

# Two-Year Progress Report

## Nanotechnology Collaborative Program (MSc, MAsC, PhD)

### February 2021

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#### BACKGROUND

In accordance with the University's Institutional Quality Assurance Process (IQAP), this 2 year report provides recommendations of the external evaluation and the internal response and assessments of the collaborative program in Nanotechnology (Nano program) delivered by the Faculty of Science and the Faculty of Engineering. Six departments collaborate on the program: Chemistry, Physics and Astronomy, Chemical Engineering, Electrical and Computer Engineering, Mechanical and Mechatronics Engineering, and Systems Design Engineering.

This 2 year report is based on information extracted from the self-study, the external reviewers' conducted on a site visit to the University on May 25-26, 2017, and the program response. The last review was completed in May 2019.

#### PROGRESS ON IMPLEMENTATION PLAN

##### A. Recommendations

**1. Curriculum Authority:** *The program should consider that the current Graduate Nanotechnology Committee receive formal approval and responsibilities on curriculum matters with the aim to revise all courses related to the program.*

##### Response

- Current member department representatives on the Graduate Nano Committee have responsibility for and authority to approve minor Graduate Nano Program core curriculum changes (such as removal of the course elective list from the nano program requirements for all member programs, enclosed in the Nano 14 motion **approved by the FEC, SFC and SGRC on Dec 15, and Jun 22, 2020, and Feb 8, 2021, respectively**).
- Currently being implemented that after approval of Curriculum Committee motions the Graduate Nano Committee, those motions have been forwarded directly to the Faculty level, after approval via email from the Chairs or Associate Chairs of the member departments (e.g. Nano 14 had to be approved by all Departments before being forwarded to the respective Faculty Councils).

**2. Full Time Administrative Coordinator:** *The program should consider that the Administrative Coordinator position become permanent. The administrative coordinator should serve in the*

*Graduate Nanotechnology Committee and play a leading role in the student advisement.*

**Response**

- The Faculty of Engineering is providing temporary staff support to the Collaborative Nano Grad program until end of 2021, and has committed to provide permanent staff support starting Jan 2022.

**3. Departmental Collaboration:** The Graduate Nanotechnology Committee should work closely with the departments to develop a truly collaborative program by removing inflexible traditional administrative practices and developing effective interdependence among the founding departments. A more coordinated effort between departments and the Nanotechnology Program Committee should be considered for recruiting students with truly interdisciplinary interest.

**Response**

- The Graduate Nano Committee members currently have enabled with considerable departmental authority to approve changes on behalf of their department to reduce the complexity and increase the speed of the program's approval process.
- The Nano Program section within the University's website ([www.uwaterloo.ca/nano-graduate](http://www.uwaterloo.ca/nano-graduate)) has been created, that includes information about its various degree options and links directly to the program descriptions in the [Graduate Studies Academic Calendar](#).
- Working on collaborating with University - and member departments - to promote the Graduate Nano Program to potential students via the university website and departmental and Faculty recruitment events, as resources permit.
- At planning/information gathering stage: work with Waterloo Institute for Nanotechnology Graduate Student Society (WINGSS) and member departments to coordinate student-centric programs and events that will promote positive student experiences and collaboration among students in member departments.

**4. Curriculum Map Task Force:** The Graduate Nanotechnology Committee should consider forming a task force to develop a comprehensive curriculum map according to the Quality Assurance Framework and Guidelines of the Ontario Universities Council on Quality Assurance (OUCQA). This will provide the framework for developing clear pathways to achieving the specified program learning outcomes and degree level expectations. A handbook could be developed to provide clear documentation for the incoming students detailing expectations, requirements, time-lines and other important instructions for fulfilling the degree requirements.

**Response**

- With representatives from each member department, the Curriculum Committee has been created that reports to the Graduate Nano Committee.
- Core course content, delivery and sequencing have been reviewed to ensure that the core course offerings are comprehensive, appropriate and delivered effectively; and as a result, the curriculum

changes have been recommended to the Grad Nano Committee, and a comprehensive curriculum has been developed and approved by the FSC, SFC, and SGRS (Nano 14 motion, enclosed).

- Information for students regarding expectations, requirements, timelines and other important instructions will have been placed online in a revised Graduate Nano website section ([www.uwaterloo.ca/nano-graduate](http://www.uwaterloo.ca/nano-graduate)) starting from Fall 2021 when the new program curriculum (Nano 14 motion) be in effective.
- Determine (to be discussed with the Graduate Nano Committee) if a separate handbook would be useful for Graduate Nano students.

**5. Reduction in Required Courses:** The program should consider reducing the number of required courses as partial fulfilment of the degree sought (particularly for PhD) in favour of intensification of research.

**Response**

- This suggestion has been brought up and discussed with the Graduate Nano Committee and implementation has been progressing. The total number of courses varies by Department but the overall requirement for the number of courses in terms of course weight has not changed regardless of what program a student is in (i.e. previously students have to take four 0.25 weight courses to meet the core course requirements. Now they need to take two 0.5 weight courses; so overall the students are still taking 1.0-unit worth of credits for the core courses. The course weights have just been changed.).
- According to the current revised academic calendar (to be effective in Fall 2021):
  1. *General Requirements Doctor of Philosophy (PhD)* in Participating Department – Nanotechnology (approved by Faculties of Engineering and Science for 2021-2022, and the Senate Graduate & Research Council (SGRC)):
    - a. Candidates must successfully complete NANO 600 Introduction to Nanotechnology, 1 nanotechnology core course (NANO 60X), and
    - b. Candidates must successfully complete at least 1 more graduate course from the list of technical electives\* (0.50-unit weight) with an overall average of 70% including the core courses in **a** (no more than 1 of the courses used for credit towards the PhD degree may be taught by the candidate's supervisor).
 

\*There is a general list of technical electives to be updated by the Graduate Nano Committee and it is up to students' supervisors and their host department to select technical electives from the revised technical elective list.
  2. The actual program is decided by the student and the supervisor(s), subject to the approval of the Associate Chair for Graduate Studies of the participating department.
  3. *General Requirements Masters (MSc, MASc)* in Participating Department – Nanotechnology (approved by Faculties of Engineering and Science for 2021-2022, and the SGRS):
    - a. Students must complete 4 one-term (0.50-unit weight) graduate level courses (or courses acceptable for graduate credit), including NANO 600 Introduction to Nanotechnology and 1 nanotechnology core course (NANO 60X).
    - b. A maximum of 1 500-level course may be counted for credit.

- c. Students who have completed their Bachelor of Applied Science (BASc) degree in Nanotechnology Engineering at the University of Waterloo cannot take NANO 600 Introduction to Nanotechnology. Instead, they can choose 1 course from the list of nanotechnology core courses (NANO 60X).
- The curriculum committee will be also encouraged to develop a concise set of differentiating learning outcomes for students of different background and home department “to get buy-in and to help market the collaborative program to prospective students”.

**6. Faculty Support:** The supporting Faculties should consider providing more direct support to the program, facilitating institutional organizational structure, providing oversight, student advocacy, compliance, coordination and facilitation of graduate study and post-doctoral fellowship programs.

**Response**

- The current Graduate Nano Program structure has been approved through an official document endorsed by the Deans of Science and Engineering and SGRS (Nano 14 motion enclosed).
- Secure program funding commitment from the two Faculties and six departments involved in the program. The Associate Deans, for Graduate Studies of Engineering and Science Faculties have been approached and they are supportive. However, the levels of financial support haven’t been articulated yet but in progress.
- Create a governance document that outlines the various commitments, processes and expectations of the departments and Faculties involved in the program (please see previous bullet about the levels of financial support).
- A Waterloo Institute for Nanotechnology Graduate Student Society (WINGSS) member was invited in previous years to join Graduate Nano Committee meetings as a student advocate / representative to get feedback about the Nano Grad Program Curriculum.
- No involvement with the nanofellowships program from the Graduate Nano Committee is needed because the nanofellowships program is run by the Waterloo Institute for Nanotechnology (WIN).

**7. Graduate Funding Model:** The graduate funding model should be revisited and revised to meet the needs of the graduate students. In addition, the member departments should provide a small annual flexible fund to the program for enabling nano-program centric activities, such as seminars and workshops that involve the students.

**Response**

- The graduate funding model is outside the scope of the Graduate Nano Committee mandate.
- Maintain WINGSS’ responsibility for creating an annual plan and budget for nano-

program centric activities, such as seminars and workshops, and approaching the Program Director to request funding (to be revisited).

- Require WINGSS to continue developing annual budgets rather than engaging in long-term planning that would require multi-year, advanced funding commitments from departments (to be revisited).
- Approach the member department chairs to request investment into the budget, via the Program Director, if he/she approves the WINGSS budget and objectives (to be revisited).
- Maintain the department chairs' ultimate authority to determine the amount of support their department will provide to WINGSS.

#### **B. Recommendations that were not selected for implementation**

**Research Promotion:** The program should consider developing a plan for promoting nanotechnology research to industry. This plan should also include mentorship activities that promote collaborative research between academia and industry.

#### **Response**

- WIN promotes nanotechnology research to industry, and there is no need for the Graduate Nano program to duplicate its efforts.

**UPDATED IMPLEMENTATION PLAN**

	<b>Recommendations</b>	<b>Proposed Actions</b>	<b>Responsibility for Leading and Resourcing (if applicable) the Actions</b>	<b>Timeline for addressing Recommendations</b>
1.	<b>Curriculum Authority:</b> The program should consider that the current Graduate Nano Committee receive formal approval and responsibilities on curriculum matters with the aim to revise all courses related to the program.	<ul style="list-style-type: none"> <li>Determine if member department representatives on the Graduate Nano Committee may have responsibility for and authority to approve (minor) Graduate Nano Program core curriculum changes.</li> <li>Determine if, after approval of Curriculum Committee motions by the Graduate Nano Committee, those motions could be forwarded directly to the Faculty level – ensuring the opportunity for departmental review of changes while eliminating the time-consuming process now required to attain formal multi-departmental approval.</li> <li>If possible, grant authority to Graduate Nano Committee to approve curriculum matters in the program</li> </ul>	<p>Program Director</p> <p>Program Director</p> <p>Deans and Chairs</p>	<p>Update: changes have been implemented (see above sections).</p> <p>Update: changes have been implemented (see above sections).</p> <p>Update: pending (anticipated date: Jan 2022)</p>

2.	<p><b>Full-Time Administrative Coordinator:</b> The program should consider that the administrative coordinator position become permanent. The administrative coordinator should serve in the Graduate Nano Committee and play a leading role in student advisement.</p>	<ul style="list-style-type: none"> <li>• Maintain the administrative coordinator position at a part- time level.</li> <li>• The administrative coordinator has been already involved with the Graduate Nano Committee and student advisement, as appropriate, given that member departments advise their own students. The role will continue to act as a single point of contact for program-related questions from students, administrative staff and faculty that cannot be answered at a departmental level.</li> <li>• Assign the administrative coordinator additional tasks related to the administration of the Curriculum Committee, online and recruitment communications, program promotion and administrative documentation.</li> <li>• Monitor the administrative coordinator’s program-related workload.</li> <li>• Approach the associate deans of graduate studies for the Faculties of Science and Engineering via the program director, if evidence indicates that the position requires more time.</li> </ul>	<p>Administrative Coordinator</p> <p>Administrative Coordinator</p> <p>Program Director</p> <p>Program Director</p> <p>Program Director</p>	<p>Completed (see above)</p> <p>Completed.</p> <p>Pending (anticipated date: Jan 2022)</p> <p>Completed.</p> <p>Completed.</p>
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3.	<p><b>Departmental Collaboration:</b> The Graduate Nano Committee should work closely with the departments to develop a truly collaborative program by removing inflexible traditional administrative practices and developing effective interdependence among the founding departments. A more coordinated effort between departments and the Graduate Nano Committee should be considered for recruiting students with truly interdisciplinary interest.</p>	<ul style="list-style-type: none"> <li>Investigate opportunities to invest Graduate Nano Committee members with limited departmental authority to approve changes on behalf of their department to reduce the complexity and increase the speed of the program’s approval process.</li> <li>Create and maintain within the University’s website a centralized Graduate Nano Program section that includes information about its various degree options.</li> <li>Collaborate with University- and member department- resources to promote the Graduate Nano Program to potential students.</li> <li>Work with WINGSS and member departments to coordinate student-centric programs and events that will promote positive student experiences and collaboration among students in member departments.</li> </ul>	<p>Program Director</p> <p>Administrative Coordinator</p> <p>Administrative Coordinator</p> <p>Administrative Coordinator</p>	<p>Update: enabled with considerable departmental authority to approve changes <b>(to be confirmed)</b>.</p> <p>Completed.</p> <p>Pending (anticipated date: Jan 2022)</p> <p>Pending (anticipated date: Jan 2022)</p>
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4.	<p><b>Curriculum Map Task Force:</b> The Graduate Nanotechnology Committee should consider forming a task force to develop a comprehensive curriculum map according to the Quality Assurance Framework and Guidelines of the Ontario Universities Council on Quality Assurance (OUCQA). This will provide the framework for developing clear pathways to achieving the specified program learning outcomes and degree level expectations. A handbook could be developed to provide clear documentation for the incoming students detailing expectations, requirements, time-lines and other important instructions for fulfilling the degree requirements.</p>	<ul style="list-style-type: none"> <li>• Create, with representatives from each member department, a Curriculum Committee that reports to the Graduate Nano Committee.</li> <li>• Develop a comprehensive curriculum map.</li> <li>• Review core course content, delivery and sequencing to ensure that the core course offerings are comprehensive, appropriate and delivered effectively.</li> <li>• Recommend curriculum changes to the Grad Nano Committee.</li> <li>• After clear information for students regarding expectation, requirements, timelines and other important instructions has been posted online in a new Graduate Nano website section, determine if a separate handbook would be useful for students. (See <i>Recommendation – Error! Reference source not found.</i>).</li> </ul>	<p>Program Director</p> <p>Curriculum Committee Curriculum Committee</p> <p>Curriculum Committee</p> <p>Graduate Nano Committee</p>	<p>Completed.</p> <p>Completed. Completed.</p> <p>Completed.</p> <p>Pending (anticipated date Jan 2022).</p>
5.	<p><b>Intensification of Research:</b> The program should consider reducing the number of required courses as partial fulfilment of the degree sought (particularly for PhD) in favour of intensification of research.</p>	<ul style="list-style-type: none"> <li>• Discuss after finalizing the grad course schedule and learning outcomes.</li> <li>• Suggest changes to the Graduate Nano Committee</li> </ul>	<p>Curriculum Committee</p> <p>Curriculum Committee</p>	<p>Completed.</p> <p>Completed.</p>

6.	<p><b>Faculty Support:</b> The supporting Faculties should consider providing more direct support to the program, facilitating institutional organizational structure, providing oversight, student advocacy, compliance, coordination and facilitation of graduate study and post-doctoral fellowship programs.</p>	<ul style="list-style-type: none"> <li>Formalize the current Graduate Nano Program structure through an official document endorsed by the Deans of Science and Engineering.</li> <li>Secure program funding commitment from the two Faculties and six departments involved in the program.</li> <li>Create a governance document that outlines the various commitments, processes and expectations of the departments and Faculties involved in the program.</li> <li>Invite a WINGSS member to join Graduate Nano Committee meetings as a student advocate/representative.</li> <li>No involvement with the nanofellowships program from the Graduate Nano Committee is needed because the nanofellowship program is run by WIN.</li> </ul>	<p>Program Director Program Director</p> <p>Administrative Coordinator</p> <p>Program Director</p> <p>Program Director</p> <p>Program Director</p>	<p>Completed.</p> <p>Pending (anticipated date: Fall 2021)</p> <p>Pending departmental approvals (anticipated date Jan 2022).</p> <p>Completed.</p>
7.	<p><b>Graduate Funding Model:</b> The graduate funding model should be revisited and revised to meet the needs of the graduate students. In addition, the central administration should provide a small annual flexible fund to the program for enabling nano-program centric activities, such as seminars and workshops that involve the students.</p>	<ul style="list-style-type: none"> <li>The graduate funding model is outside the scope of the Graduate Nano Committee mandate.</li> <li>Maintain WINGSS' responsibility for creating an annual plan and budget for nano-program centric activities, such as seminars and workshops, and approaching the program director to request funding.</li> <li>Require WINGSS to continue developing annual budgets rather than engaging in long-term planning that would require multi-year, advanced funding commitments from departments.</li> <li>Approach the member department chairs to request investment into the budget, via the program director, if he/she approves the WINGSS budget and objectives.</li> <li>Maintain the department chairs' ultimate authority to determine the amount of support their department will provide to WINGSS.</li> </ul>	<p>Program Director</p> <p>Program Director</p> <p>Program Director</p> <p>Program Director</p> <p>Graduate Nano Committee</p>	<p>Pending (anticipated date: Jan 2022).</p> <p>Completed.</p> <p>Pending (anticipated date: Fall 2021)</p> <p>Pending (anticipated date: Fall 2021)</p>

The Department Chair/Director, in consultation with the Dean of the Faculty shall be responsible for monitoring the Implementation Plan.

Date of next program review: \_\_\_\_\_  
Date

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Signatures of Approval:

*Mustafa Yawuz*

Feb 22, 2021

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Chair/Director

Date

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AFIW Administrative Dean/Head (For AFIW programs only)

Date

*Mary Wells*

Sept 16, 2021

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Faculty Dean

Date

**Note:** AFIW programs fall under the Faculty of ARTS; however, the Dean does not have fiscal control nor authority over staffing and administration of the program.

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Associate Vice-President, Academic  
(For undergraduate and augmented programs)

Date

*Jeffrey M. Caell*

August 16, 2021

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Associate Vice-President, Graduate Studies and Postdoctoral Affairs  
(For graduate and augmented programs)

Date

