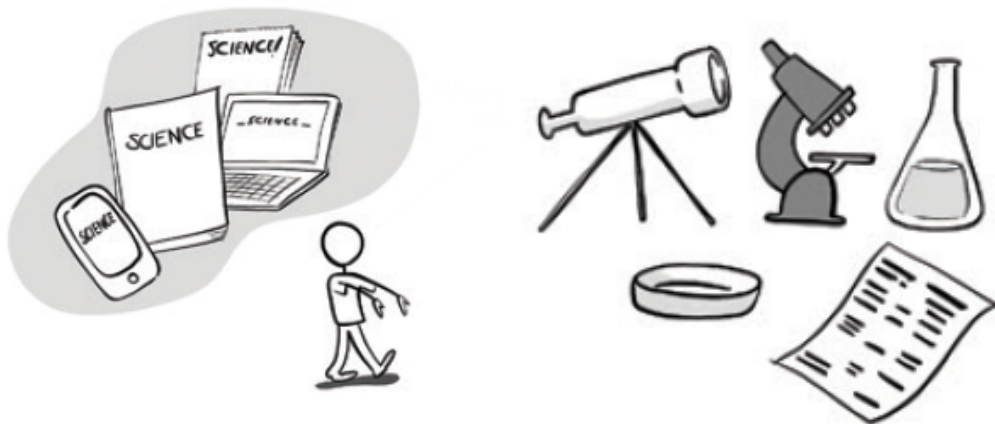


A FORENSIC INVESTIGATION: 15 years of team-teaching in an interdisciplinary science course

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The subject of this talk is being published in English and in French in an upcoming article: [**Revue-Ete2022-Vol.35-4_Bell**](#)

(Of interest to those designing the integrative course in the new Science Program (competency 0NTC))

**Interdisciplinary science
is needed to solve
“Wicked Problems” such
as pandemics, loss of
biodiversity, climate
change etc.**

Traiter de situations complexes dans une perspective d'interdisciplinarité

En s'appuyant sur ses connaissances disciplinaires, l'élève établit des liens entre les différentes disciplines. Il organise ses acquis adéquatement de façon à pouvoir les utiliser efficacement dans divers contextes.

Au terme de sa formation, l'élève adopte un point de vue plus large sur des problématiques en faisant des liens entre les disciplines. De plus, il s'est construit un ensemble de savoirs cohérents et complémentaires l'amenant à créer des liens appropriés où les interrelations entre les disciplines sont essentielles.

Apprécier les liens unissant les sciences, les technologies et la société

Les sciences et les technologies interagissent et ne se développent pas en vase clos, hors de la société. Elles émergent dans un contexte historique et social qui, à son tour, est influencé par les découvertes et les inventions scientifiques. Ainsi, les sciences et les technologies permettent à l'élève d'affiner son regard sur différents domaines.

L'élève est sensibilisé au contexte historique et social dans lequel s'élaborent des théories scientifiques et des technologies de même qu'il est initié à des dimensions épistémologiques. Ainsi, il comprend mieux comment les savoirs scientifiques se construisent et comment la science peut répondre aux besoins contemporains par des réalisations technologiques.

L'élève prend aussi conscience de l'importance des enjeux de société au moyen de savoirs scientifiques faisant l'objet de consensus établis. Il acquiert une compréhension plus approfondie de ces enjeux, laquelle est jugée nécessaire à une culture scientifique de base. En tant que citoyen responsable, il est outillé pour contribuer positivement à l'évolution de la société et au bien-être des communautés. Ses choix éclairés tendront notamment à minimiser les effets anthropiques négatifs sur l'environnement.

Faire preuve de sens critique et de rigueur intellectuelle

L'élève est en mesure de construire des raisonnements, des démonstrations et des preuves. Il est capable de repérer un certain nombre d'idées relativement à un sujet, de les comparer, de les classer

So why are there so few successful examples of interdisciplinary science courses?



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DIVERSE PERSPECTIVES ON INTERDISCIPLINARITY FROM MEMBERS OF THE COLLEGE OF THE ROYAL SOCIETY OF CANADA >

Abstract

Various multiple-disciplinary terms and concepts (although most commonly “interdisciplinarity,” which is used herein) are used to frame education, scholarship, research, and interactions within and outside academia. In principle, the premise of interdisciplinarity may appear to have many strengths; yet, the extent to which interdisciplinarity is embraced by the current generation of academics, the benefits and risks for doing so, and the barriers and facilitators to achieving interdisciplinarity, represent inherent challenges. Much has been written on the topic of interdisciplinarity, but to our knowledge there have been few attempts to consider and present diverse perspectives from scholars, artists, and scientists in a cohesive manner. As a team of 57 members from the Canadian College of New Scholars, Artists, and Scientists of the Royal Society of Canada (CCNAS) who self-identify as being engaged or interested in interdisciplinarity, we

<https://rsc-src.ca/en/voices/diverse-perspectives-interdisciplinarity-from-members-college-royal-society-canada>

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From the Royal Society of Canada article:

“Perhaps the clearest message emerging from this exercise is that working across established boundaries of scholarly communities is rewarding, necessary, and is more likely to result in impact. Solving many of the world’s complex and pressing problems (e.g., climate change, sustainable agriculture, the burden of chronic disease, and aging populations) demands thinking and working across long-standing, but in some ways restrictive, academic boundaries.”

BENEFITS

- Learners use higher level reasoning, have better retention and knowledge, better decision making strategies
Johnson et al (2000)
- Teachers develop a better contextual understanding of their own discipline in relationship to other disciplines
Burkhardt (2006)

From the Royal Society of Canada article:

“However, there are barriers that limit the ease with which this can occur”

BARRIERS

- Departments are organised to be autonomous and are often competing for limited resources.
Burkhardt (2006)
- There are significant cultural differences between disciplines in their epistemic values, jargon, skill sets, and methodologies.
Anderson (2010)

Example: Forensic scientists measure larval length as the most accurate way to estimate time of death: this is foreign for a physicist.

INTRODUCTION to FORENSIC SCIENCE



- The course was first launched in Fall 2007. The aim was to design an Introduction level 1 complementary course especially for students in the Criminology Option of the Social Science program that was then being launched by the college.
- The course is distinguished by its authenticity – real forensic techniques being taught by scientists who are experts in their field, in a way that mimics the organisation of different units of a Forensic Science lab.

Course Objectives:

- To understand the scope and approach of Forensic Science in the study of a crime scene
- To understand, appreciate and apply the basic elements of the scientific process of inquiry

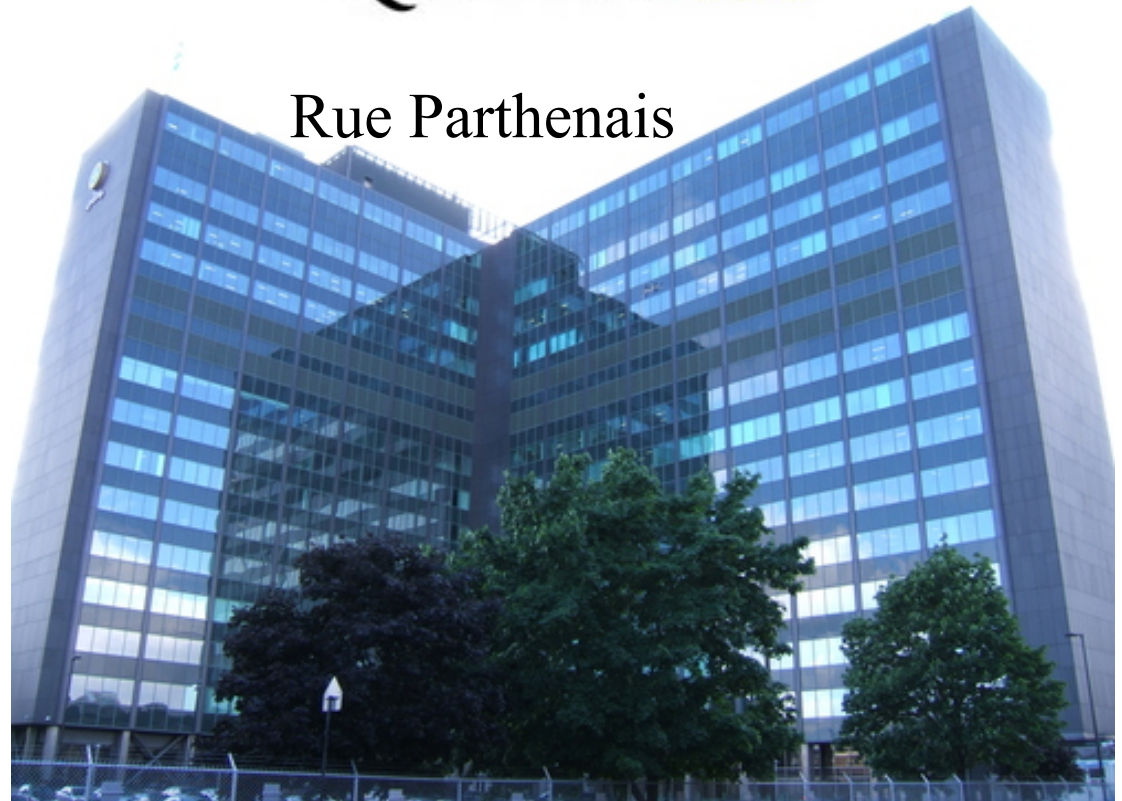
To research the course, the course designers were given a guided tour of the LSJML, by its then director in 2007, Yves “Bob” Dufour.

**Laboratoire
de sciences judiciaires
et de médecine légale**

Québec 

The LSJML was founded in 1914, modeled on *Laboratoire de police scientifique* in Lyons, France. It was the 2nd to be established in the world.

Rue Parthenais



<http://www.securitepublique.gouv.qc.ca/lajml/a-propos.html>

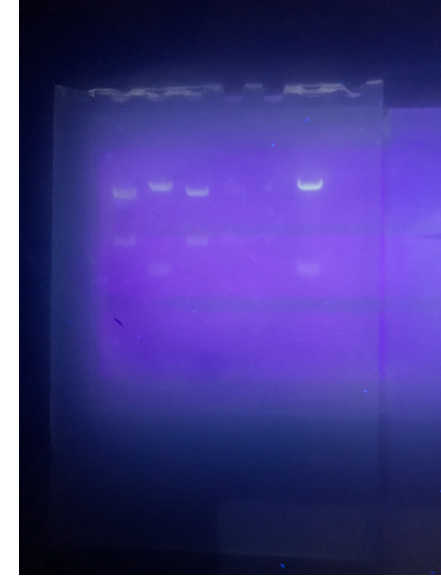
From the Course Objectives, the Unifying Theme of the course is: ***the role of the forensic scientist as a person who supplies objective and material evidence in order to help come to a fair and just determination of guilt or innocence.***



Fly larva



Animal hair



DNA profiling

- Students rotate between a Biology teacher, a Chemistry teacher and a Physics teacher for different units of the course – mimicking the units of a forensic science lab. Each teacher has $3 \times \frac{1}{3} = 1$ course workload.
- Students have one theory class and one lab class per week.
- The labs teach the pragmatic and skill based (expert) nature of science, and establish the importance of accuracy and precision in measurement.

Student Section I Home Teacher A	Student Section II Home Teacher B	Student Section III Home Teacher C
2 weeks GENERAL INTRODUCTION With Teacher A Quiz	2 weeks GENERAL INTRODUCTION With Teacher B Quiz	2 weeks GENERAL INTRODUCTION With Teacher C Quiz
4 weeks DISCIPLINE B With Teacher B Unit Test B	4 weeks DISCIPLINE C With Teacher C Unit Test C	4 weeks DISCIPLINE A With Teacher A Unit Test A
4 weeks DISCIPLINE C With Teacher C Unit Test C	4 weeks DISCIPLINE A <u>with</u> Teacher A Unit Test A	4 weeks DISCIPLINE B <u>with</u> Teacher B Unit Test B
4 weeks DISCIPLINE A With Teacher A Unit Test A	4 weeks DISCIPLINE B With Teacher B Unit Test B	4 weeks DISCIPLINE C With Teacher C Unit Test C
1 week SYNTHESIS ASSIGNMENT With Teacher A	1 week SYNTHESIS ASSIGNMENT With Teacher B	1 week SYNTHESIS ASSIGNMENT With Teacher C
Total = 15 weeks	Total = 15 weeks	Total = 15 weeks

Introduction: history of Forensic Science, the scientific method, and the role of Forensic Science within the legal system. (The quiz can be used to form permanent groups of mixed abilities.)

Units: Forensic techniques such as ballistics, DNA profiling, toxicology, voiceprint, spectroscopy

Synthesis: oral and written assignments link forensic techniques to concepts outlined in Introduction

SUCSESSES

1. **Longevity** (15 years and still going!). Its resilience is derived from the flexibility within the course design.

Teachers are relatively autonomous and can implement their own pedagogical approaches without impinging on the other teachers in the course. This makes the course a low stakes creative space for innovation. Teaching three iterations of the same topic helps perfect innovative techniques. R scores are not impacted and alignment between sections can be controlled by a common final synthesis assignment.

2. **Correct targeting** to the student population

“the majority of students from the profile continue on in crime-oriented studies at university (including law, criminology, justice, social work, rehabilitation) or in policing (including Police Technology at the Cégep level and RCMP training at the federal level).”

**Anthony Singelis Dean of Curriculum and Faculty Development,
Champlain College Saint Lambert**

3. Popularity with students.

A survey in Fall 2021 showed overwhelming satisfaction with the course.

“We also know that all the students in the profile are attracted to it because of the “crime solving” over-arching theme in the curriculum.”

**Anthony Singelis Dean of Curriculum and Faculty Development,
Champlain College Saint Lambert**

Student Responses to Survey

“It shows a realistic and in a sense more mature aspect of the course. The covered content would most likely appear in the work that a criminology student would end up doing. For some, it would indicate if they wanted to pursue studies in this field.”

“If you want to know what criminology is all about, this is the perfect class.”

“Techniques and real vocabulary were so useful and interesting. I can now understand police series.”

STUDENT FEEDBACK QUESTIONNAIRE

The *Introduction to Forensic Science* Course 105-CAI-LA was launched in 2007, and has continued uninterrupted for 15 years. It is the only multidisciplinary course at Champlain College, and it is unique within the Cégep System.

We would very much like to hear your feedback about the course to see if it is achieving its goal of cementing interest in the Criminology option of the Social Science program, while helping you understand the requirements of a career in Forensic Science. Please could you spare a few minutes to fill out this short questionnaire. Your responses will be anonymous. **(47 responses)**

1. Did this course reinforce Criminology as the right program option for your studies?

Yes | No. Please Explain. **(93% Yes)**

2. Did this course help give you insight about the role of Forensic Scientists as expert witnesses in trials (conducting tests, collecting and presenting evidence, and objectively explaining the techniques and conclusions to the general public)?

Yes | No. Please Explain. **(94% Yes)**

3. Did the use of a Case Study (the fictitious murder case in Seaway Park) help you to better understand the contribution of different branches of scientific evidence to Forensics?

Yes | No. Please Explain. **(62% Yes)**

4. Did the multidisciplinary approach to this course help make it a more authentic representation of the contribution of science to criminology?

Yes | No. Please Explain. **(83% Yes)**

5. Is this a course that you would recommend to anyone wanting to study Criminology?

Yes | No. Please Explain. **(96% Yes)**

ISSUES

A student feedback questionnaire distributed in Fall 2021 showed very high satisfaction rates among students on completing the course. However some students were not able to make the links between the units and with the introduction section of the course.

SURVEY QUESTION #4: Did the multidisciplinary approach to this course help make it a more authentic representation of the contribution of science to criminology?"

83% "Yes": they liked seeing the different aspects of forensic science. They enjoyed switching between teachers and appreciated the expertise of the teachers in their discipline. One respondent said,

"Although it may seem overwhelming, each discipline is intertwined and some initial concepts can be found throughout them. This makes everything seem more manageable, whilst also giving the course at a certain level of depth."

17% "No": they found it confusing and overwhelming to be continually switching teachers, and they felt that they did not have time to understand the material.

The original concept of the course was to have the same crime scene (case study), taught from three different perspectives. This has not been consistently applied as it was not explicitly set out in the initial design of the course, and because of the difficulty of finding an appropriate case study.

This resulted in the course tending towards multidisciplinarity rather than interdisciplinarity. Teachers became too isolated, and were not coordinating properly.

Despite this, the course maintained coherence and quality because all the teachers strongly identified with and understood the importance of the scientific method.

Therefore they all embraced the Unifying Theme: *the role of the forensic scientist as a person who supplies objective and material evidence in order to help come to a fair and just determination of guilt or innocence.*



The effectiveness of the case study was lower because:

1. The case study was not applied in a consistent and explicit manner
2. Many students would have liked to explore a real-life case study, but a fictitious one is more practical, as the elements can be tailored to particular teacher resources (e.g. lab equipment).

Conclusion for improving integration within the course:

A common case study would use various different strands of evidence from the three disciplines to triangulate on a particular conclusion, as a vehicle for course delivery. This models the scientific process and should help guide both teachers and students to connect the different parts of the course, and act as an explicit manifestation of the unifying theme of the course.



Wikimedia Commons

https://upload.wikimedia.org/wikipedia/commons/b/b6/Clues_0068.JPG

RECOMMENDATIONS

1. **Teacher autonomy**, so that teachers can be **creative and innovative** within their own personal limits. Team work is challenging, so it needs to be an attractive choice for a teacher, especially for a long term course where teachers often cannot choose who they are teamed up with. The course should be framed in a way that **teachers feel unthreatened** and are encouraged to have a **curiosity-driven and experimental pedagogical approach**. This helps overcome disciplinary barriers and interpersonal friction.
2. **Home teachers** and the creation of **semester-long student groups of 4-7 students**, to help shepherd students through a complex course, and to harmonise with the collaborative spirit of the course.
3. A **clear unifying theme** as the underpinning philosophy of the course.
4. A **common “quest”** that is a concrete manifestation of the unifying theme and clearly and explicitly makes links between different parts of the course (e.g. case study).
5. An **Introduction section and Final synthesis that are clearly linked**, and also explicitly linked to the separate units of the course.
6. An **authentic and sincere pedagogical approach**, in that students can clearly observe the relevance of the teacher’s expertise to the concepts that are being taught.

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