UNIVERSITY OF WATERLOO

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UNIVERSITY OF WATERLOO:
KNOWLEDGE INTEGRATION (KI)

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PROGRAM SUMMARY

Knowledge Integration (KI) is a four-year honors program delivering a Bachelor of Knowledge Integration (BKI) degree. Unlike many project-based learning programs that are accessed by students from departments and schools across campus, KI is a complete undergraduate degree program designed to support students with a broad range of interests in developing the knowledge, skills and attitudes to engage in effective interdisciplinary, collaborative problem-solving. Project-based learning is integrated throughout the curriculum.

The degree program comprises:

- **Core courses:** Specific courses required for the BKI and mostly taught by KI faculty — designed to teach transferable skills and knowledge aimed at teaching and empowering students to collaborate effectively and appreciate and leverage diversity in the application of problem-solving skills.

- **Breadth courses:** Required topics (math, science, ethics and social justice, conflict management, statistics, computer science, English, cultural diversity) to develop understanding and base-level knowledge in different disciplines — not enough for fluency, but enough to be able to interact, understand the values and methods of different disciplines, and know what they don't know. These courses are typically not taught by KI faculty and are taken alongside disciplinary students. Within each topic area, students have freedom to select courses that are appropriate for their interests and level (e.g., one student might choose BIOL 130 and BIOL 230 for their sciences while another might choose PHYS 120 and CHEM 120).

- **Elective courses:** Courses that students use to build their own deeper specializations — these may align with existing degrees on campus (e.g., biology), but are also customizable (e.g., combining math and music, or anatomy and linguistics).

The program is divided into semesters, with terms offered in the fall and winter (Waterloo has a spring semester that runs May–August, but KI courses are only offered in fall/winter). The structure and core courses are listed in the table below. With a couple of exceptions, core courses are taught by Department of Knowledge Integration faculty.

Year 1	Year 2	Year 3	Year 4
The Art and Science of Learning Collaboration, Design Thinking and Problem Solving Public Speaking Critical Thinking 6 Electives (including remaining Breadth courses)	Nature of Scientific Knowledge The Social Nature of Knowledge The Museum Course: Field Trip 8 Electives (including remaining Breadth courses)	The Museum Course: Research and Design The Museum Course: Practicum and Presentation Research Design and Methods 7 Electives (including remaining Breadth courses)	Senior Honors Project: Part A Senior Honors Project: Part B 7 Electives (including remaining Breadth courses)

Various courses throughout the program include both individual and group research/problem-solving projects (specifics noted below). Project work is scaffolded throughout the degree and supported with explicit training in collaboration, allowing students to gain applied experience integrating knowledge. Each engages partners in different ways, including campus partners, community partners and student-selected projects that are community/campus-engaged. Projects range from a few weeks to eight+ months, and are done in groups ranging in size from one to eight, depending on the course.

INTEG 121: Collaboration, Design Thinking and Problem Solving

- Core course taken in the second semester of a student's first year.

- 50–60 students, of which about 20 are KI majors, with the remainder being from other programs across campus.

- Teaches collaboration and design thinking models and includes two to three small-group projects.

- Project example: design a public-service campaign for a campus partner such as the sustainability office or food services (groups of two to three working for three weeks).

INTEG 320/321: The Museum Course

- Core course taken in fall and winter terms of the third year.

- 20–30 students, all KI majors; studio-like course.

- End goal is to create a 225-square-foot museum exhibit on a topic related to the United Nations Sustainable Development Goals.

- Groups of five to six work from September to March to select, scope and research a topic; design learning outcomes; and design, research, build and exhibit an interactive, object-centric informal learning experience to encourage visitors to meet the learning outcomes.

- Museum design experts and subject matter experts from the community act as expert critics to provide feedback.

INTEG 420A/B: Senior Honors Project

- Core course taken in fall and winter of final year.

- 20–30 students, all KI majors.

- Students work typically individually, but sometimes in groups of two, on an in-depth senior honors project, supervised/advised by volunteer subject matter experts typically drawn from the University community but sometimes from beyond.

- End products range widely from a typical academic paper/poster to podcasts, game design, playwriting, poetry, children's books, etc.

INTEG 499A/B: Real-World Problem Solving

- Elective course taken in third or fourth year.

- Six to 12 students, typically all KI majors but open to others as well.

- Students work in groups of five to six in a client/consultant model with a partner.

- Partners typically drawn from outside the university (e.g., design an online portal for a local bookstore) but sometimes from within (e.g., develop a proposal for the integration of a new regional bike share program into campus systems for the university sustainability office).

RESOURCES AND ADMINISTRATIVE MODEL

The Department of Knowledge Integration (and hence the program) is housed in the Faculty of Environment, which also houses four other academic units that together deliver a total of nine undergraduate programs. It has a traditional department structure, with a chair reporting to the dean of the faculty and an associate chair managing the undergraduate program, both drawn from the five faculty (four tenured and one definite-term).

The program has a 1,600-square-foot teaching and studio space (the "KI studio") and is supported by three part-time staff. The outreach and administrative manager (KI, 0.8 FTE) leads recruitment and supports the chair and other faculty in administering the department. The department has an undergraduate advisor (KI, 0.6 FTE) to support students with course selection and administrative hurdles. A workshop coordinator from the Faculty of Environment has part of their time allocated to KI for support of the Museum Course, which uses a shared workshop (maker space, woodworking, etc.).

As an undergraduate degree program, we rely on operating funds from the university, which come from per-student tuition and government grants. Because of our small size (~20 students per cohort), we are effectively dependent on "transfer payments" from other units which is a challenge. As of July 2025, the Department of Knowledge Integration will merge with the School of Environment, Resources and Sustainability (SERS) within the Faculty of Environment at Waterloo. This collaboration will reduce administrative burdens by eliminating the need for a chair and associate chair within a small group of professors. The program will also reduce staffing for outreach, administration and advising. These changes are a reflection of the budgetary difficulties experienced by universities and colleges across Canada, especially for smaller programs.

BEST PRACTICES AND LESSONS LEARNED

Central to the program learning outcomes are:

- Appreciation of diverse perspectives in problem-solving.
- Understanding how to leverage diverse perspectives for effective interdisciplinary collaboration.
- Collaborative problem-solving skills and experience.
- Depth in an area of specialization, whether it be traditional or custom.

It has been our experience that some of the program design aspects that facilitate these outcomes are:

Building a psychologically safe community of learners, which means explicitly teaching about psychological safety and then putting in place appropriate conditions to facilitate it. Among other things, these conditions include a small cohort size and higher faculty-student ratios than are typical.

Explicit training in collaboration, scaffolded throughout the KI courses and applied in groups of varying sizes from first to fourth year, but also supported by the Conflict Management breadth requirement. It is surprising to see the number of other programs across campus expecting significant group work (e.g., in capstone design courses) but not teaching students explicitly how to understand and manage conflict.

Ensuring a combination of "knowing" and "doing" that means students gain theoretical knowledge but also have the opportunity to apply it through experiential learning, most often in collaborative groups of varying sizes and lengths. This cycle of knowing and doing appears within each of the core courses, but also across the program including the breadth electives. For example, students will learn concepts from feminist and scientific epistemology (e.g., epistemic humility, values and proof in different disciplines) in second-year core courses and then apply them in their breadth courses. A great success of the program design from that perspective is that students gain their breadth by being embedded with honors students in other disciplinary contexts on campus as opposed to taking "Biology for KI Students," for example.

Significant grace from our campus partners, as we depend critically on access to resources and courses in other academic units across campus. This unique model is both an enormous benefit, and also a significant challenge. The program is bound by both the institutional structures and processes (e.g., course timetabling, registration, enrollment limits/restrictions, budget model) and the goodwill of faculty members and administrative staff across campus. KI students enjoy a strong reputation, and a very significant majority of faculty who get to know KI students say they look forward to working with more of them. However, this arrangement is very sensitive to institutional processes, workloads and budget models. Significant growth in the number of KI students could also challenge our ability to maintain this grace and generosity.

CHALLENGES AND PRIORITIES FOR THE FUTURE

Aside from the challenge of depending heavily on goodwill, grace and structures we have no control over, other key challenges include:

MARKETING AND RECRUITMENT: While alumni, employers, parents and current students all strongly express their appreciation for the program and its graduates, it remains a significant challenge to explain it to prospective students. It is not clear how to identify a specific target group, and graduating high school students are often looking for job training in known fields (e.g., engineer, teacher, doctor, lawyer). For those students who are interested in broader

knowledge, they are not, for the most part, aware of what an interdisciplinary program might bring them. General messaging about the world needing collaborative interdisciplinary problem-solvers to tackle the great challenges we face doesn't seem to stick. The practical outcome is that, while we believe a small cohort size is key (see above), we would like that to be closer to 40 than 20. We have enrolled up to 36 in fall first-year admission, but in recent years the number of incoming students has dropped below 20.

RESOURCE COMMITMENT: While the university and the Faculty of Environment are strongly supportive of KI, we face resource constraints. The INTEG 499A/B course, for example, is under threat because it enrolls only about six to 12 students per term. In Fall 2024, the course was co-offered with a two-term project course from another department to increase enrollment across the two courses. While it seems an important part of the KI students' experience, allowing them to experience "client-driven" problem solving, it is financially difficult to run regularly.

INSTITUTIONAL STRUCTURES: In some cases, KI has pioneered the introduction of new institutional structures to support interdisciplinarity (e.g., in the tenure and promotion processes for interdisciplinary faculty). In other cases, institutional structures that have been designed for disciplinary silos have been frustrating. Just one example is the complexity of trying to set up a senior capstone course that would integrate KI students with other units' students in taking on large, longer-term projects.

FITTING IN WITH THE BRAND: Waterloo is known for its students' successful entrepreneurial innovations (it has a large, well-oiled successful startup culture), and for its cooperative education program (it was the first university to introduce Co-ops at a large scale, in 1957). Finding ways to evolve KI to better align with these key aspects of the university's brand is critical from both the perspectives of external marketing and internal support. This is a significant challenge and a priority.

The University of Waterloo is a public, comprehensive and research-intensive university in Waterloo, Canada. It has 1,400 faculty and 42,000 students. It is known for its STEM-oriented programs, co-operative education model and start-up culture, having graduated 20% of Canadian tech founders. Because most students at Waterloo are in a co-operative education model, it places a high value on experiential education. Waterloo is consistently ranked as Canada's most innovative university.