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Nicolas Antheaume, Rima El Sayed

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## **For a Pragmatist Approach to Teaching Accounting for Sustainable Development: Programme Proposals and Illustrations**

**Nicolas Antheaume, LEMNA, Nantes Université, France**

[nicolas.antheaume@univ-nantes.fr](mailto:nicolas.antheaume@univ-nantes.fr)

**Rima El Sayed, LEMNA, UCO, Nantes**

[relsayed@uco.fr](mailto:relsayed@uco.fr)

### **Introduction**

This paper addresses the teaching of accounting for sustainable development (or social and environmental accounting). The term "accounting" encompasses, in its broadest sense, financial and managerial accounting, management control, and audit, with specific adaptations for sustainable development. To understand how we approach the teaching of accounting for sustainable development, it may be helpful to explain our perspective as co-authors. Author 2 is a junior professor. Her research initially focused on the articulation between management control (ABC method) and quality management. The theme of articulation has always been a central question, especially regarding the relationship between teaching and research. The opportunity to conduct research on social and environmental accounting has raised a dual question of articulation. The growing demand for education in these subjects extended her inquiry into the relationship between research and teaching. Finally, accounting for sustainable development can also be viewed as an articulation between financial accounting and one or more social and environmental accountings. Author 1 is a senior professor. He was among the first persons in France to defend a thesis on environmental accounting at a time when the topic was not widely recognized. He was also the first mission officer for the French Institute of Chartered Accountants on the topic of environmental accounting, tasked with coordinating a working group that produced four collective works on the subject. Early in his career, he had the opportunity to teach financial accounting to first- and second-year students for ten consecutive years. He recalls removing the section on accounting for refundable deposits, for reusable packaging, from his program. Years later, during a project with a company that was reintroducing a reusable packaging system with refundable deposits, he heard the

project's stakeholders (stores, producers, and bottle manufacturing companies) discussing their accountants' lack of understanding and skills regarding these topics and how to account for them. The number of hours he dedicates to teaching social and environmental accounting has grown from eight hours per year at the beginning of the 2000s to about a hundred hours today, and he has been exploring how to integrate discussions about social and environmental dimensions into traditional courses such as accounting, investment decisions, and business valuation. He presented some proposals as part of hearings with the Shift Project in 2022 and 2023.

Both of us share the view that the way accounting, management control, and finance are taught today reflects outdated models in which the environment barely existed, and the social dimension was minimally considered. An emblematic example of an outdated model might be the "invention" of the return on investment (ROI) concept as it appears in Sloan's book (1990), published in 1964, based on his years at General Motors following the 1929 crisis. The way this tool is taught and used has changed little since then. Moreover, when teaching financial or managerial accounting or management control, our exercises, while addressing technical aspects, rarely consider the context of business models for ecological transition. We rely on existing manuals and programs. These subjects have a strong technical dimension, and the meaning of what constitutes value creation is rarely addressed. Today, we are no longer convinced by this teaching approach. Sometimes, we feel uncomfortable with the content of the programs that don't resonate with our experience as researchers in social and environmental accounting. However, we stick to the program. Although we allow some room for discussion and bring a more critical perspective, it remains incremental. Are there elements in the program more useful than others to facilitate ecological transition? Could we focus on organizations whose activities are socially and environmentally desirable to develop our "classic" accounting courses?

On the other hand, when we teach courses in accounting for sustainable development, we show the limitations of traditional accounting. This time, the notion of financial value is addressed and critiqued. However, not all students have access to a specific course on accounting for sustainable development, and their knowledge of sustainable development varies widely. Economic and financial performance is at the core of financial accounting courses. Social and environmental performance is at the center of courses on accounting for sustainable development. Although the relationship between financial and non-financial

accounting has been addressed in a professional and research context (Antheaume, Gibassier, et al., 2020), its application in education remains partly an uncharted territory. Offering separate courses for the two types of accounting does not necessarily lead to addressing this articulation. Furthermore, knowledge, regulations, and standards regarding accounting for sustainable development have evolved significantly in recent years and constitute a normative, fluid, and uncertain field of knowledge. This makes it sometimes challenging to teach. In summary, we approach the question of the content of accounting courses and the articulation between financial and non-financial accounting in a dynamic context where even the teacher is in a learning position. In the first part, we formulate content proposals for an accounting curriculum. Reflection on these proposals then leads us to the concepts of inquiry and semiotic mediation (Lorino, 2009, 2020) as investigation tools. We present them in the second part, reflecting on how to apply them in the courses. Finally, in the third part, we discuss examples of education approaches based on these concepts.

### **First Part: Syllabus Proposals for an Accounting Course**

In this part, we suggest practical pathways along a continuum comprising five levels. It ranges from incremental adaptation of existing classic courses, not incorporating sustainable development, to the development of specific courses on accounting and sustainability. These levels can also be viewed as steps on a staircase leading to a good understanding and articulation of financial and sustainable development accounting. The purpose here is to outline course design modalities without entering into detailed content, which would exceed the space allocated to this chapter.

#### **1.1. Recommendations for Transitioning from a Financial Accounting Course to Integrate Ecological and Social Concerns**

**The first level** involves reintroducing into the curriculum the accounting, financial, or management treatment of activities that align with the needs of ecological and social transition. For example, certain accounting operations have disappeared from most financial accounting programs, even though they align with the needs of ecological transition. By following the news on initiatives for creating reusable packaging, the first example that comes to mind is accounting for refundable and returnable packaging. In an introductory or intermediate-level accounting course, this topic would fit within a section focused on

purchase and sale operations. Students could be encouraged to study real cases or inspired by real cases. For example, the Rebout case on glass bottle reuse, freely accessible (in French at this stage), could be used. Students could be asked to first create a diagram explaining the circulation of bottles between the various stakeholders—producer, bottler, retailer, client—and how the return and reuse processes work. In a second stage, they could be asked to answer questions typically posed by those engaging in such a project for the first time: Should VAT be collected on refundable packaging? When should it be considered sold? Who owns the bottles? In a third stage, students could then create accounting entries for refundable packaging when the product is sold with its packaging, and for refundable deposits when the packaging is returned by the customer at the point of sale. Depending on the time available, the focus could be on one or two cases (the bottle supplier and its bottling customer, the retailer selling food products, and the consumer).

Liabilities for risks and expenses related to site remediation or ongoing exploitation is another topic that could have a place in a course section dedicated to end of year operations. These liabilities must be recognized whenever a company has legal or contractual obligations to repair environmental damage. Two industries could be used as examples: quarry exploitation, which involves remediation obligations at the end of quarry life (in France), requiring regular provisions throughout the exploitation period, and nuclear energy, which involves obligations to decommission power plants and store spent nuclear fuel. Based on the annual reports of major companies in these industries, students could understand the level of public information provided. The question of the discounting of future cash flows and its impact on the amount of liabilities recognized could then be discussed in the context of providing a true and fair view. Students could then, based on a few prompts, create accounting entries for liabilities for risks and future expenses. The instructor could also propose a discussion with the students by presenting a case of a company that committed to installing air filters on its factory chimneys to prevent future atmospheric pollution. Would it be allowed to set aside a liability for risks and expenses based on such a commitment? The answer is negative, as such liabilities are intended for repairing damage caused by the company's activities, not for prevention. This type of discussion on the exact meaning of financial accounting information, what it reflects, and what it does not, is essential for properly interpreting accounting information. Following financial accounting, learning about intermediate management balances could lead to

discussions on value sharing. Analyzing publications on salary gaps in annual reports could also be an opportunity to emphasize the social role of accounting to debate value sharing (this could be addressed in a financial analysis and management control course).

**A second level** would be to design cases that address classic accounting program topics, but with companies transforming their business model in a way that is compatible with the imperatives of ecological transition. For example, companies active in the fields of recycling, functional economy, rental, selling or renting bicycles instead of cars, short supply chains, social integration, and eco-design. Although these companies present classic accounting or management accounting issues, their business models have some critical specificities. For example, a company that sells tires and a company that rents them will have different cost structures and break-even points. A rental company will have a much higher percentage of fixed costs compared to a company that sells products because the former needs to finance the acquisition or manufacturing of the products it rents, constituting a fixed asset. The company selling these same products will have a higher proportion of variable costs related to the quantities sold. Following financial accounting, the program could address joint costs between co-products and give it more prominence using examples from circular economy business models. Consider the example of a second-hand car disassembly plant aimed at recovering spare parts. A significant portion of the process involves dismantling the vehicle, common to all spare parts. Thought must be given to how this joint cost is distributed among different spare parts. This could be taught in a management control course. To go further, we propose using these examples to develop cases, guiding students through classic cost calculation, break-even point calculations, and return on investment. This could then be followed by a discussion on the social and environmental evaluation of these projects and the tools that enable them to be operationalized. For example, a brewery switching from single-use to reusable glass bottles would necessarily calculate the costs of both options. It would be essential to determine how many times a bottle needs to be reused for the cost of a more expensive reusable bottle to be lower than multiple single-use bottles. Similarly, the case could provide data on greenhouse gas emissions, allowing a comparison between the two options based on emissions. This extended case could also be used to present the scopes of greenhouse gas emission calculation, which goes beyond operations (Scope 1), including emissions from energy production (Scope 2), and the value chain upstream and downstream (Scope 3). Cost calculation is confined to the company's legal boundaries, while

greenhouse gas emissions encompass the entire value chain, indicating the company's extended responsibility across the value chain. For a concept illustration, see Soosay et al., 2012. A connection could be made with the concept of responsibility and its legal definition. **The third level** would focus on developing students' critical thinking skills regarding the meaning of accounting data, what can or cannot be recorded, what appears and does not appear on the balance sheet, and the significance of what is published. For example, how would a fruit orchard be accounted for under IAS 41, which establishes the accounting treatment of biological assets during growth, degeneration, production, and reproduction, as well as the initial measurement of agricultural products upon harvest? The instructor could provide the text of the standard to students and facilitate a discussion by asking some questions. What are the trees worth? How are the water consumption of trees accounted for when they are growing but not yet producing fruit? Does the standard consider trees with limited lifespan? Can the soil quality that nourishes trees and the biodiversity present in an orchard be considered within this standard? Students would learn that a fruit orchard is not a unified entity but a set of separate characteristics: the value of the trees, for example, is distinct from that of the land (but what would the land be worth without trees?). They would also learn that trees follow IAS 16 rules for tangible assets and are considered "like machines," in terms of future income they may generate, and they are re-evaluated or depreciated according to the same rules as tangible assets. As for the crops, they are valued at market prices, minus the costs required to organize the sale. If the market values organic agriculture, the "quality" of the orchard is indirectly taken into account through this channel. Trees grown organically are worth more than those cultivated conventionally simply because the fruits sell at higher prices. However, if organic products no longer attract customers, a rich soil and land with high biodiversity would not necessarily increase the value of the trees. Another example could be a rare natural area containing one of the last unpolluted aquifers in France. Accounting-wise, the value of this natural area is assessed based on the revenue a company could derive from it. This revenue would be higher the rarer pure natural water is. If this natural area were subjected to an exploitation ban to protect endangered species and ensure water access, the company owning it could no longer generate revenue from it. The value of such an asset would then become nearly zero. Following a critical interpretation of financial accounting data, the instructor could conclude with the need to develop specific

accounting approaches for biodiversity. This point would emphasize the importance of interdisciplinarity in building accounting for sustainable development.

**The fourth level** would focus on information systems, with a reflection on the information content of invoices. An invoice contains both financial and non-financial data, descriptive of a transaction. However, for industries such as IT or transportation, invoices often include an estimate of greenhouse gas emissions corresponding to the product or service provided to customers. Our proposal lies at the intersection of accounting, information systems, and audit. It requires considering how non-financial data from an invoice can be recorded. When an invoice is entered, what financial and non-financial data feeds into the management information system, and based on which considerations (legal, economic, environmental, or fiscal)? The instructor must also raise awareness among the audience about the disparity in calculation methods for these data. The financial part is the result of an agreement between two parties. The amount is accepted and recorded as agreed upon. Greenhouse gas emissions do not have the same status. They are calculated by the supplier, multiplying an emission factor (e.g., kg of CO<sub>2</sub> per km), considering the type of vehicle, type of fuel, and the number of kilometres travelled. Emissions are calculated across the entire value chain, meaning they include fuel combustion to move the vehicle and greenhouse gas emissions required to manufacture the fuel. The resulting calculations are estimates. The data do not have the same status as the financial amount. However, financial and non-financial aspects are linked because purchasing a transportation service leads to greenhouse gas emissions. The disparity in data types implies that auditing cannot be conducted in the same way. In a financial audit, the verification of the financial part is conducted differently from the verification of the greenhouse gas emission part. For a transportation invoice, the auditor would verify the existence of an order, then a procedure for confirming service (circularization), and a proper accounting entry. For the part concerning greenhouse gas emissions, the auditor would verify the validity of the calculation methods and the quality of the underlying data. They might also provide an opinion on the information system that tracks greenhouse gas emissions (internal control assignment).

The fifth level involves specific accounting courses for sustainable development aimed at introducing students to new accounting frontiers focusing on:

- Carbon accounting,
- Water accounting,



- Biodiversity accounting,
- Green taxonomy,
- CSRD (Corporate Sustainability Reporting Directive),
- Multi-capital accounting. Each of these topics could be a book on its own, and we lack the space to discuss them in detail. The following table summarizes these proposals, capturing, for each level, the objectives and the accounting data as they could be presented in a dashboard and annual documents (management report, balance sheet, income statement, notes).

## 1.2. What Are the Key Entry Points?

These proposals highlight three possible key entry points for teaching:

The first entry point is the "orthodox" accounting and financial framework. By adhering to this field, the focus is on specific technical elements (such as refundable deposits, provisions, asset impairment, and discount rates linked to new risk signals via taxonomy) or specific contexts, like companies involved in ecological transition, serving as a pretext or background to address traditional accounting questions. This first entry point does not reach the desired solution for at least two reasons: first, "orthodox" accounting adheres to principles that aim to present a true and fair view of assets and past performances, not in a forward-looking manner. Second, verification according to this first entry point aims to ensure businesses are ongoing concerns from an exclusively financial perspective.

The second entry point is the ethical and/or techno-scientific framework. This pertains to the field of extra-financial accounting, encompassing various dimensions: life cycle analysis, carbon accounting, biodiversity, water, circular economy, environmental and social management control, reporting, and standardization. While these courses criticize orthodox accounting and finance, they do not interact with them, leaving students to navigate between the two contents in separate courses. This second approach, which doesn't integrate social, environmental, and financial dimensions, results in ethical polarization and does not provide the desired solution in terms of information, which is articulation.

A third key entry point contained in our recommendations seems more promising. It involves choosing processes and involved individuals contributing to both financial and extra-financial performance. This could involve examining an invoice, a non-financial performance statement, an orchard, or a press review. All these elements are starting points for initiating

the learning process and offering teaching modalities in a course that integrates financial and extra-financial accounting. The path of inquiry according to the pragmatist approach and semiotic mediation, adapted for teaching, seems promising. We explore these two concepts in the following section.

**Part Two: Presentation of the Concepts of Inquiry and Semiotic Mediation** Introducing sustainability issues into accounting courses requires addressing at least two main shortcomings: (1) the instability caused by the evolving regulations still under development, and (2) the dichotomous nature of financial and extra-financial information. The first shortcoming could be addressed through an exploratory approach in search of good solutions using the dialogic inquiry method. The second could be addressed through semiotic mediation. These two concepts are discussed by Lorino (2009, 2020), and Lorino et al. (2011). Before proposing an adaptation of these concepts for teaching social and environmental accounting, this second part of the chapter will focus on defining them.

### **2.1. The Concept of Inquiry**

For Lorino (2009, 2020), the search for solutions falls within a processual, dialogic, collective, and pluralistic inquiry. It progresses progressively and reflexively, with stakeholders seeking to understand a situation through exchange, often from different, sometimes contradictory or even conflicting, perspectives. This is the principle of pragmatism according to Dewey, as explained by Lorino (2020). It plays a significant role requiring a learning phase, investigations, and experience exchanges. These exchanges will allow the transition from understanding managerial needs (what we need to manage, how, and why) to the genesis of innovation (what tool solutions to use) and finally to its institutionalization as a taught and practiced management tool. Understanding human action and creativity is part of these experiences and relates to the principle of reflexivity, which is the "interplay between action and reflection" that "develops during the course of action" (Lorino, 2009).

Adopting a pragmatist approach in collective inquiry implies a consensual acceptance and a tacit application of four principles (Farjoun et al., 2015):

1. **Focus on Processes:** Observing phenomena that emerge in everyday life.
2. **Prioritization of Dynamic Relationships** between societal entities inherent to these processes (identifying as they go which entities are most involved in a given process at a given time for a specific question).

3. **Maintaining a Reflexive Mode of Action** in iterative loops that intertwine action and reflection, ensuring a constant connection between individual and collective levels (for example, how an architect defines the quality of their work and how this individual perspective impacts collective performance, like meeting construction deadlines).
4. **Anti-Dualism**: An essential principle to avoid sliding into one or the other of two considered antagonistic approaches (like safety and deadlines on a construction site).

Let's illustrate this inquiry concept with an example. In a 2009 article, Lorino references an investigation into why the rate of workplace accidents had plateaued within a large construction group. He outlines the steps taken in the collective inquiry to understand the causes. The first task was to study all the steps involved in constructing a building, conducting 32 interviews and immersive observation, followed by organizing working groups (principle 1: focus on processes). As the processes were characterized, the typical division into two major phases: design-planning on one side and implementation on the other, emerged as critical. Each phase corresponds to a specific professional domain with different stakeholders (principle 2). After numerous reflexive iterations (principle 3), it became clear that the lack of communication between these two domains created potentially dangerous situations during the implementation phase. Budget-driven decisions often lead to consequences regarding accident risk. This division between the two domains is both managerial, professional, and cultural. The inquiry concluded that design should not be considered a preliminary phase to implementation but that it continues throughout the construction process. Consequently, the working group recommended that designers be involved in project monitoring and that construction project actors be consulted during the design phases. To overcome dualism, the design phase was redefined as an overarching concept that spans the entire building construction process (principle 4). In this inquiry process, despite being an expert, Lorino is also in a learning position alongside those involved in the inquiry. He is not investigating them but with them.

## **2.2. Semiotic Mediation**

Inquiry also has the potential to address the second shortcoming, the dichotomy between two potentially antagonistic "accountings"—financial and sustainable development. For organizational reasons and convenience, the solution often treats the dichotomy as a given, leading to conclusions. This approach is not effective in overcoming the dichotomy. In the

inquiry cited as an example, it would have resulted in observing the dichotomy between two professional domains without addressing it. The obvious outcome of these attempts is maintaining the status quo. However, the goal is not to reinforce this dichotomy but to reduce compartmentalization between approaches, functions, or services associated with these approaches. Semiotic mediation precisely aims to connect a sign (a word, an indicator, a model) to an observed reality (an object) to identify a potential solution (a potential for action).

By borrowing a language, a sign, or a technical substrate, mediation takes as its entry point the situated and contextualized object of the problem: the activity. Thus, it directs reflections and inquiries toward a solution for this object. It reconstructs the connection between the activity, its representation, and the potential for action on this activity.

Semiotic mediation is advocated by the pragmatist school of thought, where models (signs) are semiotic (symbolic) mediations rather than exact reproductions (faithful) of reality. They constitute tangible artifacts that act as symbolic supports for interpreting reality, contrary to the alternative where models are supposed to provide a faithful image of reality. The subtle difference between the two alternatives lies in the definition of the object of representation (or model): the first seeks to reproduce an image of a specific, finished, and fixed object (orthodox accounting), while the second focuses on the reflexive objectivation of the process of creating the object itself. Thus, the model serves as a semiotic mediation of action. Semiotic mediation is occupied by a sign, in our case, a dashboard, indicator, invoice, etc. Lorino (2009) proposes a reading framework outlining five canonical functions fulfilled by semiotic mediation:

1. **Reflexivity:** Allows actors, through distancing, to reflect and debate their activity and collectively advance in their search for a solution.
2. **Abstraction:** Allows for classification, generalization, and conceptualization based on individual cases and specific experiences.
3. **Socialization:** Allows for the inclusion and involvement of all stakeholders who directly or indirectly participate in or are impacted by the activities.
4. **Memorization:** Allows for capitalizing on collective and accumulated experience.
5. **Spatial-Temporal Configuration:** Allows for managing extra-territoriality and integrating elements and activities from distant locations into the relevant context.

In the example used earlier in this second part, reflexivity (function 1) was fostered through the use of signs like diagrams and timelines, allowing for distance and promoting discussion. The collected data on specific situations were coded to identify generic activity categories. For example, a problematic situation involving the automated concrete pouring technique on a construction site contributed to conceptualizing a more abstract category, "choice of concrete pouring techniques" (function 2). This was possible only through the formation of working groups and collective inquiry by the involved actors (function 3). Recommendations were made by the collective, leading to new diagrams and timelines enabling action based on these recommendations (function 4), applicable to future situations regardless of their specifics (function 5).

**How does semiotic mediation allow for transcending the dichotomy and moving toward a plausible solution?** According to Lorino, it forms a triadic relationship between an object (a reality), a word (a model, a technical substrate), and a concept. The word "produces a meaning, not by reflecting the shape or structure of [the object], but by connecting [the object] to a social potential for action." Thus, "semiotic mediations are performative: they transform situations." "The word-concept-object triad allows for embedding the object in a specific and meaningful action project, within an organizational process." This is how mediation brings the focus back to situated activity, regardless of the stakeholder or their perspective. "The word refers to both the dictionary and the situation." It allows for:

- Initiating a pluralistic inquiry from a situation of uncertainty and doubt without having a clear and pre-established idea of the end state.
- Gradually and collectively discovering solutions through a trial-and-error, reflexive process.

It represents the transcendence of a static representation of ONE reality into a utility role associated with the word/model. Lorino explains in his article that semiotic mediation found in processes, standards, tools (such as a dashboard, invoice, software, or budget), and languages "are not representations or symbolizations of ..., maintaining a univocal relationship with their object, but mediations between object and concept." For example, the word "budget" is not a description of a budget, but a bridge between what a budget is (and what actors understand it to be) and what it allows (planning, controlling deviations between forecast and reality, etc.). If the word "pie" commonly referred to a set of tables allowing for a financial plan, "pie" would be used instead of "budget." The word itself

doesn't carry the description. Unlike "representation" in the cognitive sense, the practical role of the sign [tool] does not unilaterally derive from how it mimetically reproduces the world; it is connected to how it is interpreted by actors in the spatial, historical, and socio-organizational context of their activity."

For example, at the beginning of the first part, the proposals to modify an accounting course were presented as steps on a staircase to climb. At no point is the word "staircase" intended to represent the reality of an accounting course, but the idea of the staircase, familiar to everyone, is used to convey the idea of different levels, interconnected, with a logic of progression and structuring (you don't start from the middle steps). This is an example of semiotic mediation adapted to the presentation of a teaching curriculum for accounting students in higher education in 2024. Like the "bourgeois gentilhomme" who unknowingly practiced prose, we are doing semiotic mediation.

### **Part Three: Applying the Inquiry Process and Semiotic Mediation to Our Proposal for Teaching Accounting for Sustainable Development**

To apply the concepts of inquiry and semiotic mediation in the context of the program proposed in the first part, we suggest taking a specific tool as a starting point: a management report, an invoice, a dashboard, etc., to initiate and conduct the inquiry. Let us now revisit some of the levels by outlining more formally how the pragmatist approach can be used to structure teaching. We propose a detailed example for the first and third levels. We outline a few ideas for the fourth and fifth levels.

#### **3.1. Suggestions for the First Level**

We will use one of the previously mentioned examples to structure how an instructor can organize a course in the form of an inquiry. The process for managing reusable packaging is a good entry point because it involves both financial and extra-financial accounting. The first step would be to start with a phase of understanding how packaging management works. How is it designed, manufactured, and used? How does the packaging return process work? What logistics are involved? What information systems are used? Who are the involved actors, and what are the issues for each actor? This phase could involve examining documents, listening to professionals, or following a company visit. This phase could conclude with a diagram illustrating the flow of bottles between the various involved actors. Thus, we apply the first principle of the inquiry method, focusing on a process. The starting

point is not a legal rule but confronting a real fact to extract the meaning of the rule (like the accounting method for refundable deposits). We then reach the application of the second and third principles, respectively based on prioritizing the dynamic relationships between the involved actors and their back-and-forth between action and reflection. Understanding the processes and representations by the actors should highlight accounting, financial, social, and environmental issues. For example, the following reactions might be possible :

- Marketing managers fear consumer rejection of reusable packaging.
- Accountants are unsure how to account for refundable packaging and those that don't return, hesitating on VAT accounting.
- A business leader whose financiers do not want to take risks might be afraid of refundable deposits; conversely, an entrepreneur whose investors condition their funding on environmental objectives might see an opportunity in refundable deposits.
- Logistic experts offer bottle collection solutions, and choices must be made according to social, environmental, and economic criteria.

These relationships can lead to conflicts and contradictions requiring compromise for the project to succeed. No perspective can be excluded because they are all interconnected and condition the project's success. Successive iterations must shape the solution, with each part contributing to the overall success. For example, without technical accounting expertise on refundable deposit accounting, reusable packaging projects cannot exist, thus environmental and social benefits would not materialize. Behind the idea of refundable deposit accounting lies a potential action, fulfilling the fourth principle. According to this principle, finding the right accounting entry for refundable deposits and returned packaging is not an end in itself. It is already the result of a good understanding of reusable packaging's functioning, but, more importantly, it allows for tracking packaging and achieving environmental performance. Liabilities for risks and costs for site remediation or cleaning of polluted sites follow the same logic and can be summarized in table form.

Principle	Application
Focus on process	Explain the processes that lead to the damage for which liabilities must be accounted for; briefly explain how a quarry works and the possibilities for restoration; explain how the end-of-life of nuclear power plants and the

	management of radioactive waste have been planned. Show how the cost of dismantling power plants and managing waste has been estimated. If the teacher has enough time, rather than explaining the processes, he or she can ask the students questions (how does a quarry work?) and ask them to investigate the processes.
Priorisation of dynamic relations between actors	It is important to present the parties involved: accounting standards bodies, investors, the government, customers, society. This can be done through the process survey. The teacher should ask you to explain who the players involved are, at what point in the process and for what reasons.
Reflexivity	After explaining the concept of contingent liabilities, based on the study of processes, the teacher can have the students make accounting entries, and then question them on the meaning of the data thus produced. Examples from annual reports should be used. The teacher should also encourage critical analysis. How are these provisions accounted for, and what are their limitations (use of a discount rate that gives less weight to the future, long-term uncertainties, etc.)? Above all, it is important to teach what it is impossible to provide for today (for example, provisions to preserve future air quality). A provision corresponds to the repair of a damage, not to the improvement of the future quality of the environment). Students could then be asked to reflect on whether or not it is possible to depart from this principle.
Anti-dualism	Students should be reminded that accounting for contingent liabilities is not an end in itself for financial reporting purposes. The end is the potential for action. It is important to make a clear link between the process that leads to the recording of contingent liabilities and the actions to repair damage that this process makes possible (for example, the restoration of a quarry).

**Table 1: Accounting for contingent liabilities**

Through these two examples, we can see the functions of semiotic mediation, as described in the second part, being applied in the following ways:

- **Reflexivity:** Gaining distance and understanding the activity.
- **Abstraction:** Deriving general accounting rules beyond the specific case being studied.



- **Socialization:** Including all stakeholders (clients, employees, suppliers, the State, etc.) in the students' reflections, and working in groups in class to analyze a process without excluding any perspective.
- **Memorization:** Allowing the student to retain a new skill set resulting from interactive work in class.
- **Spatial-temporal Configuration:** The ability to generalize and transpose beyond the examples covered.

### 3.2. Suggestions for the Third Level

At the third level, the annual report becomes the focal point. It typically consists of a management report, summary financial statements, and appendices. Here, it is necessary to explain how, why, and for whom this report is produced, which standards apply, and what latitude the report's preparers have.

The first principle to apply is focusing on the processes, so the instructor should either:

- Explain to students how an annual report is produced, or
- Ask them to investigate with a list of questions they must answer.

In line with the second principle, the actors involved in the production of financial statements and their relationships should be presented, possibly emphasizing specific aspects related to ecological and social issues with their legal implications. In this context, local community associations, subcontractors, courts, external directors, and independent verification bodies can all impact what information is disclosed and the importance of topics identified by the company.

Applying the third principle could involve, for instance, successive iterations to analyze what is "material" or not, from both financial and extra-financial perspectives.

At this level, a set of annual reports could be presented to students, along with a list of significant events and facts. For each event and fact, students should identify:

- Who is affected by this event,
- Whether it is reflected in the annual report, and how/where and why,
- Whether this event can be known otherwise than through the annual report, and how,
- What is the impact of this event on the company's situation, and how can it be measured?

Some examples:

- The terrible health condition of the business' CEO,
- The layoff of part of the staff (visible immediate savings),
- The company's acquisition of a fruit orchard,
- An industrial accident,
- Deforestation in South America,
- A fishing quota purchased by the company,
- A denigration campaign by an NGO,
- And more.

In line with the anti-dualism principle, the teaching should emphasize the potential actions made possible by the annual report preparation process. For example, information regarding layoffs is not an end in itself. It invites understanding the implications for the transformation of the company (what actions were taken to use outsourcing or temporary work, what activities were potentially abandoned, what dividends will be distributed, what is the concrete involvement of employees in governance, what actions will be taken for laid-off employees, etc.).

This example also allows applying the functions of semiotic mediation:

- **Reflexivity:** Gaining distance and understanding the activity through annual report analysis.
- **Abstraction:** Achieving generalized rules for producing information and reporting, both financial and sustainability-related.
- **Socialization:** Including all stakeholders (clients, employees, suppliers, the State, etc.) in the students' reflections.
- **Memorization:** Allowing the student to retain new skills resulting from interactive work in class.
- **Spatial-temporal Configuration:** The ability to generalize and transpose beyond the examples covered.

### 3.3. Suggestions for the Fourth Level

The object we propose to study is not yet fully developed. There are a few examples in an embryonic state, like the information on greenhouse gas emissions that must be included on transport quotes and invoices. Thus, the object being studied is an "augmented accounting document," and the investigation should focus on the process of producing such accounting documents. Who enters the information, and how is the measurement done?

A concrete entry point could be an invoice sent by a carrier to its client. This invoice contains the description of the service, but also an estimate of greenhouse gas emissions. The following questions could be addressed:

- What other information could the invoice contain, and to what level of detail, to facilitate other environmental assessments?
- What is the process for producing this invoice? For example, what are the emission factors and activity data used to calculate greenhouse gas emissions? Who is responsible for calculating and selecting emission factors? Is the activity measured by the number of kilometres or by fuel consumption? These data on distances and consumptions are known to carriers and already exist, so how could they be linked to invoices, and on what basis of allocation or direct measurement?

Depending on the available time, students could be asked to investigate by interviewing different involved actors (carriers, carbon consultants, software developers, transport service buyers, legal experts, etc.).

This level should encourage students to reflect on a system for producing both financial and extra-financial data.

### **3.4. Proposals for the Fifth Level**

This level involves specific accounting courses for sustainable development. Here, the key entry points are extra-financial, with multiple concepts: double materiality, value chain analysis, life cycle, carbon, water, biodiversity, sustainability.

To maintain the focus on the process, the instructor could start with a product or service: a pair of shoes, a garment, a train journey, a night at a hotel, a music festival, etc.

The first step would be to study the entire value chain of this product or service, from cradle to grave, and invite students, after diagramming the process, to identify related questions: cost, greenhouse gas emissions, water, biodiversity, and social issues, using a list of preliminary questions to guide them. With a value chain-focused approach, students can be introduced to the concept of systemic vision. The goal is to demonstrate that the best solutions must be thought out at the value chain level, not just the company. This reasoning avoids transferring burdens or impacts from one part of the chain to another—which happens when there's a limited view of the scope. A chosen example can address financial materiality and impact. For instance, it could be shown that a food company is financially at risk due to prolonged droughts, affecting the consistency, volume, and cost of its raw

material supplies. At the same time, this company sells products containing animal and plant materials, whose farming and cultivation require high water consumption in areas where it is becoming scarce. Thus, it contributes to an environmental problem that it also directly suffers from financially (though this may not always be the case).

Let's remember from this third part of the chapter that the pragmatist approach proposed by Lorino is useful for structuring course preparation. It allows structuring a scenario based on the principles of inquiry and the functions of semiotic mediation. Through inquiry, it allows the instructor to investigate with the students and accept the evolving and unstable nature of the content being taught.

### **Conclusion:**

In this paper, we began by contrasting two accounting approaches:

- A very financial-accounting-centred approach, where extra-financial questions are treated peripherally, inadequately, or in separate courses when they exist.
- A very sustainable development accounting-centred approach, focusing on extra-financial aspects, like carbon accounting, water, and biodiversity accounting.

We then aimed to transcend this dualism by applying the pragmatist approach advocated by Lorino, and we proposed an object-sharing-based approach. Each object must be modelled and understood in its entirety, considering all emerging financial and sustainability questions from understanding the subject. By involving themselves in understanding the object, the instructor and students uncover conflicts, contradictions, choices to be made, compromises, and possibilities for transcendence, dynamically and continuously. Sustainable development accounting requires the contribution of multiple disciplines, so any level proposed will make an accounting instructor feel limited in what they can teach. They are neither climate change experts, nor social issues experts, nor biologists, nor engineers. However, they should help students understand the need for an interdisciplinary approach, and perhaps this is an opportunity to forge connections with colleagues outside of management sciences.

At the end of this chapter, we conclude with two recommendations:

- The first concerns the teaching function: teaching accounting for sustainable development requires new partnership modalities among instructors and a new configuration emphasizing objects to be taught rather than disciplines. The object mobilizes knowledge that requires contributions from several instructors.

- The second concerns accounting students who, due to their training, are used to categorizing information and knowledge into distinct compartments. Through an accounting course for sustainable development, we must encourage them to break down barriers and connect knowledge from different disciplines, which contradicts the typical learning patterns of a classic accounting student.

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