



**TO:** Mike Mahon  
President and Vice Chancellor

**DATE:** September 26, 2016

**FROM:** Alan Siaroff  
Chair, Academic Quality Assurance Committee

**RE:** Mathematics Academic Quality Assurance Review

In accordance with the U of L *Academic Quality Assurance Policy and Process*, the Academic Quality Assurance Committee approved the review of Mathematics at its September 22, 2016 meeting.

The Self Study Committee for this review comprised Hadi Kharaghani (Program Review Coordinator), David Kaminski, and Sean Legge. The review produced four documents:<sup>1</sup>

1. *Department of Mathematics & Computer Science: Mathematics Self Study Report* (received February 26, 2016) – Self Study Report, developed by the Mathematics Self Study Committee.
2. *University of Lethbridge: Mathematics Program Review – April 2016* (received April 27, 2016) – External Review Report by Heinz Bauschke (University of British Columbia) and Anthony Quas (University of Victoria) based on their site visit of April 19-20, 2016.
3. *Program Response* (received June 1, 2016) – response of the Self Study Committee to the external review.
4. *Dean's Response* (received September 12, 2016) – response to the review, written by Craig Cooper, Dean of the Faculty of Arts and Science.

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<sup>1</sup> All documents are available upon request.

## **Self Study**

The Self Study Report noted several strengths of the mathematics and statistics areas of the Department of Mathematics and Computer Science:

- The variety of programs of study are comparable with similar sized universities in Canada.
- Faculty are active in research. Most faculty members have held, or currently hold, NSERC research grants.
- Most math education students are female, giving the math courses a strong gender balance.
- The new major in Applied Statistics will likely grow over time and allow for the development of a financial mathematics program.
- Students can pursue graduate studies in mathematics at the M.Sc. and Ph.D. levels.
- There are a variety of community outreach programs, such as LUMACS (Life, yoU, Mathematics, And Computer Science), Fun With Math, and Day of Math.
- The programs align well with the liberal education mission of the U of L.
- Most natural or social science programs require mathematics or statistics, and so Mathematics has a wide influence at the U of L.
- Number Theory is the most prominent research area in Mathematics. This group has attracted post-doctoral fellows and M.Sc. students and has presented seminars by graduate students, post-doctoral fellows, and visiting scholars.
- A second principal research area is Combinatorics. This group holds frequent seminars and attracts graduate students.
- The Pacific Institute for Mathematical Sciences has had many positive impacts on research activities in Mathematics.

The report discussed several weaknesses and challenges for the mathematics and statistics areas:

- Budget is constrained, making it difficult to change program and course offerings.
- A degree in mathematics does not necessarily lead to a career in mathematics, and so career prospects for graduates could be improved.
- The curriculum does not effectively address the needs of students training to be teachers.
- There is no Honours degree program for stronger students who are considering graduate studies.
- There are several restrictions on students' program design, including the limit on the number of courses that can be taken within one department, the General Liberal Education Requirement, and the cap of 12 courses at the 1000 level.
- Math education students can slow progress through the material in mathematics courses.
- Math 2090: Number Systems, a service course for Education students, has had disappointing enrolment in recent years.
- For the M.Sc. in Mathematics, there are only two regularly-scheduled graduate courses, which limits the attractiveness of the program.

The report contained short-term and long-term recommendations for improvement:

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**Short-term  
recommendations**

- Hold regular meetings with other departments and faculties whose graduates need mathematics/statistics courses, to address curriculum and scheduling issues.
- Consider if some of the mathematics/statistics courses offered outside Mathematics and Computer Science should be housed within the department.
- Consider developing a course, similar to Math 2090, that is aimed at teachers of middle and high school mathematics.
- Consult with the Faculty of Education in scheduling key courses for Education students so they do not conflict with these students' Professional Semesters.
- Publicize career paths for Mathematics majors.

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**Long-term  
recommendations  
(next 5-10 years)**

- Rename the department to reflect growth in statistics offerings.
  - Refresh the curriculum, with the aim of improving graduates' job prospects.
  - Grow the faculty complement.
  - Hire three more statisticians to handle the growth in popularity of the major in Applied Statistics.
  - Develop a minor in Statistics.
  - Make accommodations for faculty who train graduate students.
  - Start to use graduate students in delivering tutorials.
  - Maintain the association with the Pacific Institute for Mathematical Sciences.
  - Capitalize on the department's welcoming environment for female students.
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There were several questions directed at the External Reviewers:

- How can the department balance recognition of the time commitment of professors to their graduate students with their other reaching duties?
- How can the curriculum and programs be changed to better prepare graduates for mathematically-oriented careers?
- How can the degree programs better serve students who are training to be high school mathematics teachers?

## **External Review**

In their External Review Report the External Reviewers commented that, overall, the Mathematics division is very strong in research and teaching, and had several commendations and recommendations:

### **Commendations**

- The Mathematics division is well run and cohesive.
- Faculty members are active and productive in research.
- Developing the Applied Statistics program is a good idea and should continue to be well supported.
- Faculty members have excellent qualifications and are impressive in terms of both research and teaching.
- Outreach activities are numerous and high quality.
- Faculty members are passionate and dedicated.
- The membership in the Pacific Institute for the Mathematical Sciences is having a significant positive impact on research.

### **Recommendations**

1. When there is a critical mass of qualified students, create a statistical consulting service for other departments and local industry.
2. Hire a faculty member to support the Applied Statistics program.
3. Strive to understand and accommodate the scheduling constraints of Education students.
4. Consider developing two tiers of Statistics courses: one for science majors, the other for non-science majors.
5. Consider developing a Mathematics Working Group to discuss the mathematics and statistics offerings throughout the U of L.
6. Establish a Mathematics Help Centre with extended opening hours.
7. Continue encouraging the use of new technologies like open courseware and web works.
8. Ensure there are smaller tutorial sections.
9. Establish a Tier 2 Canada Research Chair in Big Data or Data Science.
10. Create a third year level Mathematics and Computation course where students learn about Python, R, Octave, Geogebra, and other tools.
11. Organize regular end-of-term events for faculty, staff, and students. Encourage the formation of a math club.
12. Form collaborations with local industry. Explore opportunities like MITACS Accelerate, NSERC Engage, and NSERC CRDs.
13. Develop a mathematics strategic plan.
14. As part of the development of the mathematics strategic plan, critically examine course offerings.

15. Ensure multiple sections of mathematics and statistics courses are delivered consistently, using similar course outlines, course materials, and a common final exam.
16. Ensure all faculty members have meaningful opportunities to shape the future direction of the Mathematics division.
17. Assign a formal mentor to all pre-tenured faculty members.
18. Give the Department of Mathematics and Computer Science a stronger role in graduate student admission decisions.
19. Work with the School of Graduate Studies and the Faculty of Arts and Science to ensure a more streamlined procedure for hiring post-doctoral fellows.

The body of the report contained the following strengths and weaknesses for the Mathematics division:

### Strengths

- Graduate students are very happy with their program.
- Undergraduate students appear very satisfied.
- The Pacific Institute for the Mathematical Sciences creates research opportunities through visiting scholars initiatives and postdoctoral fellows.
- Publication and citation numbers compare favourably with institutions of similar size.
- Faculty members work with students on research projects, even at the undergraduate level.

### Weaknesses

- There is the lack of a more formalized system of peer evaluation of teaching.
- There is a high degree of variability when the same course is taught in different semesters or by different teachers.
- The centralized system of evaluating the credentials of foreign graduate students is problematic.
- Some concerns expressed by undergraduate students were: uncertainty of which courses are offered and when; limited availability of help at the drop-in centre; variability in the level of difficulty for different offerings of the same course; and lack of clear expectations for examinations in some upper-level courses.
- Significant numbers of Education students switch from Mathematics Education to General Science Education.
- There is a lack of uniformity in undergraduate courses.
- Some students feel courses are aimed mostly at preparing students for graduate work.

### **Program Response**

The Program Response provided commentary on the recommendations from the External Review Report:

<b>Recommendation:</b>	<b>Program Response:</b>
1. When there is a critical mass of qualified students, create a statistical consulting service for other departments and local industry.	This is an excellent idea, but will have to wait several years for implementation to build the critical mass of students and faculty needed.
2. Hire a faculty member to support the Applied Statistics program.	Agreed.
3. Strive to understand and accommodate the scheduling constraints of Education students.	Agreed. Using a broad discussion to achieve consensus on this matter is a good suggestion.
4. Consider developing two tiers of Statistics courses: one for science majors, the other for non-science majors.	This will be a good course of action when there is a sufficient level of staffing in the statistics area.
5. Consider developing a Mathematics Working Group to discuss the mathematics and statistics offerings throughout the U of L.	This is a good suggestion but will require time and staff from more than the Department of Mathematics and Computer Science.
6. Establish a Mathematics Help Centre with extended opening hours.	Agreed. Funding and staffing for this recommendation are critical issues.
7. Continue encouraging the use of new technologies like open courseware and web works.	Agreed.
8. Ensure there are smaller tutorial sections.	Agreed.
9. Establish a Tier 2 Canada Research Chair in Big Data or Data Science.	Agreed, though a case for a Tier 1 CRC can be made, and it could be shared with the computer science side of the Department.
10. Create a third year level Mathematics and Computation course where students learn about Python, R, Octave, Geogebra, and other tools.	Agreed.
11. Organize regular end-of-term events for faculty, staff, and students. Encourage the formation of a math club.	Agreed. The Department can take a more active role in encouraging students to maintain a student match club and can help organize events were students and staff can socialize.
12. Form collaborations with local industry. Explore opportunities like MITACS Accelerate, NSERC Engage, and NSERC CRDs.	Agreed, but there is less opportunity for these connections in a city the size of Lethbridge.
13. Develop a mathematics strategic plan.	Agreed.

<b>Recommendation:</b>	<b>Program Response:</b>
14. As part of the development of the mathematics strategic plan, critically examine course offerings.	Agreed. This could fall within the scope of a strategic plan (recommendation 13).
15. Ensure multiple sections of mathematics and statistics courses are delivered consistently, using similar course outlines, course materials, and a common final exam.	Agreed. Addressing this will be challenging, as academic freedom provisions give instructors latitude in course delivery.
16. Ensure all faculty members have meaningful opportunities to shape the future direction of the Mathematics division.	Agreed.
17. Assign a formal mentor to all pre-tenured faculty members.	Agreed.
18. Give the Department of Mathematics and Computer Science a stronger role in graduate student admission decisions.	Agreed. The Department must work with the School of Graduate Studies on this.
19. Work with the School of Graduate Studies and the Faculty of Arts and Science to ensure a more streamlined procedure for hiring post-doctoral fellows.	Agreed.

The Program Response went on to address some further comments from the External Review Report:

<b>External Review Report comment:</b>	<b>Program Response:</b>
Develop a document for new faculty that describes the expectations for tenure.	The Faculty Handbook already has the expectations, and a supplementary document specific to the Department is not needed.
There is no formalized system for the peer evaluation of teaching.	The Faculty Handbook already cautions faculty to not rely exclusively on student evaluations of teaching. The Department can remind its faculty members to seek alternative methods of teaching assessment.
Large numbers of B.Sc. / B.Ed. students are switching from mathematics education to general science education.	Data from Institutional Analysis does not support this claim.

### ***Dean's Response***

In his response Craig Cooper, the Dean of Arts and Science, commented on the 19 External Review Report recommendations and the Self Study Committee's response to these recommendations:

<b>Recommendation:</b>	<b>Dean's Response:</b>
1. When there is a critical mass of qualified students, create a statistical consulting service for other departments and local industry.	This is a future initiative. It will take time to build the critical mass of students and faculty to support such a consulting service. The Department should explore this concept and draft a document outlining the requirements for developing a statistical consulting service.
2. Hire a faculty member to support the Applied Statistics program.	It is unclear how an additional hire can be funded as there was no new funding for the Applied Statistics major. If the program grows, then a case can be made for a new hire, or an additional faculty member can come from a retirement or resignation.
3. Strive to understand and accommodate the scheduling constraints of Education students.	This can be part of a curriculum review. See the response to recommendation 13.
4. Consider developing two tiers of Statistics courses: one for science majors, the other for non-science majors.	Agreed.
5. Consider developing a Mathematics Working Group to discuss the mathematics and statistics offerings throughout the U of L.	Agreed.
6. Establish a Mathematics Help Centre with extended opening hours.	Agreed.
7. Continue encouraging the use of new technologies like open courseware and web works.	Agreed. A faculty member should pilot the use of these tools in their class and give their feedback to the other faculty members.
8. Ensure there are smaller tutorial sections.	Agreed, but there are cost implications and space restraints.
9. Establish a Tier 2 Canada Research Chair in Big Data or Data Science.	Agreed. The Department should develop a proposal for a CRC when one becomes available, and also consider if this position could be created as an NSERC Industrial Research Chair.



Recommendation:	Dean's Response:
10. Create a third year level Mathematics and Computation course where students learn about Python, R, Octave, Geogebra, and other tools.	Agreed. This should be part of the curriculum review.
11. Organize regular end-of-term events for faculty, staff, and students. Encourage the formation of a math club.	Agreed.
12. Form collaborations with local industry. Explore opportunities like MITACS Accelerate, NSERC Engage, and NSERC CRDs.	Agreed.
13. Develop a mathematics strategic plan.	Agreed.
14. As part of the development of the mathematics strategic plan, critically examine course offerings.	Agreed.
15. Ensure multiple sections of mathematics and statistics courses are delivered consistently, using similar course outlines, course materials, and a common final exam.	Agreed.
16. Ensure all faculty members have meaningful opportunities to shape the future direction of the Mathematics division.	Agreed. These opportunities can begin with the development of the strategic plan.
17. Assign a formal mentor to all pre-tenured faculty members.	Agreed.
18. Give the Department of Mathematics and Computer Science a stronger role in graduate student admission decisions.	Agreed. However, there are some constraints related to graduate funding.
19. Work with the School of Graduate Studies and the Faculty of Arts and Science to ensure a more streamlined procedure for hiring post-doctoral fellows.	The Dean's office will discuss this with the School of Graduate Studies.

The Academic Quality Assurance Committee is satisfied that the Mathematics academic quality assurance review has followed the U of L's academic quality assurance process appropriately, and acknowledges the successful completion of the review.

Sincerely,

A handwritten signature in cursive script that reads "Alan Siaroff". The signature is written in black ink and is positioned above a horizontal line.

Alan Siaroff

Chair, Academic Quality Assurance Committee

Cc: Andrew Hakin, Provost and Vice President (Academic)