MASTER OF DIGITAL TRANSFORMATION AND INNOVATION WITH CONCENTRATION IN APPLIED DATA SCIENCE

Overview
Summary
- Degree offered: Master of Digital Transformation and Innovation (MDTI)
- Registration status options: Full-time
- Language of instruction: English
- Program option (expected duration of the program):
  - within two years of full-time study
- For immigration purposes, the summer term (May to August) for this program is considered a regularly scheduled break approved by the University. Students should resume full-time studies in September.
- Academic units: Telfer School of Management (https://telfer.uottawa.ca/en/), Faculty of Arts (https://arts.uottawa.ca/en/), Faculty of Engineering (http://engineering.uottawa.ca/), School of Electrical and Computer Science (http://engineering.uottawa.ca/eecs/)

Program Description
The Digital Transformation and Innovation program is a multi-faculty collaboration between the Telfer School of Management, the Faculty of Arts, and the Faculty of Engineering to train highly qualified professionals to create, manage and research the profound change to our world that is happening as a result of electronic digital technology. At its heart, the technology enables the collection and communication of huge amounts of data that transforms how business and society works. It also creates a new online environment where the experience of business and social interactions by individuals is being reinvented. Innovation is an important aspect of the program to emphasize the re-invention and creative design of user experiences in business and social interactions.

The concentration in Applied Data Science is a multidisciplinary graduate program with a strong commitment to industry relevance and ethics. In the program, students will:

1. Develop and demonstrate the ability to communicate with and integrate multi-disciplinary expertise related to data.
2. Develop and demonstrate the ability to lead, design, and create data-driven transformation and innovation using current and emerging tools, techniques and technology.
3. Obtain the required skills in data cleaning, data quality, data analytics and machine learning to apply data science methods in practice to real problems involving digital transformation and innovation.
4. Develop and demonstrate the ability to assess, test and research innovation in data science with sensitivity and awareness around ethics, equity, diversity, business impact and social impact.

Other Programs Offered Within the Same Discipline or in a Related Area
- Doctorate in Philosophy Digital Transformation and Innovation
- Master of Science Digital Transformation and Innovation
- Master of Digital Transformation and Innovation
- Master of Digital Transformation and Innovation with Concentration in UX Design

Fees and Funding
- Program fees

The estimated amount for university fees (https://www.uottawa.ca/university-fees/) associated with this program are available under the section Finance your studies (http://www.uottawa.ca/graduate-studies/programs-admission/finance-studies/).

International students enrolled in a French-language program of study may be eligible for a differential tuition fee exemption (https://www.uottawa.ca/university-fees/differential-tuition-fee-exemption/).

- To learn about possibilities for financing your graduate studies, consult the Awards and financial support (https://www.uottawa.ca/graduate-studies/students/awards/) section.

Notes
- Programs are governed by the general regulations (http://www.uottawa.ca/graduate-studies/students/general-regulations/) in effect for graduate studies at the University of Ottawa.
- In accordance with the University of Ottawa regulation, students have the right to complete their assignments, examinations, research papers, and theses in French or in English.

Program Contact Information
Graduate Studies Office, Faculty of Engineering (https://engineering.uottawa.ca/graduate-studies-office/)
STE 1024
800 King Edward Ave.
Ottawa ON Canada
K1N 6N5
Tel.: 613-562-5347
Fax.: 613-562-5129
Email: engineering.grad@uottawa.ca

Twitter | Faculty of Engineering (https://twitter.com/uOttawaGenie?lang=en/)
Facebook | Faculty of Engineer (https://www.facebook.com/uottawa.engineering/)

Admissions Requirements
For the most accurate and up to date information on application deadlines, language tests and other admission requirements, please visit the specific requirements (https://www.uottawa.ca/graduate-studies/programs-admission/apply/specific-requirements/) webpage.

To be eligible, candidates must:

- Have a Bachelor’s degree with a specialization or a major (or equivalent) in a relevant discipline with a minimum admission average of 75% (B+).

  Note: International candidates must check the admission equivalencies (https://www.uottawa.ca/graduate-studies/international/study-uottawa/admission-equivalencies/) for the diploma they received in their country of origin.

- Have completed a course in statistics; a course in management information systems or computing; and two advanced courses showing specialization in one of three disciplines: creative arts and humanities (online multi-media or communications); management (digital transformation management or strategy); technology (online application development or data science).

Language Requirements

Most courses are delivered in English as the international language for advanced information technology. However, the program will provide an appropriately supportive environment for francophone students to develop professional competence in technical English at their own pace. Students have the right, as stipulated in the University’s bilingualism regulations (Academic Regulations I-2), to complete all their work, including their thesis, in the official language of their choice (French or English). There are fully bilingual professors and advisors who can support students in French.

Applicants whose first language is neither French nor English must provide proof of proficiency in the language of instruction through one of the following two requirements or one of the language tests below.

- Proof of completion within the last five years, of a previous degree program in an English language university.
- Proof of recent prolonged residence and exercise of a profession in an English speaking country (normally at least four years over the last six years).

Language tests recognized by the University of Ottawa:

- TOEFL minimum score of 600 (paper-based) with a minimum score of 50 on the written and 50 on the spoken or a minimum score of 100 (internet-based).
- IELTS minimum score of 7 for 3 of the 4 tests (Reading, Listening, Writing, Speaking) and a minimum score of 6 in the fourth test.
- A score of at least 14 on the CANTEST, with no individual test score below 4.0, along with a minimum score of 4.5 on the oral component of the test.

Note:

- Candidates are responsible for any fees associated with the language tests.
- Test scores cannot be more than two-years-old as of September 1 of the year of potential entry into the program.

Notes

- The admission requirements listed above are minimum requirements and do not guarantee admission to the program.

- Admissions are governed by the general regulations (http://www.uottawa.ca/graduate-studies/students/general-regulations/) in effect for graduate studies.

Applying to the COOP Option

In order to apply to the co-op option, you must first be admitted to a program that offers co-op.

Your application must be submitted by the end of the first month of enrollment in your primary program, i.e., by the end of September.

Admission to the co-op option occurs on a competitive basis and is managed by the Co-op office. Enquiries should be directed to that office.

To be admitted to the co-op option, you must:

- Be enrolled as a full-time student in the master’s in Master of Digital Transformation and Innovation.
- Have and maintain a minimum CGPA of 7.0 (B+ or 75%) in course taken at the University of Ottawa.
- Be a Canadian citizen, a permanent resident or an international student (authorization or diplomat)
- Pay the required co-op fees.

Program Requirements

Master’s with Project

Students must meet the following requirements:

Compulsory Courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>DTI 5125</td>
<td>Fundamentals for Applied Data Science</td>
<td>3 Units</td>
</tr>
<tr>
<td>DTI 5126</td>
<td>Data Science Applications</td>
<td>3 Units</td>
</tr>
<tr>
<td>DTI 7101</td>
<td>Research Workshop in Digital Transf. and Innovation</td>
<td>1.5 Units</td>
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<tr>
<td>3 optional course units from:</td>
<td></td>
<td>3 Units</td>
</tr>
<tr>
<td>CMN 5115</td>
<td>Communication Ethics</td>
<td>1.5 Units</td>
</tr>
<tr>
<td>DTI 5310</td>
<td>Ethics for Design, AI, and Robotics</td>
<td>1.5 Units</td>
</tr>
<tr>
<td>ISI 5310</td>
<td>Ethics, Values and Information Dilemmas</td>
<td>1.5 Units</td>
</tr>
<tr>
<td>4.5 optional course units from the list of Foundation courses</td>
<td></td>
<td>4.5 Units</td>
</tr>
<tr>
<td>6 optional course units from the list of Applied Data Science courses</td>
<td></td>
<td>6 Units</td>
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<tr>
<td>3 optional course units from the list of optional courses</td>
<td></td>
<td>3 Units</td>
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Research Project

- DTI 6997 | Research project | 6 Units |

Applied Data Science Courses

<table>
<thead>
<tr>
<th>Course</th>
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<th>Units</th>
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</thead>
<tbody>
<tr>
<td>ADM 6277</td>
<td>E-Business Energy Management</td>
<td>1.5 Units</td>
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<tr>
<td>ADM 6287</td>
<td>Business Intelligence Technologies and Big Data Analytics for DTI</td>
<td>1.5 Units</td>
</tr>
<tr>
<td>ADM 6420</td>
<td>Digital Marketing</td>
<td>1.5 Units</td>
</tr>
<tr>
<td>CSI 5115</td>
<td>Database Analysis and Design</td>
<td>1.5 Units</td>
</tr>
<tr>
<td>CSI 5180</td>
<td>Topics in Artificial Intelligence</td>
<td>1.5 Units</td>
</tr>
<tr>
<td>CSI 5311</td>
<td>Distributed Databases and Transaction Processing</td>
<td>1.5 Units</td>
</tr>
<tr>
<td>CSI 5386</td>
<td>Natural Language Processing</td>
<td>1.5 Units</td>
</tr>
<tr>
<td>DTI 6302</td>
<td>Topics in Applied Data Science</td>
<td>1.5 Units</td>
</tr>
</tbody>
</table>
DTI 6303  Topics in Applied Data Science  1.5 Units
DTI 6230  Business Process Management and Performance Measurement  3 Units
EBC 6230  Business Process Management and Performance Measurement  3 Units
ELG 5142  Ubiquitous Sensing for Smart Cities  3 Units
GNG 5121  Planning of Experiments in Engineering Design  3 Units
GNG 5122  Operational Excellence and Lean Six Sigma  3 Units
GNG 5123  Enterprise Architecture  3 Units
ISI 6322  Digital Preservation  3 Units
ISI 6332  Metadata and Taxonomies  3 Units
ISI 6343  Digital Asset Management Technologies  3 Units
ISI 6351  Social Media  3 Units

Foundation Courses

Management Orientation

DTI 5124  Internet Technologies and Mobile Commerce  3 Units
DTI 6130  Web Services  1.5 Units
DTI 6170  Cyber Security Systems and Strategies  1.5 Units
DTI 6220  Data Analytics and Business Intelligence  1.5 Units
DTI 6260  Integrated Networks for the Enterprise  1.5 Units

Technology Orientation

DTI 5175  Mobile Commerce Technologies  3 Units
DTI 5380  Systems and Architectures for Electronic Commerce  3 Units
DTI 5389  Electronic Commerce Technologies  3 Units

Creative Arts and Humanities Orientation

ISI 6342  Web Architecture and Technologies  3 Units

Optional Courses

Management Orientation

ADM 6260  Project Management I  1.5 Units
ADM 6261  Project Management II  1.5 Units
ADM 6276  Enterprise Resource Planning Systems Management  1.5 Units
ADM 6277  E-Business Energy Management  1.5 Units
ADM 6279  Socio-Technical Change  1.5 Units
ADM 6286  International E-Business Strategies for DTI  1.5 Units
ADM 6420  Digital Marketing  1.5 Units
DTI 5124  Internet Technologies and Mobile Commerce  3 Units
DTI 5125  Data Science Applications  3 Units
DTI 5126  Fundamentals for Applied Data Science  3 Units
DTI 5990  Directed Readings I  1.5 Units
DTI 5991  Directed Readings II  1.5 Units
DTI 6130  Web Services  1.5 Units
DTI 6170  Cyber Security Systems and Strategies  1.5 Units
DTI 6180  Strategic Knowledge Management  1.5 Units
DTI 6220  Data Analytics and Business Intelligence  1.5 Units
DTI 6230  Business Process Management and Performance Measurement  3 Units
DTI 6240  Mobile Commerce  1.5 Units
DTI 6260  Integrated Networks for the Enterprise  1.5 Units

DTI 6300  Topics in Digital Transformation and Innovation  3 Units
DTI 6301  Topics in Digital Transformation and Innovation  3 Units
DTI 6302  Topics in Applied Data Science  3 Units
DTI 6303  Topics in Applied Data Science  1.5 Units
DTI 6304  Topics in User Experience Design  3 Units
DTI 6305  Topics in User Experience Design  1.5 Units
MBA 5270  Knowledge and Information Management  1.5 Units
MBA 6220  Managing Customer Relations and the Sales Process  1.5 Units
MGT 6111  Venture Capital and Private Equity  3 Units
MGT 6160  Systems of Innovation  3 Units
MHA 6271  Application of Information Technology in Health Care  1.5 Units
POP 8950  Special Topics in Population Health  3 Units

Technology Orientation

ADM 6287  Business Intelligence Technologies and Big Data Analytics for DTI  1.5 Units
CSI 5105  Network Security and Cryptography  3 Units
CSI 5111  Software Quality Engineering  3 Units
CSI 5112  Software Engineering  3 Units
CSI 5115  Database Analysis and Design  3 Units
CSI 5118  Automated Verification and Validation of Software  3 Units
CSI 5122  Software Usability  3 Units
CSI 5180  Topics in Artificial Intelligence  3 Units
CSI 5311  Distributed Databases and Transaction Processing  3 Units
CSI 5386  Natural Language Processing  3 Units
DTI 5175  Mobile Commerce Technologies  3 Units
DTI 5380  Systems and Architectures for Electronic Commerce  3 Units
DTI 5389  Electronic Commerce Technologies  3 Units
DTI 6300  Topics in Digital Transformation and Innovation  3 Units
DTI 6301  Topics in Digital Transformation and Innovation  3 Units
DTI 6302  Topics in Applied Data Science  3 Units
DTI 6303  Topics in Applied Data Science  1.5 Units
DTI 6304  Topics in User Experience Design  3 Units
DTI 6305  Topics in User Experience Design  1.5 Units
MBA 5270  Knowledge and Information Management  1.5 Units
MBA 6220  Managing Customer Relations and the Sales Process  1.5 Units
MGT 6111  Venture Capital and Private Equity  3 Units
MGT 6160  Systems of Innovation  3 Units
MHA 6271  Application of Information Technology in Health Care  1.5 Units
POP 8950  Special Topics in Population Health  3 Units

Creative Arts and Humanities Orientation

GNG 5120  Technology entrepreneurship for Engineers and Computer Scientists  3 Units
GNG 5121  Planning of Experiments in Engineering Design  3 Units
GNG 5122  Operational Excellence and Lean Six Sigma  3 Units
GNG 5123  Enterprise Architecture  3 Units
GNG 5130  Communication and Influence for Engineers  3 Units
GNG 5131  Sales and Influence for Engineers  3 Units
GNG 5231  Sales Engineer Internship Project  6 Units
GNG 5300  Topics in Engineering  3 Units
GNG 5310  Topics in Industry Practice  3 Units
GNG 5314  Engineering Design  3 Units
GNG 5411  Creativity and Innovation  3 Units
GNG 5902  Industry Internship Project  6 Units

Creative Arts and Humanities Orientation

AHL 5300  Creativity and Innovation  3 Units

The courses DTI 5124, GNG 5124 cannot be combined for units.

Course Component: Lecture
The courses DTI 5125, CSI 5155, CSI 5387, GNG 5125 cannot be combined for units.

DTI 5126 Fundamentals for Applied Data Science (3 units)
Essential data science concepts relevant to practical applications are covered including: problem formulation; data acquisition; data preprocessing, modeling and statistical analysis. Hands on experience with data science tools and techniques including: supervised and unsupervised machine learning; presentation of results; applications in areas such as accounting, finance, marketing and supply chain management.

Course Component: Lecture

DTI 5175 Mobile Commerce Technologies (3 units)

Course Component: Lecture

DTI 5310 Ethics for Design, AI, and Robotics (3 units)
Artificial Intelligence technologies are becoming ever more present in applications like: automated vehicles and mobility-as-a-service (e.g. driving and system-level control algorithms); business intelligence (e.g. predictive resource allocation); consumer electronics (e.g. social robots and smart speakers); healthcare (e.g. image classification in medical imaging); the justice system (e.g. recidivism prediction and sentencing); and weapons systems (e.g. targeting and kill decision-making). Many of these applications are raising significant ethical concerns. A range of topics in applied technology ethics are examined through the lens of contemporary philosophy and applied ethics texts and popular media articles. Practical frameworks, methodologies and tools for anticipating, and addressing, ethical issues are introduced through hands-on, group-based design thinking workshops and projects.

Course Component: Lecture
The courses DTI 5310, CSI 5195 cannot be combined for units.

DTI 5380 Systems and Architectures for Electronic Commerce (3 units)

Course Component: Lecture

DTI 5389 Electronic Commerce Technologies (3 units)

Course Component: Lecture
DTI 5501 Fondements de gestion pour les affaires électroniques (3 crédits)
Volet : Cours magistral

DTI 5502 Fondements des technologies de l'information pour les affaires électroniques (3 crédits)
Volet : Cours magistral

DTI 5503 Fondements des statistiques pour les affaires électroniques (3 crédits)
Volet : Cours magistral

DTI 5990 Études dirigées / Directed Readings I (1.5 crédit / 1.5 unit) 
Volet / Course Component: Recherche / Research

DTI 5991 Études dirigées / Directed Readings II (1.5 crédit / 1.5 unit) 
Volet / Course Component: Recherche / Research

DTI 6130 Web Services (1.5 unit)
Web services business models and strategies. Enterprise Application Integration and Service Oriented Architectures. Web services technology standards. Consumer and enterprise adoption of web service technologies and platforms such as Mashups and Cloud Computing.
Course Component: Lecture

DTI 6170 Cyber Security Systems and Strategies (1.5 unit)
Course Component: Lecture

DTI 6180 Strategic Knowledge Management (1.5 unit)
Leveraging a firm's intellectual capital to enhance organizational performance. Business analysis frameworks, strategy roadmaps and enterprise architectures relevant to the planning and execution of knowledge management initiatives in organizations. Using the web to maximize knowledge acquisition and sharing among employees.
Course Component: Lecture

DTI 6210 Electronic Commerce Architecture (1.5 unit)
Course Component: Lecture

DTI 6220 Data Analytics and Business Intelligence (1.5 unit)
Introduction to business data collection, data pre-processing, data warehouses, data marts, and online analytical processing. Data mining tasks including classification, clustering and association rules. Data mining model building, tools and techniques including decision trees, neural networks, and regression analysis. Application of these techniques in business including CRM, target marketing, credit scoring, churn, survival analysis, and fraud detection.
Course Component: Lecture

DTI 6230 Business Process Management and Performance Measurement (3 units)
Hands on introduction to Business Process Management Technologies. Review of the latest concepts for using technology to improve performance of business processes. Analysis of advances in Internet-enabled B2B and enterprise business models with emphasis on service-oriented and event-driven architecture. Introduction to current performance measurement tools and the role of data science in business process management. Example applications such as supply chain management, order processing, and health care process management will be studied.
Course Component: Lecture

DTI 6240 Mobile Commerce (1.5 unit)
Course Component: Lecture

DTI 6250 Document Engineering for Digital Transf. and Innovation (1.5 unit)
Course Component: Lecture

DTI 6260 Integrated Networks for the Enterprise (1.5 unit)
Course Component: Lecture

DTI 6300 Topics in Digital Transformation and Innovation (3 units)
Recent and advanced topics in the field of Digital Transformation and Innovation and its related areas. Topics vary from year to year.
Course Component: Lecture

DTI 6301 Topics in Digital Transformation and Innovation (3 units)
Recent and advanced topics in the field of Digital Transformation and Innovation and its related areas. Topics vary from year to year.
Course Component: Lecture

DTI 6302 Topics in Applied Data Science (3 units)
Recent and advanced topics in the field of Applied Data Science and its related areas. Topics vary from year to year.
Course Component: Lecture
DTI 6303 Topics in Applied Data Science (1.5 unit)
Recent and advanced topics in the field of Applied Data Science and its related areas. Topics vary from year to year.
Course Component: Lecture

DTI 6304 User Experience Principles and Practices (3 units)
User experience (UX) facets including functionality, usability and desirability as key success factors for technology adoption and acceptance; Human-computer interaction (HCI) theories; UX frameworks and patterns for interaction design, information design, and visual design; UX management best practices; UX design methods and tools; UX evaluation and usability engineering.
Course Component: Lecture

The courses DTI 6104, CSI 5122 cannot be combined for units.

DTI 6401 User Experience Principles and Practices (3 units)
Course Component: Lecture
Prerequisite: CSI 5122 or DTI 6401.

DTI 6700 Thèmes choisis en affaires électroniques (3 crédits)
Sujets actuels et avancés en affaires électroniques et disciplines connexes. Les sujets varient d'une année à l'autre.
Volet : Cours magistral

DTI 6701 Thèmes choisis en affaires électroniques (3 crédits)
Sujets actuels et avancés en affaires électroniques et disciplines connexes. Les sujets varient d'une année à l'autre.
Volet : Cours magistral

DTI 6900 Stage international / International Work Term (3 crédits / 3 units)
Expérience pratique dans un milieu de travail international. Noté S (satisfaisant) / NS (non satisfaisant) selon les résultats de rapport écrit et l'évaluation de l'employeur. / Practical international experience.
Volet / Course Component: Cours magistral / Lecture

DTI 6950 Lectures dirigées / Directed Readings (1.5 crédit / 1.5 unit)
Volet / Course Component: Cours magistral / Lecture

DTI 6997 Projet de recherche / Research project (6 crédits / 6 units)
Le sujet de recherche, ainsi que le professeur qui va le diriger, doivent être approuvés par la direction du programme avant l'inscription à la troisième session. Le sujet peut être de nature théorique (par exemple, une évaluation de la documentation ou une étude de la littérature scientifique) ou appliquée (par exemple, des études de cas). Un mémoire, d'une cinquantaine de pages, doit être rédigé et approuvé par le professeur qui le dirige ainsi qu'un autre professeur. / The research topic and the professor who will direct it must be approved by the program director prior to registration in the third session. The topic can be theoretical (for instance, based on a documentation assessment or a review of the scientific literature) or applied (based on case studies). A research paper, about 50 pages long, must be written and approved by the project director and another professor.
Volet / Course Component: Recherche / Research

DTI 7100 Research Methods in Digital Transf. and Innovation (3 units)
Course Component: Lecture

DTI 7101 Research Workshop in Digital Transf. and Innovation (1.5 unit)
Writing a Research Project proposal including problem formulation and work plan. Essentials of graduate report writing, information management, literature search techniques and reference management. Research ethics including academic integrity and avoiding academic fraud.
Course Component: Lecture

DTI 7102 Interdisciplinary Research Methods in Digital Transf. and Innovation (1.5 unit)
Writing a Thesis Proposal. Research design. Introduction to positivist and interpretive approaches, behavioral and design science research, qualitative and quantitative research methods, and sampling strategies and techniques.
Course Component: Lecture

DTI 7103 Visual Literacy and User Experience Design Principles (3 units)
Invited workshops, presentations and events involving researchers from business, engineering, and arts and experts from industry. In addition to in-class quizzes and assignment, student write a literature survey paper and submit a research or project proposal to address a topic in User Experience Design (UXD).
Course Component: Lecture
Prerequisite: CSI 5122 or DTI 6401.

DTI 7990 Proposition de thèse / Thesis Proposal
Volet / Course Component: Recherche / Research

DTI 8101 Interdisciplinary Doctoral Seminar in Digital Transformation and Innovation I (3 units)
Recent developments in Digital Transformation and Innovation research. Critical analysis of theories, models, and methods. Critical synthesis of the field literature from different perspectives. Students will write a systematic survey paper of the literature relevant to their research in one of the three fields of the program. The paper must be in a different field from that selected for the paper in DTI 8102. Course reserved for students in the Digital Transformation and Innovation PhD program.
Course Component: Seminar
DTI 8102 Interdisciplinary Doctoral Seminar in Digital Transformation and Innovation II (3 units)
Recent developments in Digital Transformation and Innovation research. Critical analysis of theories, models, and methods. Critical synthesis of the field literature from different perspectives. Students will write a systematic survey paper of the literature relevant to their research in one of the three fields of the program. The paper must be in a different field from that selected for the paper in DTI 8101. Course reserved for students in the Digital Transformation and Innovation PhD program.
Course Component: Seminar

DTI 9997 Projet de thèse doctoral / Doctorate Thesis Proposal
Volet / Course Component: Recherche / Research

DTI 9998 Examen général de doctorat / Comprehensive Exam
Volet / Course Component: Recherche / Research