource – to the right place, and at the right time through its labour market policies and programs.

The challenge is clearly complex. Even the best efforts to narrow the talent gap – when done within traditional organizational, industry, sector, and regional boundaries – will have limitations.

Participants at the Summit unanimously agreed:

- Canada's Big Data Talent Gap is a multi-sector challenge that requires a multi-sector solution.
- Canada's Big Data Consortium is an excellent model to facilitate continuing discussion and collaboration.

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**Canada's Big Data Talent Gap is a multi-sector challenge that requires a multi-sector solution. Even the best efforts to narrow the talent gap – when done within traditional organizational, industry, sector, and regional boundaries – will have limitations.**

---

Despite competition among many of these organizations for the same talent, participants at the Summit were candid about their challenges, and were ready to collaborate on strategies to close the talent gap. Here is what the participants proposed:

- Industry and government (as employers) should provide input on talent needs to help academia expand existing curriculum at all levels – including K-12, high school, undergraduate, graduate, professional, and executive – to build up the Big Data and Analytics talent pool.
- Industry should collaborate as a sector (e.g. via industry associations such as the Canadian Electricity Association, and functional associations such as CIO Association of Canada, and Information Technology Association of Canada) on talent retention and recruitment strategies and initiatives.
- Academia should work with industry and government to secure real-world data sets that students can work on, and co-op and internship placements that students can participate in.

This study and paper are the Consortium's first steps to help close Canada's Big Data Talent Gap. Ryerson will continue to work with the Consortium to establish a framework of ongoing collaboration on key issues related to Big Data and Analytics, including Canada's Big Data Talent Gap. Ryerson will also continue to facilitate and grow the Consortium, and strategically build out working groups, particularly around the talent gap strategies presented in this paper.

## 2. Improve Labour Market Clarity: Establish Common Professional Definitions, Career Pathways

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**There is significant variation in professional definitions. What are we referring to when we use the terms, “Big Data,” or the many variants of “Analytics”? What *is* a Chief Data Officer, a Data Scientist, a Data Solution Architect, or a Business Manager? And what do they *do*?**

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Based on the research conducted in *Phase One: Online Survey and Labour Market Research* and *Phase Two: Canada’s Big Data Talent Gap Summit*, there is significant variation in definitions. What are we referring to when we use the terms, “Big Data,” or the many variants of “Analytics”? What *is* a Chief Data Officer, a Data Scientist, a Data Solution Architect, or a Business Manager? And what do they *do*?

What kind of talent are employers looking for? In the absence of common professional definitions, organizations are struggling to clearly express their Big Data and Analytics talent needs.

Likewise, in the absence of these common definitions and career pathways, prospective talent are finding it difficult to assess their suitability, interest, and candidacy in the field of Big Data and Analytics.

Participants at the Summit unanimously agreed that common definitions and career pathways are essential foundational steps to tackling Canada’s Big Data Talent Gap. Here is what the participants proposed:

- Industry, government, and academia should propose common definitions for Big Data and Analytics professions, including: key knowledge, experience, competencies, education, and training; and accreditation options.
- Industry, government, and academia should propose career pathways for prospective talent, and roadmaps on how they could become Big Data and Analytics professionals.
- The initial set of roles for common definitions and career pathways should include: Chief Data Officer; Data Scientist; Data Solution Architect; Business Manager; and Business Analyst.

Ryerson will be seeking input from Consortium members, Summit participants, as well as any other interested academic, industry, and government contributors – leading to the development of these common professional definitions and career pathways. They will be publicly shared and available for re-use.

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**In the absence of common professional definitions and career pathways, organizations are struggling to clearly express their talent needs and prospective talent are finding it difficult to assess their suitability, interest, and candidacy in the field of Big Data and Analytics.**

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### 3. Better Meet Employer Demands: Build More of the Right Types of Talent

Based on the research conducted in *Phase One: Online Survey and Labour Market Research* and *Phase Two: Canada's Big Data Talent Gap Summit*, organizations are looking to academic institutions – universities, colleges, and professional training companies in particular – to take the lead in building the next generation of Big Data and Analytics professionals, and a data-literate workforce.

Academia has a dual societal responsibility. On the one hand, it has a responsibility to develop leading research. But it also has a responsibility to develop a nation's talent pool, and highly employable graduates.

Academia recognizes that it has a critical role in helping close Canada's Big Data Talent Gap by designing and delivering the right curriculum, in sufficient volume and frequency, to meet employer needs. Here is what the participants proposed:

#### **Building the Next Generation of Big Data and Analytics Professionals**

Based on the research conducted in *Phase One: Online Survey and Labour Market Research*, while organizations are looking for candidates with technical skills, such as data mining and data analysis, employers also value candidates' complementary skills, particularly their project management and consulting-related skills.

As discussed on page 12, our research found that existing curriculum is currently limited in its industry-specific offerings, including for in-demand Finance and Insurance and Professional, Scientific, and Technical Services industries. Our research also found that existing curriculum is currently limited in its function-specific offerings to Sales and Marketing, which overlooks other functions, such as Corporate Management, Information Technology, and Business Operations.

Perhaps most importantly, our research found that existing curriculum is typically focused on technical competencies, such as data mining, data analysis, and data solution architecture, and is limited in covering project management and consulting-related skills. As discussed on page 11, these complementary skills were cited as frequently as technical skills throughout our sample of LinkedIn® Jobs researched.

Yet, a sampling of the Big Data and Analytics offerings currently available in the Greater Toronto Area through universities, colleges, and training companies shows that existing curriculum is not currently meeting the full scope of employer demand.

To build the next generation of Big Data and Analytics professionals, academia not only needs to increase its supply of curriculum at all levels (i.e. undergraduate, graduate, professional, and executive), it also needs to expand existing curriculum to at least incorporate project management and consulting-related skills, and ideally more industry and functional area applications that map to existing demand. And, as industry and functional knowledge and experience are best gained through on-the-job experience, an increase in the supply of internships and co-op opportunities also needs to be addressed.

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**Academia not only needs to increase its supply of curriculum at all levels (i.e. undergraduate, graduate, professional, and executive), it also needs to expand existing curriculum to incorporate project management and consulting-related skills, and ideally more industry and functional area applications that map to existing demand.**

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## Building a Data-Literate Workforce

Data literacy is rapidly becoming an imperative for all professionals. The ability to analyze data and derive insights to improve decision-making can no longer remain the exclusive domain of the Big Data and Analytics professionals.

Yet, a sampling of the offerings currently available in the Greater Toronto Area through universities, colleges, and training companies shows that existing curriculum is not currently meeting this increasing employer demand for data-literate professionals. New offerings are being introduced, but they are typically offered at the executive education level, which may be cost-prohibitive for the mass market.

If we take a career pathways view for the next generation of professionals, data literacy should start long before where it commonly begins today, which is often at the graduate, professional, and executive education levels. At the Summit, attendee Dr. Fred Popowich, Professor of Computer Science and Director of the Professional Masters Program in Big Data at Simon Fraser University, proposed that data literacy curriculum should actually start as early as K-12, an argument that received unanimous support from participants.

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**To build the next generation of data-literate professionals, academia needs to review its curriculum at all levels – K-12, undergraduate, graduate, professional, and executive – to ensure data skills are embedded at the right level at the right time.**

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To build the next generation of data-literate professionals, academia needs to review its curriculum at all levels – K-12, undergraduate, graduate, professional, and executive – to ensure data skills are embedded at the right level at the right time.

The academic members of the Consortium will review the research conducted in *Phase One: Online Survey and Labour Market Research* and *Phase Two: Canada's Big Data Talent Gap Summit* and determine how they will adapt their existing curriculum, as well as internship and co-op opportunities, at their individual institutions. Moreover, recognizing that data literacy should start long before where it commonly begins today, Ryerson will continue to facilitate and grow the Consortium, including inviting experts from the K-12 education segment to participate.

## 4. Leverage Existing Talent: Source and Grow Talent Internally

Based on the research conducted in *Phase One: Online Survey and Labour Market Research* and *Phase Two: Canada's Big Data Talent Gap Summit*, organizations' primary strategy to address their talent gap is to recruit new talent. Over 75% of survey respondents rated recruiting new talent as either very important or important to their overall talent strategy.

But there are distinct advantages to developing Big Data and Analytics talent from within organizations. Existing employees typically have deep industry and functional expertise, as well as knowledge of their organization's people, processes, and technologies that could potentially take years – if not a career lifetime – to acquire. And because extracting value out of data depends so much on context, knowledge and experience possessed by existing talent is essential, if not irreplaceable.

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**Recruiting new talent alone is not sufficient to close an organization's Big Data Talent Gap.**

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Participants at the Summit unanimously agreed that recruiting new talent alone is not sufficient to close an organization's talent gap. Here is what the participants proposed:

- Employers should consider reviewing the common professional definitions to be developed as a follow-on to this paper. These common definitions will provide a baseline for key Big Data and Analytics professionals in terms of knowledge, experience, competencies, education, training, and accreditation requirements.
- As a complementary strategy to recruiting new talent, using these common definitions, employers should also consider looking in-house to identify additional sources of talent. An employee's role and responsibilities today does not accurately reflect his or her past experience, or future capacities and capabilities. The right talent can be found in unexpected places – an investment in training and development of in-house talent can be an effective talent strategy.



## Talent Recruitment, Meet the Digital Age

Based on the research conducted in *Phase One: Online Survey and Labour Market Research*, organizations are still heavily relying on traditional methods of recruiting external talent: employee referral; company website; university and college career centres; staffing firms and consultants; and online career websites. This finding was confirmed during *Phase Two: Canada's Big Data Talent Gap Summit*.

However, a key issue here is that there appears to be a mismatch between the recruiting methods used, and the talent targeted. The push model of traditional recruitment methods can be effective at reaching the active talent pool, those already interested in a career change, but less effective at reaching the hidden talent pool.

### **Engage Candidates through Social Media.**

Because Big Data and Analytics professionals are already in short supply, the high availability of opportunity means that talent is not easily reached by traditional recruiting methods.

The power currently rests in the hands of talent. Organizations need to stop assuming talent will go to them; instead, they need to go where the talent is and engage them where they are already frequently active – through social media.

**Gamify Recruitment.** The ideal candidate can come from multiple knowledge, experience, functional, industry, education, training, and accreditation backgrounds. An interest and aptitude for investigation, the love of asking the right questions, a hunger for answers and insights – these characteristics are all essential for extracting value out of data. But the traditional question-and-answer interview method is not well suited to test these types of competencies. Using a variety of non-traditional recruiting tools such as social media, hackathons, and simulations, organizations can better observe candidates showcasing their competencies in actively engaged contexts.

Participants at the Summit all agreed that traditional talent management tactics needed to be modernized, and augmented with new recruitment strategies, such as social media engagement, and gamification.

## 5. Optimize Talent Utilization: Use Shared Services Models

Based on the research conducted in *Phase One: Online Survey and Labour Market Research* and *Phase Two: Canada's Big Data Talent Gap Summit*, Canadian organizations of all sizes, from all regions, sectors, and industries are feeling the effects of Canada's Big Data Talent Gap.

The impacts of this shortage are being felt at all levels. As a result, organizations are challenged to develop and implement Big Data and Analytics strategies and initiatives. They are unable to design, develop, and implement pilots and proof-of-concepts, let alone a more comprehensive suite of programs and projects.

In some cases, talent exists, but is located in an organization's function (e.g. Information Technology, Business Operations, Sales and Marketing, etc.), and is not readily accessible to other groups. As a result, these high-demand resources cannot be easily shared and leveraged enterprise wide.

Participants at the Summit challenged themselves to stop looking for "unicorns," — those individual candidates that appear to possess that perfect mix of technical, project management, consulting-related, and industry and functional knowledge and expertise. Instead, these leading organizations proposed two alternate strategies:

### 5.1. Team-Based Model

Based on an assessment of its requirements, organizations can meet their talent needs by establishing a team of multiple resources, each with specific expertise, which collectively fulfills the full spectrum of an organization's Big Data and Analytics knowledge, experience, competencies, education, training, and accreditation requirements. The resources may or may not be dedicated to Big Data and Analytics, can be virtual or co-located, and can belong in any organizational function.

This model is often used in organizations that are in the early stages of Big Data and Analytics adoption, typically up to the point where an organization's function is looking to complete some proof-of-concepts and pilot projects.

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**Participants at the Summit challenged themselves to stop looking for "unicorns," — those individual candidates that appear to possess that perfect mix of knowledge and expertise and take different approaches to develop collective skills the organization needs. Instead, these leading organizations proposed two alternate strategies: (1) Team-Based Model; and (2) Centre of Excellence Model.**

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## 5.2. Centre of Excellence Model

As organizations move along the adoption cycle, Big Data and Analytics often transitions from being a functional resource into an enterprise resource. In doing so, organizations can begin to build an enterprise-wide Centre of Excellence (CoE), either by expanding an existing functional CoE, or by creating a new CoE.

Similar to the team-based model, an organization builds its CoE by assessing its requirements, and then building a team of resources, each with specific expertise, which collectively fulfills the full spectrum of an organization's Big Data and Analytics knowledge, experience, competencies, education, training and accreditation requirements. In a CoE, model, however, resources are fully dedicated to the CoE's Big Data and Analytics mandate.

The concept of building a Centre of Excellence is not new. But in practice organizations have found it to be an effective strategy to optimize and amplify talent that is valuable yet in short supply. For example, projects can be selected and prioritized based on factors such as strategic fit, business need, and business impact, and best practices and lessons learned can be codified and disseminated enterprise wide.

Moreover, CoEs encourage retention and critical on-the-job training through a steady flow of strategic, impactful, and interesting projects. A CoE model means that talent works on projects from any functional area of an organization, which encourages a deep level of understanding of multiple facets of an organization critical for effective strategic thinking.

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**In practice, organizations have found building Centres of Excellence to be an effective strategy to optimize and amplify talent that is valuable yet in short supply. Moreover, CoEs encourage retention and critical on-the-job training through a steady flow of strategic, impactful, and interesting projects.**

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## Centre of Excellence Case Study 1: Workplace Safety and Insurance Board

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The Workplace Safety and Insurance Board (WSIB) adopted a centralized Centre of Excellence (CoE) model in building a Predictive Analytics area back in 2011. Under the leadership of Dr. Eugene Wen, WSIB's Vice-President and Chief Statistician, the CoE became an enterprise-wide resource aiming to *"Deliver predictive analytical insights to staff and management in every line of business at the time they make decisions."*

Today, the Predictive Analytics area collaborates and supports the enterprise on a variety of topics including claim management, compliance, actuary, enterprise risk management and finance, with the overall goal of developing predictive models and carrying out in-depth analytical investigations. New technologies and best practices are also introduced into the organization and become part of routine input into senior executive discussions and decisions.

Building the CoE didn't happen overnight. WSIB senior management made investments into advanced analytics as part of its major strategic business transformation and focused on training and mentoring new recruits.

WSIB incrementally built the CoE looking for a diverse range of competencies and expertise that included statistics, math, computer science, database management, data analysis, consulting, simulation and management. Upon staff on-boarding, intensive training was arranged on modeling, and business process and consulting skills. Opportunities were offered to build business relationships with executives and frontline staff allowing the CoE team to work with different areas across the company and take on a variety of assignments.

Today, the CoE works on enterprise-wide projects originating from WSIB's President and CEO and senior executives in order to address challenging questions and information gaps in their strategic discussions and operational decisions.

## Centre of Excellence Case Study 2: Deloitte's Centre of Excellence for Analytics

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As Canada's largest professional services firm, Deloitte has long been addressing the challenge of recruiting, retaining, and training this type of niche-talent. As its practice continued to grow, the firm recognized the need to bring together expertise residing across the enterprise and, in 2013, launched its Centre of Excellence for Analytics.

With end-to-end Big Data and Analytics project support in mind, the CoE features two key, complementary facilities: (1) the Greenhouse; and (2) the National Discovery and Analytic Centre (NDAC).

Headquartered in Toronto, Deloitte's Greenhouse is a collaboration facility that enables organizations to explore Big Data and Analytics initiatives in an innovative environment that blends interactive immersive technologies, expert facilitation, and functional and industry expertise. It was here that Canada's Big Data Talent Gap Summit was held. Adjacent to the Greenhouse, the NDAC is a dedicated data and advanced analytics facility designed to manage today's high-volume processing requirements for Big Data and Advanced Analytics projects.

### **Strategic Resource Utilization, Enterprise-Wide**

In addition to providing a maximum security environment for data processing and hosting, Deloitte's Centre of Excellence for Analytics supports Big Data and Advanced Analytics projects of all sizes and complexities, across all of industries that the firm services.

Using this shared-services model, the CoE employs in-demand resources – data scientists, data architects,

data visualization experts, and software and tools experts – who are easily located and deployable across projects in a strategic way. As the CoE is connected to Deloitte's global network, the CoE is able to scale even more by being able to leverage the firm's expertise worldwide. As a result, the firm has been able to accelerate its project work, despite a talent gap in the broader labour market.

### **Enhanced Talent Recruitment, Retention, and Training**

From the recruitment perspective, the CoE has become a beacon for both in-house and new talent. Deloitte has recognized that there is a shortage of Big Data and Analytics talent and as a result, is being intentional in its efforts to attract and retain candidates by providing them with a competitive environment that promotes development and growth opportunities.

In its role as a Big Data and Analytics "evangelist," as the broader firm learns more about the field, in-house professionals have increasingly self-identified as candidates for related roles. And because the CoE is involved in leading-edge Big Data and Analytics projects from across all of Deloitte, its resources benefit from the kind of professional learning and development and continuous on-the-job training that is essential to top talent retention.

Today, external talent identifies Deloitte's Centre of Excellence for Analytics as a key reason for selecting the firm as a preferred employer.

On the surface, building a Centre of Excellence may appear more realistic for larger organizations – they simply have more resources at their disposal. But small and medium-sized organizations can still benefit by building components of a CoE around the right subject matter expert, and then build incrementally.

Alternatively, small and medium-sized organizations can engage relevant industry associations (e.g. the Canadian Electricity Association) and functional associations (e.g. CIO Association of Canada, and Information Technology Association of Canada) to discuss development of a collaborative Big Data and Analytics Centre of Excellence.

Ryerson will work with the Consortium members, Summit participants, and any other interested academic, industry, and government contributors, to conduct further research on the best practices around the development of Big Data and Analytics Centres of Excellence and to explore the feasibility of a multi-sector pilot Big Data and Analytics Centre of Excellence.

## 6. Government as Key Enabler: Develop a National Talent Strategy for Big Data and Analytics

Participants at the Summit unanimously agreed that the support of all levels of government can amplify industry and academia's collective efforts to close Canada's Big Data Talent Gap. Here is what the participants proposed:

- Currently, there are no governmental talent development programs specific to Big Data and Analytics. Government should consider whether support specific to Big Data and Analytics, as well as any other areas where talent gaps exist or are anticipated, might be appropriate.
- All levels of government – federal, provincial, and municipal – should collectively assess its strategic levers (e.g. legislation, policies, programs, funding, etc.) to determine which resources could be used to support efforts to close this talent gap, and develop a national strategy for Big Data and Analytics accordingly.
- Government should continue to explore ways to better leverage already existing but underutilized talent pools, such as women, older professionals, and immigrants. By minimizing barriers and encouraging participation by these groups, the pool of Big Data and Analytics talent grows.
- Government should continue to explore ways to facilitate the movement of talent within Canada, but also internationally through strategic immigration policies. Summit participants highlighted existing immigration policies as a priority for government

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**Through their participation in the Consortium, the Government of Canada and the Government of Ontario have demonstrated their interest in collaborating with industry and academia in tackling Canada's Big Data Talent Gap.**

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review in order to support Canada's ability to source global talent. Moreover, government should continue to develop strategies that help industry and academia to maintain connections with expatriate Canadian talent, to facilitate and encourage their return.

- Government should continue to promote awareness of its already-existing resources. For example, at the federal level, many existing policies, programs, and grants exist (e.g. Natural Sciences and Engineering Research Council of Canada (NSERC), Social Sciences and Humanities Research Council (SSHRC), Canada Foundation for Innovation, National Research Council (NRC), MITACS, etc.), but few participants were aware of, or understood, the programs in sufficient detail to be a beneficiary.
- Government should become a model user of Big Data and Analytics, spurring talent development by sharing its vast data sets through Open Data / Open Information gates, so that students and professionals undertaking education, and training can work on real data sets and problems.

Government is an important advocate of economic growth, competitiveness, and innovation. Through their participation in the Consortium, the Government of Canada and the Government of Ontario have demonstrated their interest in collaborating with industry and academia in tackling Canada's Big Data Talent Gap.

# Help Us Close Canada's Big Data Talent Gap

Canada's Big Data Talent Gap is not a future shortage; it's here now. Our economic growth and ability to innovate as a nation, and the competitiveness of our organizations, industries, and sectors, are inextricably linked with our ability to attract and retain the best talent.

This study represents the first in-depth examination of the size and nature of Canada's Big Data Talent Gap; this paper is our Consortium's first step towards addressing talent gap.

We recognize that closing Canada's Big Data Talent Gap will be a journey – and Ryerson University will continue to work with Canada's Big Data Consortium members, Canada's Big Data Talent Gap Summit participants, and any other interested academic, industry, and government contributors to continue to collaborate, to develop strategies, and to act to close the gap.

But there is no silver bullet. Closing the talent gap will take experimentation of new recruitment, retention, and training models by each organization, industry, and sector group. Closing the talent gap will take collaboration, including breaking down the traditional silos between organizations, industries, and sectors.

Throughout the paper, we have identified areas where we are taking action. As we continue to move forward in tackling Canada's Big Data Talent Gap, we invite interested participants to join us in our efforts to help ensure that Canada continues to innovate and grow economically.

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**Closing Canada's Big Data Talent Gap will take collaboration, including breaking down the traditional silos between organizations, industries, and sectors.**

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## **Project Contact**

For more information regarding Canada's Big Data Consortium and Canada's Big Data Talent Gap Study, please contact:

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*Special Project Liaison*

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Or visit us online:  
[ryerson.ca/talentgap](http://ryerson.ca/talentgap)

## Acknowledgements

We would like to thank the following organizations for their leadership and in-kind contributions to Canada's Big Data Consortium, Canada's Big Data Talent Gap Study, and to this paper, "Closing Canada's Big Data Talent Gap":

### Canada's Big Data Talent Gap Study Contributors

#### Industry and Industry Associations

Canadian Electricity Association  
electricity.ca

Cineplex Odeon Corporation  
cineplex.com

CIO Association of Canada  
ciocan.ca

Deloitte  
deloitte.ca

Information Technology Association of Canada  
itac.ca

SAS Institute Inc.  
sas.com

TMX Group Inc.  
tmx.com

Workplace Safety and Insurance Board  
wsib.on.ca

#### Government

Government of Canada  
canada.ca

Government of Ontario  
ontario.ca

#### Academia

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We would like to thank the following organizations for their leadership and in-kind contributions to Canada's Big Data Consortium, Canada's Big Data Talent Gap Study, and to this paper, "Closing Canada's Big Data Talent Gap."



**REVIEWER'S REPORT**

**Proposed Degree Program**

**in**

***Data Science***

**Faculty of Arts and Science**

**Nipissing University**

**Reviewer:**

Ayşe Başar Bener, PhD  
Professor and Director Data Science Lab  
Department of Mechanical and Industrial Engineering  
Program Director, MSc in Data Science and Analytics  
Program Director, Certificate in Data Analytics, Big Data  
and Predictive Analytics.  
Affiliated Scientist, St. Michael's Hospital  
Research Fellow, IBM CAS  
Director, Big Data, Office of the Provost and Vice President Academic  
Ryerson University



## 1. OUTLINE OF THE REVIEW

A site visit was conducted on October 25<sup>th</sup> and 26<sup>th</sup> and the following people were interviewed:

Dr. Murat Tuncali, the Dean of Faculty of Arts and Science

Dr. Pavlina Radia, the Associate Dean of Faculty of Arts and Science

Ms. Debra Iafrate, the Registrar

Dr. Nancy Black, Laura Sinclair, Executive Director and Librarian

Members of computer science and math departments: Dr. Ali Hatef, Dr. Logan Hoehn, Dr. Alex Karassev, Dr. BJ Schreyer, Dr. Ihor Stasyuk, Dr. Vesko Valov, Dr. Tzvetalin Vassilev, Dr. Mark Wachowiak, Dr. Haibin Zhu  
Dr. Arja Vainio-Mattila, Provost and Vice-President Academic and Research (conference call with her on October 28<sup>th</sup>)

The tour of the facilities including the classrooms, research labs, library, and student facilities took place. One to one meetings with some faculty members and their graduate students were conducted.

## 2. EVALUATION CRITERIA

**NOTE:** Reviewers are asked to provide feedback on each of the following Evaluation Criteria. (*Institutions are to add to these criteria if their IQAP includes additional criteria.*)

### 2.1 Objectives

- Consistency of the program with the institution's mission and academic plans.

The university defines itself as a student centric university and has a mission of developing creative thinkers who would become leaders in their own fields. The academic plan specifically mentions that the university's strategic growth plan is to develop new programs in the areas of science and technology. Therefore the proposed program in Data Science is consistent with the university's mission and academic plans.

- Clarity and appropriateness of the program's requirements and associated learning outcomes in addressing the institution's own undergraduate or graduate Degree Level Expectations.

Program requirements, associated learning outcomes and Degree Level Expectations are clear.

- Appropriateness of degree nomenclature.

Wikipedia defines Data Science as: an interdisciplinary field of scientific methods, processes, and systems to extract knowledge or insights from data in various forms, either structured or unstructured, similar to data mining. Data science is a "concept to unify statistics, data analysis and their related methods" in order to "understand and analyze actual phenomena" with data. It employs techniques and theories drawn from many fields within the broad areas of mathematics, statistics, operations research, computer science, machine learning, and software engineering. Therefore the term is appropriate for the intended degree.

### 2.2 Admission Requirements

- Appropriateness of the program's admission requirements for the learning outcomes established for completion of the program.

Admission requirements are the same as the admission requirements for entry to computer science and math programs. Data Science is a similar program in terms of the learning outcomes

established for the program such as critical thinking, problem solving skills, creating solutions/ algorithms in the form of mathematical models.

- Sufficient explanation of alternative requirements, if any, for admission into a graduate, second-entry or undergraduate program, such as minimum grade point average, additional languages or portfolios, along with how the program recognizes prior work or learning experience.

Currently there is no direct entry option.

### **2.3 Structure**

- Appropriateness of the program's structure and regulations to meet specified program learning outcomes and degree level expectations.

Program is designed to be a four year undergraduate program and it is based on the current computer science program. The proposed program's structure is appropriate to meet proposed learning outcomes and degree requirements.

### **2.4 Program content**

- Ways in which the curriculum addresses the current state of the discipline or area of study.

The proposed curriculum is designed to build high level of technical skills in mathematics, computer science, and machine learning. The first two year's curriculum is composed of fundamental courses in math and computer science. Introductory programming course is C++. Given that, Python is the standard for data science applications, I would recommend adding a programming course in Python, or teaching one of the Data Structures and Algorithms course in Python. The third and fourth year of the curriculum is designed to focus on domain specific core courses and electives. I recommend that the following core courses should be included: machine learning (two courses would be appropriate); operations research/ optimization techniques; big data tools (NoSQL, Spark, Hadoop).

- Identification of any unique curriculum or program innovations or creative components.

It is an interdisciplinary program that combines math, computer science, and statistics. It is the first undergraduate program in Data Science in Canada.

### **2.5 Mode of delivery**

Comment on the appropriateness of the proposed mode(s) of delivery to meet the intended program learning outcomes and Degree Level Expectations.

It is intended to be face-to-face classroom delivery.

### **2.6 Assessment of teaching and learning**

- Appropriateness of the proposed methods for the assessment of student achievement of the intended program learning outcomes and Degree Level Expectations.

The program is based on the existing Computer Science and Math programs, and therefore, assessment and teaching of this program will be the same as CS and Math programs.

### **2.7 Resources for all programs**

- Adequacy of the administrative unit's planned utilization of existing human, physical and financial resources, and any institutional commitment to supplement those resources, to support the program.

The program will rely on the existing faculty members in its initial years. However, I recommend that as part of medium term expansion plan of the faculty, a tenure track faculty member in machine learning should be hired to build the expertise and further develop the elective courses and capstone projects.

- Participation of a sufficient number and quality of faculty who are competent to teach and/or supervise in the program.

The current faculty members are sufficient to deliver the program.

- Evidence that there are adequate resources to sustain the quality of scholarship produced by undergraduate students as well as graduate students' scholarship and research activities, including library support, information technology support, and laboratory access.

Library has just expanded.

## **2.8 Resources for undergraduate programs only**

Evidence of and planning for adequate numbers and quality of: (a) faculty and staff to achieve the goals of the program; or (b) of plans and the commitment to provide the necessary resources in step with the implementation of the program; (c) planned/anticipated class sizes; (d) provision of supervision of experiential learning opportunities (if required); and (e) the role of adjunct and part-time faculty.

There is a plan in place that clearly lays out the list of faculty members who will teach in the program, and an annual resource plan. The class sizes are planned to be around 25.

## **2.9 Quality and other indicators** *(to be inclusive of the institution's own additional quality indicators)*

- Definition and use of indicators that provide evidence of quality of the faculty (*e.g.*, qualifications, research, innovation and scholarly record; appropriateness of collective faculty expertise to contribute substantively to the proposed program).
- Evidence of a program structure and faculty research that will ensure the intellectual quality of the student experience.

The current faculty members who will be teaching in this program each have established research programs of their own. Key members conduct research in data science and analytics. They have research labs and collaborations that would give ample opportunities for the undergraduate students to gain hands-on experience. The faculty member's research intensity is one of the major strengths of this program in creating the content of the courses in the curriculum.

**NOTE:** Reviewers are urged to avoid using references to individuals. Rather, they are asked to assess the ability of the faculty as a whole to deliver the program and to comment on the appropriateness of each of the areas of the program (fields) that the university has chosen to emphasize, in view of the expertise and scholarly productivity of the faculty.

## **3. OTHER ISSUES**

### **The minor in data science:**

The proposal has a minor option in data science. Since the program is designed to be a highly technical program, I strongly recommend that the minor should be restricted with only computer science and math students.

If a student who is not majoring in Math or Computer Science would like to do minor I suggest that they should have different requirements. On top of the courses that are included in the minor, they should also take at least three core courses as a foundation to complete the minor. These courses should be: Data Structures and Algorithms, Probability and Statistics, Database Management Systems. If these core courses

have their own prerequisites then these should also be completed. Alternatively, the department could consider developing different pathways or courses on Data Analysis for students not majoring in math or computer science.

**4. SUMMARY AND RECOMMENDATIONS**

**NOTE:** The responsibility for arriving at a recommendation on the final classification of the program belongs to the Appraisal Committee. Individual reviewers are asked to refrain from making recommendations in this respect.

**Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

## Department of Computer Science and Mathematics

### **Response to the External Reviewer's Report on the Proposed Degree Program in Data Science**

The Department wants to express its appreciation to Dr. Ayse Bener for the recommendations in her report and for the open, insightful and fruitful discussions during her visit in October 2017.

It is notable that the reviewer acknowledges the novelty of the proposed program. It will be the first undergraduate program in Data Science in Canada.

Below, our responses to the specific recommendations are outlined as per the evaluation criteria used in the report.

#### **2.1 Objectives**

The department agrees with the findings of the reviewer regarding the program's name appropriateness, the adequacy of the program requirements and learning outcomes, as well as its consistency with the mission of Nipissing University and its academic plan.

#### **2.2 Admission requirements**

It is noted that the admission requirements are similar to those for Mathematics and Computer Science programs, as these are the usual programs of reference.

#### **2.3 Structure**

We agree with the observation that the program structure is appropriate for the degree and the learning outcomes.

#### **2.4 Program content**

Inclusion of Python as a programming language was discussed during the external reviewer's visit, and it has also been discussed within the department. Given the current staffing of the department, the more practical solution is to deliver both Data Structures and Algorithms courses in Python, rather than adding a specific course in this programming language. Python is currently used in other courses as well. Additionally, it has to be noted that the existing course on Programming Paradigms introduces functional languages and scripting techniques.

Further, we agree with the recommendation that a second course in Machine Learning is added, as well as course in Big Data Tools. NoSQL, Hadoop, and other Big Data paradigms are currently taught in the Database and Database Management course. This recommendation is related to the recommendation made under 2.7 that a faculty member with expertise in these specific areas be hired as the program expands. We would like to note that the existing course on Optimization includes elements of Operations Research. It can be further customized and taught so as to accommodate the Data Science cohort.

## **2.5 Mode of delivery**

It is noted that the program will be delivered in face-to-face mode.

## **2.6 Assessment of teaching and learning**

It is noted that the assessment will be the same as in the existing Mathematics and Computer Science programs on which the proposed program is based.

## **2.7 Resources for all programs**

The department agrees with the recommendation that a faculty member with specific expertise in Machine Learning be hired to build expertise in core areas of data science and provide students with options in their senior year.

The reviewer notes that the current faculty members – who have teaching expertise and strong publication records in machine learning, data analytics, and Big Data technologies – can deliver the program. She also notes the adequacy of the library resources available at Nipissing.

## **2.8 Resources for undergraduate programs only**

We agree with the observation of the reviewer that the annual resource plan is clearly laid out. It is noted that the expected class size is around 25 students.

## **2.9 Quality and other indicators**

The report correctly points out that the research intensity and capabilities of the department's faculty are major strengths of the proposed program, and will contribute to its success.

## **3. Other issues, Minor in Data Science**

The department strongly agrees with the recommendation that the Minor in Data Science be restricted to Mathematics and Computer Science students, due to the technical nature of the program and the set of skills and prerequisites required for success in the program. We would like to draw parallel to the recent discussions during the approval of the Minor in Physics, which is restricted to Mathematics and Computer Science students.

It is further correctly noted that in order to open the minor option to students outside of Mathematics and Computer Science, at least three foundation courses should be taken. The suggestion that these be Data Structures and Algorithms, Probability and Statistics and Database Management Systems is reasonable. It is specifically noted that such courses will usually have prerequisites that would also have to be completed should a student want to take advantage of the minor option.

Thus, we consider having a minor in Data Science open to students outside of Mathematics and Computer Science to be subordinate to the successful start of the undergraduate degree program, and the restricted minor. This should be subject to further evaluation and decision taken at a later time.

**Stage 2 BSc in Data Science  
External Reviewer's Report  
Dean's Response**

**March 12, 2018**

I would like to acknowledge the excellent work done by the faculty members of Computer Science and Mathematics in developing and preparing the Stage 2 proposal for the BSc Honours program in Data Science. I would also like to thank Dr. Ayşe Bener (Ryerson University) who served as a reviewer.

The Reviewer's report is comprehensive and acknowledges the value and appropriateness of the proposed Data Science program for Nipissing University. The report recognizes the excellence of the faculty supporting the program and the innovative aspects of the program which utilize the faculty resources.

Overall, I am in agreement with the Reviewer's comments, and the responses provided by the Department. The report mainly makes two specific recommendations. I will comment on them below. Please note that the Reviewer's recommendations are italicized.

## **RECOMMENDATIONS/COMMENTS**

### **2.4 Program content**

- Ways in which the curriculum addresses the current state of the discipline or area of study.

The proposed curriculum is designed to build high level of technical skills in mathematics, computer science, and machine learning. The first two years' curriculum is composed of fundamental courses in math and computer science. Introductory programming course is C++. Given that Python is the standard for data science applications, I would recommend adding a programming course in Python, or teaching one of the Data Structures and Algorithms course in Python. The third and fourth year of the curriculum is designed to focus on domain specific core courses and electives. *I recommend that the following core courses should be included: machine learning (two courses would be appropriate); operations research/ optimization techniques; big data tools (NoSQL, Spark, Hadoop).*

I support this recommendation, and I am in agreement with the Department's response. Two of the courses, optimization techniques and operations research, exist in our course offerings.

### **2.7 Resources for all programs**

- Adequacy of the administrative unit's planned utilization of existing human, physical and financial resources, and any institutional commitment to supplement those resources, to support the program.



*The program will rely on the existing faculty members in its initial years. However, I recommend that as part of medium term expansion plan of the faculty, a tenure track faculty member in machine learning should be hired to build the expertise and further develop the elective courses and capstone projects.*

I support this recommendation. As outlined in the business plan provided, there is a plan to hire a new faculty member, pending enrollments.

## **OTHER ISSUES**

### **The minor in data science:**

The proposal has a minor option in data science. Since the program is designed to be a highly technical program, I strongly recommend that the minor should be restricted with only computer science and math students.

If a student who is not majoring in Math or Computer Science would like to do a minor I suggest that they should have different requirements. On top of the courses that are included in the minor, they should also take at least three core courses as a foundation to complete the minor. These courses should be: Data Structures and Algorithms, Probability and Statistics, Database Management Systems. If these core courses have their own prerequisites then these should also be completed. Alternatively, the department could consider developing different pathways or courses on Data Analysis for students not majoring in math or computer science.

I am in agreement with the Reviewer's observation and comments as well as the Department's response on the topic of offering a minor in data science. The Reviewer suggests that we should offer a minor on Data Analysis for students who are not majoring in math or computer science. I believe this is something doable. Once the Data Science program is implemented, we could work on developing the Data Analysis Minor.

As the Dean of Arts and Science, I am very pleased to see the development of this program. It is an important program for Nipissing University to have. It brings together the research strengths of faculty who are housed in Computer Science and Mathematics. As pointed out by the Reviewer, this program will be the 1<sup>st</sup> of its kind in Canada, if we are able to implement the program in a timely way.

Respectfully submitted,

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Dean of Arts and Science