The following is a detailed description of my teaching and training activity over the span of 10+ years.

Every class is described in terms of content, academic level and number of students; additional comments on teaching strategies and philosophy that I implemented are also reported. Student supervision experiences can be found at page 4 (Colorado State) and 6 (Saint Mary's).

The report is in chronological order.

Teaching experience at Concordia University (2010–2014)

As a consequence of the scholarships "Exemption MEQ" and "Concordia Merit award" (see CV), some teaching duties were waived during my Ph.D.

Teaching / TAing.

- *Winter and Fall 2011*: for two consecutive semesters I was appointed as instructor for one of the sections of the (coordinated) course MATH 205 – Differential and Integral Calculus II. MATH 205 is an introductory course to integrals and series; the focus is set on applications, rather than on the theoretical aspect. I was responsible for the preparation of the mid-term exam, while the final was common throughout the sections.

  Due to the tight schedule and the big quantity of material that needed to be covered, there was not enough time for engaging the students in discussion and exercises in class, but I was still trying to make the students involved in active participation to classes by asking them questions and asking them for their suggestions about ways to solve examples in class.

  As a side remark, despite the fact that the topics of power series and Taylor series were placed at the very end of the course syllabus, I do believe that they are important Mathematical tools that a student in a Calculus course should acquire. Therefore, I still tried to allocate a reasonable amount of class hours to clearly explain the material and solve exercises in class.
- *Fall 2013*: during the Fall semester 2013 I conducted exercise sessions (1 hour per week for 13 weeks in total) for the (coordinated) course MATH 201 – Elementary Functions. MATH 201 is a course covering basic mathematical notions (composition of functions, inverse function, polynomials of second order, exponential and logarithmic function) and trigonometry.

  In delivering exercise tutorials, I was carefully selecting examples that would highlight the mathematical theory behind and the different situations where the formulæ could be applied. At the beginning of class I would recall the main tools that were taught by the instructor during the week and that would have been used in the exercise session. This way the students could follow more easily the solving process.

Technical assistance. For two academic years (2012–2014) I have been responsible for the management of the online system WeBWorK for the assignments of the service courses MATH 200, 201, 202, 203, 204 and 205.

There were (approximately) bi-weekly meetings with the Undergraduate Program Director and the course coordinators, during which we were discussing a various range of topics about how to improve the learning curve of the students and implement it in the WeBWorK system.

Part of my duties was also to fix possible bugs in the systems and in the exercises (sometimes using the programming language Perl), set up the assignment load for all the courses at the beginning of each term and downloading grades to send to the instructor at the end of each term.

TEACHING EXPERIENCE AT UNIVERSITÉ CATHOLIQUE DE LOUVAIN (2014–2016)

The post-doc position at UC Louvain was funded through a European research grant (CRaMIS ERC grant) and a teaching activity was not allowed in my contract.

Training. Despite the aforementioned limitation, I was involved in training activities: I posted a thesis ("mémoire de maîtrise") proposal on Soliton theory and Integrable Systems for the master students in Mathematics[1], I gave my availability for mentoring undergraduate students for their final project and I gave tutorial lessons in Probability and Statistics. Due to the very small number of Math majors students at the time I was there, no student contacted me for either a master or a bachelor thesis.

TEACHING EXPERIENCE AT COLORADO STATE UNIVERSITY (2017–2018)

The postdoc contract at Colorado State University included a teaching load of two courses per academic year (one per semester).

Teaching.

- *Spring 2017*: in the Spring semester 2017, I was the instructor of the non-coordinated course MATH 369 – Linear Algebra. MATH 369 is a proof-based introduction on the basic notions of Linear Algebra: linear systems, matrices, vector spaces, linear transformations, eigenvalues and eigenvectors.

  Along the semester, students were asked to submit homeworks, pass one midterm test and a final exam, all prepared by myself. In order for them to better learn both the Linear Algebra theory and a general mathematical thinking and writing, I was posting detailed solutions of all the homeworks and the midterm, so that, by comparing their production with what was expected to be submitted, students could better understand what was incorrect or incomplete in their papers. This strategy turned out in a great payoff at the end of the semester, when students were capable of writing clear and structured proof in their finals.

  I also introduced the practise of giving small quizzes (timed testing) along the semester that the students were asked to solve in class and that I would later grade. Quizzes were a useful tool for giving me an overall understanding of how much the class was following my lectures, but on the other hand they were discouraging students, because the limited time that was allowed (15 minutes) was putting too much pressure on them. Therefore, I decided to abandon this project for the courses in the following semesters.
- *Fall 2017*: during the Fall Semester 2017, I conducted a graduate lecture course on Determinantal Point Processes and Random Matrices (MATH 676 – Topics in Mathematics), basing most of my lectures on research and survey papers.

  The class was meeting once a week and the format was similar to an informal working group, where attendees (graduate students, postdocs and some professors) were welcome to ask questions and start active discussions during the lectures.

  During the same semester, I was also the instructor of one section of the coordinated course MATH 317 – Advanced Calculus for one variable. MATH 317 is an advanced course mostly aimed at senior students majoring in Mathematics; the goals of the course are to

[1] At UC Louvain, in order to supervise students, faculty needs to preemptively post a thesis proposal on the department webpage for the students to pick a supervisor.

review the main results of Calculus I and II with a deeper and more theoretical perspective: sequences, limits, continuity, derivatives and integrals, series.

The homeworks, two midterm tests and final exam were mostly created jointly with the other instructor. I set up additional exercise sessions outside the class schedule whenever a midterm test or the final exam were approaching. The students highly benefitted from that and they actively participated in the meetings.

Since the textbook wasn't putting too much emphasis on some important analytical theories, like power series, I complemented the learning material with my own set of notes which were distributed it to the students and posted on Canvas as well as on my website. Some students (mostly students who wanted to continue their academic career in graduate school) gave me positive feedback on this practise.

- *Spring 2018*: I was the instructor of the Honors course MATH 345 – Differential Equations (non-coordinated). MATH 345 is an intense course on introduction to Ordinary Differential Equations: it covers first and second order equations (techniques of integration), first order systems of equations, numerical methods, qualitative analysis.

  The course testing consisted on two midterms, a set of homeworks and a final exams. Students were again provided with detailed solutions to the homeworks. For the lab sessions, I wrote complementary notes and exercises about numerical integration and the use of MATLAB for the study differential equations that were distributed to the students.

  Instead of using the quiz practise as in MATH 369, I decided to dedicate one class per week to have an exercise session. This class was not a frontal lecture, but it was a flipped class: students were given a sheet with exercises (based on the theory explained in the previous days of class and recalled at the beginning of the exercise session) and they were first given a few minutes to think about the problem individually and independently and then asked to try to solve it by actively discussing together about its resolution. One volunteer student would then come to the board and write down the solution with the help of the other students in class. Given the small size of the class (about 12 students), there was no need to divide students into small work groups. Both these exercise sessions and the extra sessions in preparation for the tests were greatly appreciated by students.
- *Fall 2018*: in the Fall semester 2018, I was the instructor of the graduate course MATH 530 – Mathematics for Scientists and Engineers. It is a course aimed at graduate students from the Engineering Department, who are enrolled in the Mathematics Graduate Interdisciplinary Studies Program at Colorado State University. The goal of the course is to teach the students a working knowledge of the fundamental mathematical tools in linear algebra, ordinary differential equations and partial differential equations.

  Being a graduate course, the lectures were fast-paced and all the student work was evaluated via weekly homeworks and a final take-home project. The aim was to accustom students to an academic research environment where they are given time to think about the problem (but still with a submission deadline) and possibly collaborating in groups. In this way, they were able to explore different solving possibilities and research tools (with the use of the textbook and programming softwares) that could be useful to them for tackling the exercises or learning new techniques based on the theory seen in class.

  Group collaborations for solving the homeworks was highly encouraged and many students benefitted a lot from that: their comprehension of the material and their exposition skills improved consistently along the semester.

Student supervision. In the Spring semester 2018, I supervised one of my students from the course MATH 345. MATH 345 allows students to conduct an honors project and gain an extra credit in their transcripts.

I gave the student a guided project where he had to analyze the Van Der Pol equation using the techniques seen in class (equilibrium points, phase space) and exploring some slightly more advanced techniques (perturbation methods and Levinson-Smith theorem for the existence of limit cycles). Since the student was majoring in Computer Science and Computational Mathematics, I also tailored the project to his main domain of specialization by adding a part of the project focused on numerical analysis and stability of numerical methods (stiffness).

We had regular meetings along the semester during which the student was reporting on his progresses and I would answer and clarify some doubts, if any. The student performed very well and greatly enjoyed facing and solving the challenges that this project was posing.

TEACHING EXPERIENCE AT CÉGEP JOHN ABBOTT (2019)

John Abbott is a teaching-intensive college. The full-time course load is three classes per semester.

Teaching.

- *Winter 2019*: I started teaching at John Abbott College in the middle of the winter semester to substitute a teacher on a parental leave. The courses taught were MATH-015 – Algebra&Trigonometry (one section) and MATH-NYB – Calculus II Science (two sections). During this period I strictly followed the instructions and the teaching style of the teacher in charge, in order to render the instructor transition as smooth as possible to the students.

  Both of the courses last 15 weeks and the size of the classes are between 20 and 30 students.

  The main goal of the course NYB – Calculus II Science is the introduction of the concept of integration (definite and indefinite integrals) and infinite series involving real-valued functions of one variable (including algebraic, trigonometric, inverse trigonometric, exponential, and logarithmic functions). The focus is exclusively on the applicative side, with emphasis on calculation techniques.

  The course 015 – Algebra&Trigonometry is designed for students who need to review or relearn the basic skills in algebra and trigonometry, most notably polynomials, rational and radical functions, exponential and logarithms, trigonometric functions. The scope of the course is to prepare students to other Mathematics courses at the college level (Calculus I and II).
- *Fall 2019*: in the Fall semester 2019, I have been appointed as course instructor and coordinator for the same courses as the previous semester: MATH-015 Algebra&Trigonometry (one section) and MATH-NYB Calculus II (two sections).

  I am responsible for the preparation of regular quizzes, weekly homeworks (set up on the WebWork platform) and four midterms for my sections. I am also part of the course committees who are responsible for the preparation of the Final exams, which is common throughout all the sections of the college.

  The student of the Calculus course are already acquainted with the pre-university environment and they definitely show independence of study and high motivation to succeed in the course.

All these qualities are lacking in the majority of the students from the Algebra&Trigonometry course. In order to compensate with that, I set up weekly flipped classes session where students are actively engaging in (re)-learning the material explained in class the week before and deepening their understanding by solving a variety of exercises of increasing level of difficulty. I encourage them to discuss with each other and to not be afraid to ask for help from other peers or directly to me.

Additionally, at the beginning of each class I invite one student to come to the board to solve a simple problem related to the material seen in the previous class. This method has a double objective:

- it is a useful review of recently covered topics that will be used in the present class;
- it mildly forces the students to keep up with the material daily, so that they will be better prepared when a midterm exam is approaching.

Clearly, this approach can be implemented in the present situation, thanks to the small size of the class (about 20 students) and the friendly environment that I constantly aim at creating when teaching in class.

TEACHING EXPERIENCE AT SAINT MARY'S UNIVERSITY (2021–)

The standard teaching load for a tenure-track professor is of two courses per semester, or one course and two recitations (exercise sessions for the service courses offered by the Department).

Teaching.

- *Fall 2021*: as I was going to be visiting MSRI (UC Berkeley), I obtained approval from the Dean of Science and VP Academic at Saint Mary's to teach remotely and to have a reduced teaching load. For the Fall semester 2021 I was only teaching one course.

  MATH 3441 – Real Analysis I is a mandatory, last year course for Math majors students. It focuses heavily on the theory of metric spaces: separability, completeness and compactness.

  The class size was small (about 8 students) and despite the challenges of online teaching, I still managed to engage with the students during classes and in office hours. The course was based on a set of notes from a similar course taught at the University of Waterloo by Prof. A. Nica, who kindly gave me permission to use them and gave me access to the editable file. I closely reviewed all the material before the beginning of classes and adapted the notes to my personal syllabus, by adding some sections and reordering the list of topics.
- *Winter 2022*: in the Winter 2022 semester, I was teaching two classes: MATH 4442 – Real Analysis II and MATH 3406 – Differential Equations II. I am additionally teaching two recitation sessions of MATH 1211 – Introductory Calculus II, to make up for the reduced teaching load of the previous semester.

  Real Analysis II is a course aimed mostly at Math major students who are considering pursuing an academic career. The main topic of the course is measure theory and Lebesgue integration.

  Differential Equations II is the continuation of the course Differential Equations I and it focuses on additional topics on Ordinary Differential Equations: series solutions, linear system of ODEs, qualitative behaviour of the solutions, phase plane, stability and equilibria, bifurcation theory and chaos.

  Both courses are elective high-level courses, therefore the number of (very motivated) students registered in the classes was extremely small (about 3 students each). Due to

the small size of the classes, it was very easy to engage with the class and follow almost individually the learning curve of the students.

Student supervision. During Summer 2022, I supervised one NSERC USRA-awarded student for a summer research project. The project was dedicated to the study of the Aztec diamond (random domino tilings and asymptotic integrable probability).

After a brief but careful study of some selected topics in enumeration[2], we proceeded with the analysis of the specific case of domino tilings of the Aztec diamond in the random setting[3]. The project culminated with the study of the limit shape of such model, the recovery of the celebrated Arctic Circle Theorem[4] and the analysis of the infinitesimal fluctuations along the circle described by the Tracy–Widom distribution[5].

The reading was complemented with "crash course" lectures about some advanced topics (in particular, Orthogonal Polynomials, Determinantal Point Processes, Steepest Descent Methods) in order to allow the student to understand and reproduce the results about the Aztec diamond. Several exercises were regularly handed to the student in order to develop a hands-on knowledge of the theoretical techniques and theories discussed during the lectures.

Parallel to the theoretical study, the student worked on developing a (Python) code that would generate random tilings of an Aztec diamond. Such numerical simulations helped visualize the results and stimulated the investigation of further models (e.g. random tilings with *non-uniform* weights, different shapes of the tiling area, etc.).

The outcomes of the project were the following:

1) the student learnt fundamental results in the field of random tilings and integrable probability, which is a very active and exciting domain of research;
2) the "crash courses" lectures exposed the student to somewhat advanced theory and techniques that they would not have the opportunity to study at Saint Mary's during their undergraduate degree;
3) the overall learned material is certainly a precious background, should the student decide to pursue a graduate degree in Mathematics;
4) the coding is publicly available to the community, as a useful resource for research and visualization.

We had approximately three 1-hour meetings per week for the whole duration of the project (16 weeks).The crash courses were explained by myself, while for all the other meetings it was responsibility of the student to prepare a portion of the program (usually 3-4 pages of notes) and present it. We would also discuss some of the exercises from the weekly assignments, if they needed clarification.

[2]M. Aigner, *A course in enumeration*, Graduate Texts in Mathematics, vol. 238, Springer, 2007.

[3]J. Baik, P. Deift, T. Suidan, *Combinatorics and Random Matrix Theory*, Graduate Studies in Mathematics, vol. 172, AMS, 2016.

[4]W. Jockusch, J. Propp, P. Shor, *Random Domino Tilings and the Arctic Circle Theorem*, arXiv:math/9801068, 1998.

[5]K. Johansson, *The arctic boundary and the Airy process*, Annals of Prob., vol. 33, no. 1, pg. 1-30, 2005.

A *non-random* selection of students's comments (chronological order).

- Very well taught. Office hours were helpful when I could attend. [...] One of the best Math professors I've had. (MATH369)
- Manuela is a great teacher and is willing to help her students. The content of this class was very challenging but she was able to help me understand during office hours. (MATH369, Spring 2017)
- This class is hard! [...] Lectures are educational though, instructor is good and answering questions. Homework is exceptionally challenging and graded harshly, but also educational and rewarding. (MATH369, Spring 2017)
- Thanks for challenging us and making the course interesting! (MATH369, Spring 2017)
- I enjoyed this class. The only thing I wish I got more from this class is understand the real world applications or why this is useful. But you're an awesome teacher! Thank you (MATH369, Spring 2017)
- Thanks for pushing me to become a better mathematician. I can walk away form this class with a solid, basic understanding of Analysis. (MATH317, Fall 2017)
- Thanks for improving and showing you care to be here. Thanks for a good semester! (MATH345, Spring 2018)
- Dr. Girotti is one of the smartest, coolest professor I've ever had! She really cares that you understand what you are doing with differential equations (as long as you show that you are making the effort). (MATH345, Spring 2018)
- Dr. Girotti was extremely helpful outside of class and was throughly enjoyable to have as a professor. Dr. Girotti, thank you for a challenging semester! I learned a lot of interesting and crazy things. (MATH345, Spring 2018)
- You're a fantastic teacher and despite this being a difficult course you made the material approachable. I appreciate the balance of theory and practise and I definitely felt like I learned much more than I expected. (MATH345, Spring 2018)
- I think the instructor did exceptionally well to cover an enormous topic of interest in just one semester of class. Partial differential equations in my opinion should be divided into two semesters in order for the engineering students to be properly adept in the topic. Nonetheless, the instructor did everything in her power to help enable us analyzing the heat and wave equations in a very organized manner. (MATH 530, Fall 2018)
- Manuela was an excellent instructor throughout. Easily the best math teacher I've had. (MATH 530, Fall 2018)
- Overall, I believe Manuela will be a good instructor, especially for math students. She was always willing to help and answer our questions. Always available for appointments and with much respect even towards our silly questions. (MATH 530, Fall 2018)
- She breaks down the material so it's easy to understand & digest, which is very much appreciated (MATH NYB, Fall 2019)
- Manuela Girotti is an incredible teacher that puts effort in making the course interesting. She is very enthusiastic and approachable. She explains the course material in a way that is clear and manageable. I look forward to her classes. (MATH NYB, Fall 2019)

- Very helpful and approachable teacher, always looking forward to attend her class. Level of difficulty of exams is fair. However, when it comes to quizzes, the questions are often harder than the examples seen in class. Despite that, I would definitely take one of her courses again. (MATH NYB, Fall 2019)
- Dr. Girotti has just taught my favorite course I have ever taken at SMU. From the many examples, to the engaging homework, to the well paced lectures I cannot begin to accurately express how fantastic of a professor she is. As I have been asked to express what could be improved upon, I will say this: the quizzes felt like a poor substitute for a traditional midterm in my opinion. Then again, it is the smallest complaint against a fantastic course and professor. (MATH 3441, Fall 2021)
- Excelled in teaching an extremely difficult topic. I feel as though I have a much deeper understanding of the field, over memorizing definitions and theorems like in some other math courses. Assignments were generally very difficult, but helped with understanding of course content. Instructor was extremely present in the course, encouraging questions and giving very meaningful answers. I felt very supported, which is necessary in a course of this difficulty. Overall, very good. (MATH 4442, Spring 2022)