THE INTERDISCIPLINARY ISLANDS OF RATIONALITY APPROACH: FOR SCIENCE AND CITIZENSHIP EDUCATION

ILLUSTRATIONS IN CEGEP TEACHING

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The objective of this article is to illustrate the process of developing interdisciplinary islands of rationality (IIRs), which consist of structured processes making it possible to form one's opinion about a concept, a phenomenon, or a complex situation, often in a decision-making context. This article presents, among other things, the application of the theoretical, methodological, and educational assumptions associated with the concept of the IIR in the educational context of CEGEPs and universities with CEGEP ties. In what follows, we will present the various stages of this approach by means of brief explanations of the tenor and scope of each stage. We illustrate the stages with both fictional examples and two IIRs prepared by future CEGEP science teachers. The first of the IIRs relates to the concept of species (Jetté, Bouchard, Schoonheere, D'Amours and Pouliot, 2010), while the second deals with embryonic stem cells (Boilard, Bouchard, Cloutier and Pouliot, 2010).

WHAT IS AN INTERDISCIPLINARY ISLAND OF RATIONALITY?

Many complex situations, including the sociotechnical controversies currently in play in our societies, are hard to handle from a single disciplinary perspective. The fact is, drawing an adequate portrait of these situations, that is, one that presents an informed and substantiated account, requires deploying several perspectives and several disciplines (biology, physics, chemistry; but also sociology, history, philosophy, psychology, economics, politics, etc.). This applies to controversies related to the use of cell phones, the employment of the concept of intelligence, and the extraction of shale gas.

The desire to properly define sociotechnical controversies is one reason for building interdisciplinary islands of rationality (IIRs). Gérard Fourez invented the concept and presented it in numerous venues.[1] IIRs have mainly been used in science courses; but they can also be used in other courses, because they rely on several disciplinary perspectives. IIRs could contribute to attaining the general goal common to the Social Science, Arts, and Science programs, which is the integration of knowledge gains. The IIR methodology also ties in with (among other goals) this general goal of the Science program: "To make connections between science, technology, and social progress." According to Fourez (1997), islands of rationality consist of "one's representation of a specific situation, a representation that always implies a context and a plan that give the representation its meaning. Its objective is to allow for communication and rational debate (in particular, concerning decision making)" [free translation] (p. 221). The word "island" serves to represent the need to choose some information elements from among the large number that exist in order to properly define a situation, while the use of the word "rationality" underlines the fact that creation of the representation allows for productive discussion, which is possible only if one makes sure to specify the meanings of the terms used and the models devised.

Dealing with complex questions by means of the IIR approach in order to guide an action (buying a car, organizing a demonstration, etc.) makes it possible to devise an informed representation of a situation. The reason is that, on one hand, this approach orients the investigation according to specific needs (which, as we will see, simultaneously concern the action plan contemplated and that action plan's target audience, the general context in which the representation is being developed, students' interests, etc.); and, on the other hand, it systematically brings together various disciplines and individuals deemed to be specialists.[2]

In the academic context, the IIR methodology is thus to be seen as a *means* (and not an end) for arriving at a viable, relevant, and useful representation of a situation. It makes it possible to identify a situation's various aspects, taking into account the action plan's target audience, the educational context, the material resources, the time available, the scope of the work planned, and the educational vision the IIR is a part of. That is, the IIR approach represents an attractive method for succeeding in planning and then implementing an action that is appropriate to a given project. An example this could be students interested in the controversy surrounding GMOs and the human food supply and wishing to participate in the inquiry undertaken by citizens in various social settings into the decision-making practices associated with the issue.

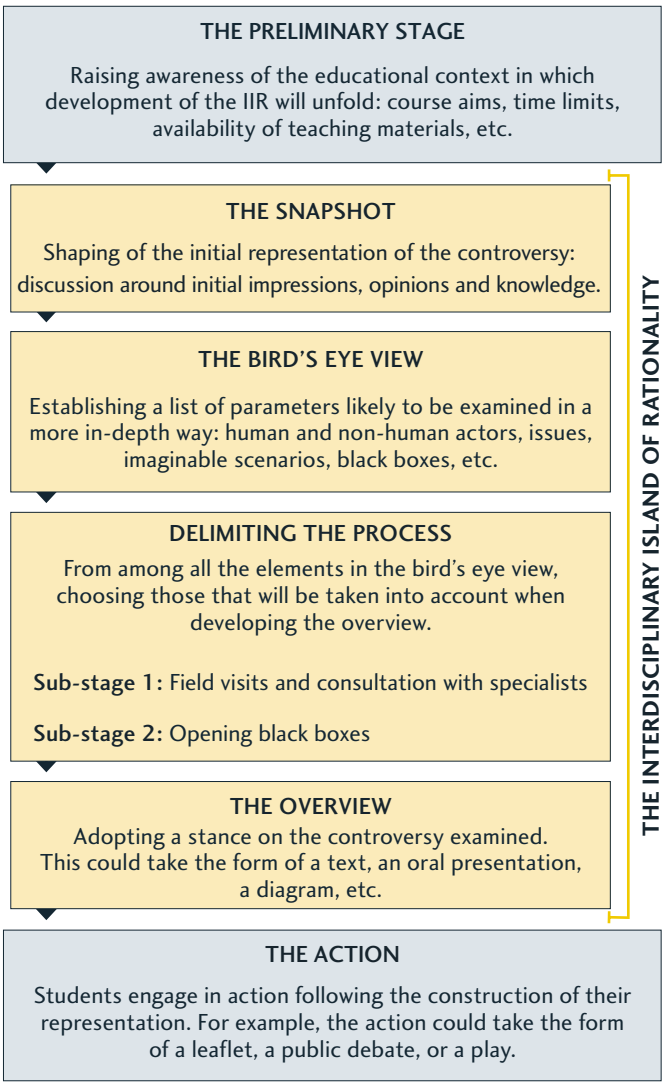
[1] See Fourez (1988 and 1997) and Maingain, Dufour, and Fourez (2002).

[2] Specialists could be users, consumers, producers, etc.

In what follows, we present each stage in the development of an IIR and identify some of the constraints likely to influence the implementation of an educational strategy that incites participants to construct an IIR.

THE STAGES OF THE ISLANDS OF RATIONALITY METHODOLOGY

First, here is a diagram that summarizes the stages of an IIR:



THE PRELIMINARY STAGE

Before beginning the construction of an IIR, the teacher and the class should become aware of the educational context in which the IIR's development will unfold. To this end, it is necessary to identify the aims of the course in which this educational experience is unfolding; set the time limits; assemble the resources (material, instructional, and teaching); and think about the purposes of the interdisciplinary representation. This is necessary because, before getting started on the development process properly speaking, and in order to construct its representation, students must take the time to reflect on an action plan or action plans[3] that appear relevant to them in light of the sociotechnical controversy they've chosen. This reflection will be a determining factor as regards the decisions to be made at every stage; and it will also be subject to being deepened, amended, and negotiated in the course of the investigation. The fact is, on one hand, the action plan will serve as an influential factor in the development of the interdisciplinary island of rationality; and, on the other hand, it will be finalized, oriented, and justified by the process of investigation and negotiation carried out by the team members. As well, it's desirable for the form taken by the representation's final product–the last stage of the IIR, also called the *overview*–to be defined by the students. In short, this stage preliminary to beginning the development of IIRs properly so called serves as a venue for introducing the methodology of the task.

THE SNAPSHOT

The snapshot is a way of giving shape to the initial representation of the controversy. Later on, investigation will allow for enriching and supplementing this sketch. Producing the snapshot consists of carrying out a brainstorming session and noting the questions, spontaneous impressions, and initial conceptions of the situation in question. This operation makes it possible, in particular, to broach the discussion while pooling students' opinions and viewpoints. The snapshot stage serves as an initial opportunity for students to refer to the knowledge they've developed regarding the situation under study. In the event of a proliferation of ideas, we suggest, with Fourez, that the teacher orient students' observations and questions according to the action plan being contemplated (Maingain and coll., 2002, p. 79).

For example, Boilard and coll. (2010) wrote up for their snapshot statements and questions they had decided to sort according to whether their nature was descriptive ("Stem cells are undifferentiated cells") or ideological ("We have to beware of people who want to clone humans").

[3] As may be imagined, over the course of the stages leading to the construction of a relevant representation, together students construct and negotiate their positions about the knowledge they have sought and the holders of that knowledge (for example, the experts); and they could come to decide, on completion of their investigation, to carry out a different action from the one contemplated before they began the process of constructing their IIR.

THE BIRD'S EYE VIEW

In essence, the bird's eye view constitutes a stage in the systemic investigation. In other words, what takes place is the application of a framework of various interdisciplinary criteria (presented below) in order to establish a list of parameters that are likely to be examined in a more in-depth manner. This stage goes beyond that of the snapshot, even though it consists of an organized brainstorming session. More exhaustive than the snapshot, the bird's-eye-view stage allows students to picture the sociotechnical controversy in a broader fashion, while avoiding getting locked into a particular disciplinary field. Use of the framework brings out the dimensions of the controversy and highlights parameters that could otherwise be overlooked. The selection of relevant parameters will take place during the next stage, that of delimiting the process. The parameters to consider in giving shape to the bird's eye view are the following:

- a list of the human and non-human actors in the situation: individuals, social groups, institutions, businesses, etc.
- a list of the constraints, norms, values, codes, and models inherent in the situation
- a list of the issues associated with the situation
- a list of the tensions and controversies it elicits
- a list of the choices, possibilities, and ways of evolving
- a list of scenarios that can be pictured for taking action
- a list of black boxes[4]

For example, the team that prepared an IIR about the concept of species (Jetté and coll., 2010) identified some 15 actors involved, ranging from geneticists through wildlife protection organizations to farmers; but they also identified ten models affected by the controversy (hybridization, reproductive isolation, etc.) and six disciplines, several constraints, and certain values associated with the concept of species.

The bird's eye view can also be supplemented by reading scientific articles, newspaper articles and chapters of reference books; [5] field visits; consultation with specialists; etc. In short, establishing the bird's eye view consists of considering the data that could be taken into account in building the overview.

DELIMITING THE PROCESS

The time assigned to delimiting the process is intended for the choice from among all the elements in the bird's eye view of those that will be taken into account in developing the overview. Undoubtedly there is more than one way to carry out the delimitation of the process. One possible avenue consists of imposing hierarchical order on the parameters on one hand (human and non-human actors, internal controversies, issues, tensions, possibilities, etc.) and on the elements found in the lists associated with each of these parameters on the other hand. Indeed, a degree of hierarchical structure is very useful, not to say necessary, since the island of rationality must lead to a relevant representation of a situation. As Gérard Fourez writes that "an island of rationality is a multidisciplinary model constructed as a way of *shedding light on a specific situation*; its complexity must be *appropriate* to the context in which the model will be applied" (Fourez, 1988, p. 192) [free translation].

Clearly a single controversy dealt with by two different teams is highly likely to elicit different representations.

Delimiting the process is thus dependent on the interests of team members and on the action plan. For example, let's suppose that two teams of students are working on developing a representation of the controversy surrounding GMOs and the human food supply. It's possible to imagine one of the teams contemplating first dealing with citizens' day-to-day food consumption habits, while the other team decides to address the issues associated with the risks and benefits connected to the production, marketing, and consumption of GMOs. In such cases, it is probable that the two teams will highlight different parameters of the situation. Thus the first team could consider issues (consumer health), choices (at the supermarket), possibilities for action (organic foods), rights (to information, to refuse to consume certain products and not be penalized for it), constraints (budget in relation to choices made), and possible scenarios for action (boycotting certain products). Meanwhile, in the second team, emphasis could be placed on the roles of multinationals and governments, the norms and values that underlie the production and marketing of GMOs, the ethical issues such as exploitation of poor nations that have genetically modified seeds, etc.

[4] The concept of the black box refers to a component of a system (whether material, conceptual, or other) that is often considered to be a given and that may or may not be investigated. Thus system components such as H_2O or DNA can be considered black boxes, just as can many of the servomechanisms that form parts of an automobile.

[5] It could be suggested to students that they note the key words of a text while reading it. Some of these key words could subsequently be viewed as black boxes ready to be opened up when the time comes.

In a word, the delimitation of the process contributes to determining the orientation and tenor of the investigation students will engage in, in order to develop a relevant representation of the situation.

Field visits and consultation with specialists

This portion of the delimitation process is one of the aspects that situates the islands of rationality methodology partly outside the bounds of the academic context. Field visits and consultations with specialists represent a stage that ensures students will be placed in concrete contact with at least one part of the controversial situation.

For example, students who work on GMOs and the human food supply can visit laboratories where transgenic activities are taking place. Similarly, a conversation with one or more specialists allows students to give their research a dynamic quality. Note that all must adopt a stance regarding the researcher's comments; the forms of knowledge sought out within each discipline all have something to contribute; and from this perspective, scientific knowledge is not knowledge that is more "true" than other kinds.

Beyond the systematic breakdown of boundaries between disciplines that it promotes, the appeal of the IIR-based approach, taking the perspective of citizenship education, resides in the liberating relationship to knowledge that it privileges and in the acquisition of potentials for action.

Opening up a black box

In the context of IIR methodology, a black box is an object or representation whose general mode of action is known but the details of whose functioning are either unknown or not understood. This may be a material object, a procedure (transgenics, allergic reaction, etc.), or a representation (for example, representations of the ethical or economic issues). In short, black boxes raise questions that can be handled in greater depth in order to supplement or refine the situation's representation. The students who constructed the IIR related to embryonic stem cells (Boilard and coll., 2010), for example, opted to open up four black boxes: those relating to embryonic stem cells, adult stem cells, induced pluripotent stem cells, and cell differentiations.

It's possible to open up a black box by means of readings, discussions, film and video screenings, consultations with specialists, etc. Thus some black boxes are opened up in class and others outside class. The material form taken by a black box can vary. Examples are a continuous text, an interview transcript, diagramming, etc. As well, the choice of black boxes to open up is made using the five criteria mentioned above (the action plan, the context, the target audience, the final product, and the time available).

The teacher will have to ensure that the black boxes chosen by students are relevant in light of the action plan and of other factors to consider, but also that they are properly opened up. For example, opening up a black box by means of a conversation with a specialist should be done using an interview plan that has first been reviewed by a teacher.

OVERVIEW

This stage of the methodology has certain very specific features. First, it emerges from the conceptual and discursive path the students have traced. This does not, however, imply rigidity; quite the contrary, because the processes gone through by the island's builders lead to a multitude of relevant representations[6] about the action plan as dictated by those builders' needs and areas of interest, and in line with the fundamental constraints mentioned above. Clearly a single controversy dealt with by two different teams is highly likely to elicit different representations.

Further, the overview is differentiated from the preceding stages by virtue of its integrative tenor. Besides being the product of a selection and negotiation process between peers, the overview serves as the venue for integrating the various approaches contemplated. In other words, within the perspective of the interdisciplinary approach that is advanced here, the overview is more than a simple collage of knowledge and learning about the question examined.

In a word, we could say with Maingain and coll. (2002) that articulating an overview consists of adopting a stance on the controversy we're interested in; that it consists of stating, "now that we have conducted this research project, it appears to us that what is mainly at issue in the debate over [X], is [A, B, and C]; and we will take account of these factors in the report we prepare for our target audience" (p. 97) [free translation].

Note that the overview, whose formulation forms the final stage of the construction of an IIR, is *in and of itself* not to be used in the course of the action. The final product, that is, the overview taking the form of a continuous text several pages long, a diagram, an oral presentation, etc., will not necessarily be presented to the target audience for the social action.

[6] This remark relates to both the overview contents and the final product (be it a material product or not) that supports the overview.

Rather, the relevance of articulating an overview has to do with the opportunity this provides to students for framing an opinion on the question that interests them, for adopting a stance; but it also has to do with the possibility it offers students for subsequently taking appropriate action structured on the basis of coherent reflection.

THE ACTION

The intention behind the framing of the present text is twofold: to explicate the IIR approach and to illustrate how it can be applied in CEGEP teaching. For this reason, we will not deal in detail with the action taken by students following the development of their representation.

However, we do find relevant to specify that the form (a leaflet or pamphlet, a booth at a student colloquium, a theatrical presentation, a public debate, etc.) and scope of the action that is taken by the island's builders ultimately have only relative significance. What counts is that students develop a shared representation and a space for communication that will promote an exchange of viewpoints.

The IIR approach represents an attractive method for succeeding in planning and then implementing an action that is appropriate to a given project.

SOME CONSTRAINTS TO TAKE INTO ACCOUNT

Whatever the form and scope taken by the construction of an IIR, we consider that the implementation of this approach depends on the following constraints.

- **The educational context**

  The development of a viable and useful representation of the complex situation will be integral to the specific educational context of the course that it's a part of and to the concerns expressed about the subject broached and the resources available in an academic setting (computers, teaching documents, reference articles and books, a teacher, etc.). It is thus essential that both the teacher and the students be aware of it.

- **The final product to be delivered**

  The production of an island of rationality can take different forms: a continuous text several pages long, an oral presentation, concept maps, a multimedia document, even the scenario for a play. As may be imagined, the final product contemplated will orient the process of investigation, influence its depth, and determine the time devoted to the various stages.

- **The action plan**

  It's essential to realize that the islands of rationality approach can be distinguished from traditional long, single-discipline assignments by the action plan contemplated. The action orients the choices made at each stage of the systemic process. Thus construction of an IIR will retroactively exert influence on the orientations for the action initially contemplated and, where relevant, it will lead students to radically alter their action plans. At bottom, it's a question of students establishing a realistic framework and specifying the IIR's outcome, all with the teacher's help.

- **The target audience**

  The target audience constitutes a determining criterion for the choices to be made in the course of the methodological process. Thus representations developed with a view to proposing "GMO-free menus" in the college cafeteria or taking action with the industrial entities involved in marketing GMOs will take differing parameters into account. And, of course, the nature of the statements, the tone of discourse, the style of argumentation, and the form of representation will vary according to target audience.

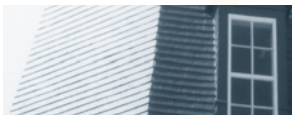
- **The available time and resources**

  Finally, the time that students have for developing their IIRs will influence their procedures. These are the things that will depend on the time available: the number of black boxes opened up, the depth of the investigation, the type of discussions held with specialists, field visits, the exhaustiveness of the representation, the scope of the action plan. Time is the most difficult criterion to manage, and this is why its management by the teacher is highly desirable.

CONCLUSION

In sum, the IIR approach allows students to better understand a complex concept by following a structured process that has recourse to several disciplines. For this reason, the IIR approach can be used in numerous contexts–academic or not–as well as within the context of diverse courses. The process differs from those associated with other approaches (in particular the project-based approach) in that it invites students to call upon specialists (Fourez, 2001).

In closing, we find it appropriate to wrap up this article by making an explicit link between the IIR-based approach and the concept of social action. Beyond the systematic breakdown of boundaries between disciplines that it promotes, the appeal of the IIR-based approach, taking the perspective of citizenship education, resides in the liberating relationship to knowledge that it privileges and in the acquisition of potentials for action. It is to this end that it incites participants to go into the field, consult experts and also specialists, and, in short, venture outside the academic context.



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