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How to Teach a Complex Discipline in a Changing Learning Environment: The Example of Sustainability

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ABSTRACT: In the “electronic age” our teaching profession is faced with new challenges. Normally, educators tend to spend a significant amount of time updating the content of what they teach. They spend less time changing their methods of teaching. Today, this no longer works. A lot of content is delivered through Google and similar partners and what is now critical is that we make the necessary changes in our teaching methods to reflect this and to have some impact on our audiences.

Based on more than forty years of teaching experience we feel qualified to underline the importance of the form and the method of teaching. Traditional teaching methods require that more time is spent transmitting the target information than would be spent if Google or relevant videos were used instead. Some forms of interaction can be substituted by some e-learning technologies as well. The only benefit of using traditional methods, if any, is the benefit to the students from the personal charisma and creativity of professors. It is certain that the right style of teaching can create a special atmosphere in the classroom.

In this paper we would like to highlight our experiences. We take as our example – not to be too general – the concrete courses on Sustainability and CSR (Corporate social responsibility) that we have taught. These topics tend to divide both students and teachers. There are a lot of questions and data about these issues but few clear and definite answers. Science is habitually late in delivering answers to such fuzzy questions, which creates a lot of freedom regarding the taught content and requirements of the methods applied.

In the first part of our paper we summarize five basic approaches to teaching. Then, using the example of Sustainability, we introduce step by step why and how complexity should be structured and then simplified. The third section concerns the concrete question of how to structure sustainability. The fourth describes how facts can be substantiated with analysis.

The authors believe that parables can sometimes lead to deeper understanding than reliance on conventional methodological approaches. We use famous parables and strategic grids to put across a simple message to students: you have to develop your own ideas about sustainability. We all are responsible for doing this — there is no given framework!

We have tried to learn as much as possible from our colleagues and peers from all over the

world. We would now like to offer something back, although we know that the methods described here are very personal to us. We hope that some of you can benefit from our experiences. Please share yours with us!

KEYWORDS

Corporate social responsibility, Sustainability, using parables in teaching, structuring complexity, teaching methods

I. THE CONTEXT

We think that in a changing learning environment over the coming years we will have to spend more time developing teaching methods than with developing content. There are three well known arguments for changing teaching methods:

- a). **“e-society” changes our behaviour.** It affects our willingness to learn facts, our inclination to read books and how we deal with time-intensive tasks. On the other hand, the open door to the digital world gives us access to an immense amount of information. e-society requires us to rethink our way of teaching because it creates a new kind of student and permanently changes the quality of information they have access to. How can we teach in a world where a lack of access to information is no longer an issue and few methods exist to deal with this situation? How can we pique the curiosity of students who are used to assuming they can rely solely on Google and on social networks for information?
- b). The **expectations and demands of well-educated students** are changing. The value of soft skills is increasing while the value of lexicographic knowledge is decreasing. Use of the right hemisphere of the brain is increasing while the left one is

losing its dominance. Design, convincing communication, creativity, empathy and social intelligence are attributes that employers are looking for. But how can we teach students to master these things?

- c). Planet Earth has become a global village. Everything is interconnected. **Complexity and uncertainty** dictate business. These things cannot be described accurately with simple, deterministic tools. ‘Inductive’, ‘intuitive’ and ‘subjective’ have become key words, instead of the traditionally used ‘deductive’, ‘rational’ and ‘objective’. Indistinct experience instead of clear logic! How can we reflect this in our business teaching?

The educator is in a bind: He or she has to identify with change; this has to be incorporated into the syllabus and the method of teaching. Nowadays, a good teacher identifies with Sisyphus (or on a more positive note, with Hercules); only incompetent teachers attempt to ignore our changing times.

It is doubtful if humanity has ever been under such pressure to adapt to such changes in education. Thanks to Socrates, Maria Montessori, Locke, Rousseau, Wilhelm von Humboldt and other giants, educational methods have undergone significant changes in the past. What is upon us today, however, requires more than change; it requires complete transformation.

In dealing with teaching methods in the field of engineering, Prince and Felder describe deductive and inductive methods. *“Inductive teaching and learning is an umbrella term that encompasses a range of instructional methods, including inquiry*

learning, problem-based learning, project-based learning, case based teaching, discovery learning, and just-in-time teaching.” (Prince & Felder, 2006). We are aware that their categorization is useful, but in this paper we use our own definitions, where besides the above-mentioned two main methods (deductive, inductive) you will find three others. Our more practical approach is based on our own teaching experience. We have experienced and can identify at least five basic approaches to teaching:

- i). **A deductive approach.** Start with a general picture, with axioms and hypotheses, and try, based on these, to come to concrete conclusions about a given situation
- ii). **An inductive approach.** Analyse a lot of examples (in our sustainability-themed case, Exxon Valdez, Chernobyl, the London Smog of 1952, the Aral Lake) and make case studies and generalize experience from these examples. Deal with single technical issues, like greenhouse gases, waste management or the rain forest
- iii). **A definition-driven, “lexicographical” approach.** Try to give a comprehensive overview of existing opinions and definitions
- iv). **A tools-driven analytical approach.** Focus on analytical tools and apply them
- v). **An illustrative and well-structured approach.** Try to find a simple, but also convincing and intellectually challenging structure for the topic. Fill this structure with parables and tales. Use illustrations, images and metaphors

The question arises: which of these approaches is best placed to take into account the three drivers of change we mentioned before?

If we take the existence of the three drivers – e-society, demand for right brain skills from the labour market and complexity/uncertainty –

seriously, then it seems that teaching approaches (ii), (iii) and (iv) are of questionable utility. They don’t account for the fact that not only do we have a brain between our ears but there is also a second brain on the desk in front of us: a computer. To employ these pedagogical approaches risks trying to replace the computer instead of leverage it.

A deductive approach (i) always makes sense, if it is possible. But in the study of economics we have doubts if a suitable deductive approach is feasible. The reason is that the required objectivity is missing. Approach (i) has another weak point; it does not support the use of right brain skills because it requires a very logical and rational approach.

We tend – in the changing teaching environment mentioned above – to prefer to use approach (v): **be illustrative and build on simple structures.** The **structures** should be simple and the challenge is to identify such structures. The **approach** should be illustrative, but require creative design, not copying.

We think that approach (v) reflects better than the other four potential approaches the new world of teaching.

1. It does not compete with e-society but delivers surprising food for thought about which the internet can only reflect but not create and penetrate. Yet the internet may supplement the method with facts and tools as needed
2. It helps develop right brain skills based on creative solutions, pictures, parables, metaphors and illustrations and by simplicity of design. As Nobel laureate Daniel Kahneman stated: “you must surprise students by individual cases” (Kahneman, 2011).
3. It tries to deal with complexity by targeting and creating compelling structures

Let us demonstrate our approach by using ‘Sustainability’ as an example. This subject matter is close to the heart of many students as it addresses their futures. It is not only an extraordinarily complex topic, but also a novel topic, and as such is incompletely researched. Students encounter disorganized ideas and teachers become disoriented and entangled by the numerous definitions which exist.

III.I. SUSTAINABILITY AS AN EXAMPLE. FIRST STEP: STRUCTURING COMPLEXITY. WHAT DOES THIS MEAN IN GENERAL

We usually start by trying to grasp a problem and develop a framework, locate the focus points and resolve complexity. This is an exercise which we can call ‘problem structuring’. The next step is to fill the framework with facts. Finally, we draw a conclusion.

Grasping the problem means sitting in front of a blank sheet of paper and trying to define the nature of the complexity of the problem and set priorities.

In such a situation it makes a lot of sense to relate the famous parable about the students of art. These students were given a theme and were allowed a significant amount of time to paint a picture. Two clusters of students could be identified: those who immediately started painting and those who waited, and spent one hour or more in front of the canvas without doing anything. Major artists came only from the second group of students. The famous masters Leonardo and Raffaello Santi used to spend a day in front of the canvas without making a mark. From their practice one can learn a lot about the importance of this phase in the success of any work of art.

Structuring complexity is a challenging endeavour. In times when the world is shaken by bank failures in Iceland or by the unbalanced national budget of Greece (and remember, both countries have less than a hundredth share of the world’s GDP¹), individual cards which wobble threaten to bring down the entire house.

Noble prize laureate Joseph Stiglitz remarks succinctly and justifiably, if not very usefully: “*The complexity of modern economic thinking goes above the heads of politicians*” (Lüchinger, 2009).. How can our students handle a level of complexity which is unmanageable even to experts?

The best way is to spend more time than is usually allotted on **structuring**, beginning by seriously contemplating the problem at hand, with patience. Stiglitz mentions that politicians prefer to jump immediately to conclusions and skip the stage of defining the structure of the problem. This approach gives poor outcomes.

Structuring can be categorized as a three-stage process:

1. The act of pondering a problem; curiosity leading to immersion in a subject. The time spent staring at a blank sheet as mentioned above. The joy that thinking can bring
2. Classic structuring: true understanding of the nature of a problem. The French philosopher Michel Foucault presented the only convincing definition of ‘structure’ in the last century. He defined a topic as being something based on the shape of its parts, their quantity, manner of distribution, interconnection, and their relative size. There is no better way of comprehending structure, and we adhere to this definition
3. Bringing a structure to life, filling it with facts. From these facts we must reach a conclusion

1 Greece’s share of world GDP is less than 0,4%, Iceland’s is less than 0,02%!

We attempt to teach this kind of structuring not as a complete academic method, but as a way of thinking.

The most convincing examples of the use of memorable structures to describe complex problems are the achievements of Linné in Biology, Kekulé and Mendeleev in Chemistry and Bohr in Physics. These are examples so surprisingly simple that they are not easily forgotten. They allow us to distil the essence of the problem – and complexity disappears. While Bohr’s model of the atom, and to a lesser extent, the periodic table by Mendeleev are outdated in their original form, they still help us to understand the principles they are meant to describe.

In economics, the best examples of clear structures for deeper understanding are the ‘Five forces’ of Michael Porter or the ‘Growth-share Matrix’ of the Boston Consulting Group. Both tools have been substantially criticized but they demonstrate a smart simplicity that is fascinating and provokes meditation on the topic. The dream of every teacher: Students start to meditate!

At the end of the process we enjoy finding a common sense solution to structuring the problem. We summarize the principles of this solution based on three conclusions, illustrated by three parables:

- **We should not be confused by an excessive amount of detail and disconnected facts, but remain aware of the problem as a whole**

Remember the five blind men in the Indian parable, asked to touch an elephant and describe what they found...

“When the blind men had felt the elephant, the raja went to each of them and said to each, ‘Well, blind man, have you seen the elephant? Tell me, what sort of thing is an elephant?’

Thereupon the men who were presented with the head answered, ‘Sire, an elephant is like a pot.’ And the men who had observed the ear replied, ‘An

elephant is like a winnowing basket.’ Those who had been presented with a tusk said it was a ploughshare. Those who knew only the trunk said it was a plough; others said the body was a granary; the foot, a pillar; the back, a mortar; the tail, a pestle, the tuft of the tail, a brush.

Then they began to quarrel, shouting, ‘Yes it is!’ ‘No, it is not!’ ‘An elephant is not that!’ ‘Yes, it’s like that!’ and so on, till they came to blows over the matter.

Just so are these preachers and scholars holding various views blind and unseeing... In their ignorance they are by nature quarrelsome, wrangling, and disputatious, each maintaining reality is thus and thus.” (Buddhism, 1995)

- **We should proceed with care and not attempt to tame complexity with superficial, commonplace descriptions**

Another parable: Zhuangzi told this story to his disciples to make a point. Once a zookeeper said to his monkeys: “You’ll get 3 bananas in the morning and 4 in the afternoon.” All the monkeys were upset. “OK. How about 4 bananas in the morning and 3 in the afternoon?” Hearing this, the monkeys were content. One should realize that a change in phrasing does not necessarily represent a real change (ZuangZi, 369?-286? b.c.).

- **We should be clear about the essence of structuring:** managing complexity and setting priorities. The following tale strongly emphasizes the importance of ‘structuring’

One day, an expert in time management was speaking to a group of business students and, to drive home a point, used an illustration those students never forgot. As he stood in front of the group of high-powered overachievers he said, “Okay, time for a quiz” and he pulled out a one-gallon, wide-

mouthed mason jar and set it on the table in front of him. He also produced about a dozen fist-sized rocks and carefully placed them, one at a time, into the jar.

When the jar was filled to the top and no more rocks would fit inside, he asked, “Is this jar full?” Everyone in the class yelled, “Yes.” The time management expert replied, “Really?” He reached under the table and pulled out a bucket of gravel. He dumped some gravel in and shook the jar causing pieces of gravel to work themselves down into the spaces between the big rocks. He then asked the group once more, “Is the jar full?” By this time the class was on to him. “Probably not,” one of them answered.

“Good!” he replied. He reached under the table and brought out a bucket of sand. He started dumping the sand in the jar and it went into all of the spaces left between the rocks and the gravel. Once more he asked the question, “Is this jar full?” “No!” the class shouted.

Once again he said, “Good.” Then he grabbed a pitcher of water and began to pour it in until the jar was filled to the brim. Then he looked at the class and asked, “What is the point of this illustration?”

One eager beaver raised his hand and said, “The point is, no matter how full your schedule is, if you try really hard you can always fit some more things in it!”

“No,” the speaker replied, “that’s not the point. The truth this illustration teaches us is this: If you don’t put the big rocks in first, you’ll never get them in all.” (businessballs.com, 2013)

There is a lot to say in favour of the use of parables, fables and anecdotes as a means of introducing students to the difficult topic of structuring and problem solving. Many of our students recollect the toy bucket used to demonstrate the aforementioned Chinese fable, even years later. Only a few remember the frequently-cited techniques

of value calculation or statistical distribution curves.

Until now have we tried to be consistent regarding our targets. We used the internet to understand that there is no simple interpretation of structuring. Wikipedia delivers the following: “*Structure is a fundamental, tangible or intangible notion referring to the recognition, observation, nature, and permanence of patterns and relationships of entities.*” No doubt this is right, but it doesn’t provide us with much help. The business online dictionary is more precise: Structure: “*Construction or framework of identifiable elements (components, entities, factors, members, parts, steps, etc.) which gives form and stability, and resists stresses and strains. Structures have defined boundaries within which (1) each element is physically or functionally connected to the other elements, and (2) the elements themselves and their interrelationships are taken to be either fixed (permanent) or changing only occasionally or slowly.*” (Dictionary)

We have tried not to copy the text available on the internet and avoided repeating existing views. We developed right brain skills – dealing with complexity, creativity and designing a problem by using a parable. In doing so we started to get a feeling about how to deal with complexity.

II.II. SUSTAINABILITY AS EXAMPLE. SECOND STEP: SIMPLIFYING THE PROBLEM. WHAT DOES “SUSTAINABILITY” ACTUALLY MEAN?

Sustainability is a buzzword. The expression sees a lot of use in the media, at universities and in business presentations. Most often, sustainability relates to environmental issues but it is occasionally used in the wider sense of the word. Donella Meadows defined it beautifully: “I call the transformed world toward which we can move “sustainable,”

by which I mean a great deal more than a world that merely sustains itself unchanged. I mean a world that evolves, as life on earth has evolved for three billion years, toward ever-greater diversity, elegance, beauty, self-awareness, interrelationship, and spiritual realization.” (Meadows, 1995)

There must be thousands of definitions of sustainability, but does teaching them really help? Many authors remark that, due to the plethora of definitions, ‘sustainability’ has lost its value and has become a catchall phrase. Let us try to move from a phrase to a topic which makes students curious and challenges them.

Our understanding of “sustainability” is simple and based on two sources. The most commonly cited one, devised a quarter of a century ago by Brundtland (Brundtland, 1987), and the oldest, dating back 250 years ago, coined by a forest officer hailing from Saxony, named Hans Carl von Carlowitz (Grober, 1999).

The Brundtland report defined sustainability as being economic and social behaviour that does not damage future opportunities, and does not negatively impact the life of our children – a clear and simple statement. “Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.” (Brundtland, 1987)

Carlowitz, meanwhile, was dismayed by the rapidly declining number of trees in the forests of Saxony which were being extensively logged at the time, primarily for firewood, as well as for use in mining, construction, and metallurgy. He appealed to King August of Saxony, and asked that an order be given out that for every tree cut down a new one had to be planted, so he would be able to “sustain” the number of trees. The King favoured his idea. (von Carlowitz, 1713) J.R.Hicks provides a similar type of definition of ‘income’ as “*the maximum value which a man can consume during a week and*

still expect to be as well-off at the end of the week as at the beginning” (Hicks, 1939) . Ecological economics has developed the notion of sustainable consumption based in part on Hicksian notions of living within limits that allow individuals or nations to remain “as well-off” as before (Toffel, 2010).

We are of the opinion that teaching “sustainability” should be done using simple definitions. We recommend not overcomplicating the topic by using a lot of technical parameters or complex references. For us, “Sustainability” simply means avoidance of negative impact on our future. ‘Not hurting the future’ can be associated with financial, social, environmental, demographical, educational and other impacts. Edification requires focus. We focus in the following paragraphs on the environmental aspect of sustainability.

II.III. SUSTAINABILITY AS EXAMPLE. THIRD STEP: BECOMING CONCRETE: STRUCTURING SUSTAINABILITY

Structuring cannot be taught only as an abstract concept; skills are developed by study of practical, but imaginative examples – e.g. the story of the bucket or Mendeleyev and Bohr’s scientific model systems – based on memorable experiences.

What is the best, and most memorable, way of structuring ‘sustainability’? The **first step** is to focus on only one of its many facets: e.g. the environment. We could have easily chosen any other field (finance, education, health services, etc.); the didactic method remains the same.

Now that we have defined the area, we undertake intensive brain storming with students. A lot of potential criteria for structuring ecological issues come to the table: regional issues, technical dimensions and degree of risk, time horizons and other things.

We come **in the second step** to the conclusion that our key structural criteria should be the cause of the ecological problem (**causality**) and *ways to manage* the problem (**change**).

These two important dimensions open up different pathways. We decided to deepen the pathway of causality and change in a **third, final step** of structuring by adding further criteria:

- For the dimension of **Causality**: Are we discussing only **direct** causes with direct environmental impact (e.g. CO2 emissions of coal fired power plants) or **indirect** causes with full environmental impact (the ‘carbon footprint’ of a beef steak)?
- For the dimension of **Change**: What are the levers for improving sustainability – regulatory measures (**regulative**) or convincing arguments in favour of certain paths of action (**communicative**)?

So we come to our final structure: **the plane of causality (direct and indirect) and the levers of change (regulative and communicative)**.

We need to explain the characteristics of the two dimensions in more detail. Students have to be made to understand that both are ways of thinking, and not precise, academic concepts.

The dimension of Change – The comparison of regulative with communicative methods puts a basic question on the table. Smith or Kant?

The great Adam Smith, writer on the modern market economy, postulated the existence of an invisible hand which would collaborate in providing all the regulation needed. This invisible hand depends on rules to govern competition, to prevent criminal activities, to determine risks, to collect taxes – and to protect the environment for the future. Mankind – as Adam Smith and Charles Darwin pointed out – tends to favour immediate and individual goals over long term goals, so it becomes

necessary to vigorously restrict certain individual activities using strong regulatory mechanisms.

In other parts of Europe, when it was found convenient to provide security to tenants both against heirs and property-owners, the term of their security was still limited to a very short period; in France, for example, to nine years from the commencement of the lease. It has in that country, indeed, been lately extended to twenty seven, a period still too short to encourage the tenant to make the most important improvements to properties. The proprietors of land were in the past the legislators of every part of Europe. Laws relating to land, therefore, were all created to uphold the interests of the proprietor. It was in his interest, they imagined, that no lease granted by any of his predecessors should hinder him from enjoying, over a long period of years, the full value of his land. Avarice and injustice are always short-sighted, and they did not foresee how much this regulation must obstruct improvement, and thereby hurt, in the long-run, the real interests of the landlord.

The equally great Immanuel Kant shows no inclination to regulate the selfish, but appeals to reason. Like Socrates, Plato, and others that came before them, he argues that rationality and insight will lead us to make the best decisions. In the knowledge of this opinion, we asked more than a hundred M.B.A. and Executive M.B.A students hailing from more than ten countries if Platonic rationality indeed provides the best guidance. A large majority of students answered ‘No’.

This answer does not simplify matters for the educator. It makes it a necessity to teach students not only using rational argument, which is much more difficult, and also more challenging. It emphasizes all the things Lao-Tzu meant when he stated “what needs to be learned cannot be taught”, or what Kahnemann referred to when he said that “psychology cannot be studied, it needs to be lived”. (“the uncomfortable conclusion that

teaching psychology is mostly a waste of time.”) (Kahneman, 2011).

Even this first discussion of the two dimensions (regulation vs. communication) leads to many opportunities to pique students’ curiosity and spur them to investigate classical philosophical and ethical questions, to visit Google and to look for ideas and potential solutions.

Similar inspiration can be found for another dimension of our structure. The plane of causality leads us to the question of direct impact vs. full life cycle impact on environmental sustainability. Full impact can be defined by the fact that almost everything leads to consumption of one form or another. Sustainability can then retroactively be interpreted by using the end product as a starting point. Tropical rain forests are cut down to clear land for subsistence farming and commercial agriculture; man-made carbon dioxide can theoretically be tracked to a single source for any consumer product.

When we discuss full versus direct effects we often use a parable from Burma (Myanmar): The king and one of his ministers were standing in a very good mood at a window in the palace. They ate fried rice with honey and were laughing so much that a little bit of honey dripped onto the windowsill.

“Your majesty“, said the minister, “there is some honey on the windowsill. Please allow me to wipe it up.” Laughing, the king answered: “It is beneath your dignity to do this and I won’t call a servant because he would disturb the conversation we are having. Don’t worry about it.”

They continued to laugh and eat, and a single drop of the spilled honey fell from the windowsill down onto the street. The king noticed this and said to the minister.

“Minister, can you see that on the street a fly has just found his dinner based on our drip of honey?” The minister looked down and noticed that a large spider had just pounced on the fly. A moment later a lizard came and ate the spider. The king

and the minister continued to laugh and eat even when they saw that a big cat had caught the lizard and eaten it. A second later a big dog attacked the cat. Then the owners of the cat and the dog started arguing and this turned into a fistfight. The king and the minister were still amused. They enjoyed it even when other people came to support the two fighters and the dispute grew into a big street fight. But soon the laughing and eating stopped. In the streets of the town a veritable battle had started. In the chaos the king called for the palace guards to get organized to defend the palace. But this was useless because the guards had already been drawn into the battle. Nobody was available to help the king and the minister. After a few hours, a civil war had started, the city was in flames, the palace was destroyed and the king and the minister were killed.

This impressive story shows that small changes or events can be the cause of large effects. Direct effects can be totally different from full impacts. This is the analogy. You may put your beef on the grill and be proud that you are environmentally-friendly because you haven’t used electricity or gas, but only wood from the garden and some charcoal. But if you understood the full environmental effects of your garden dinner you would be shocked. Beef is a food product with one of the highest CO₂ footprints of all. Your grilling is the drip of honey but the beef is the civil war.

In environmental studies there are two well-known ways of dealing with direct and full life cycle impacts.

Wassily Leontief was the first to raise this subject. In his later years he concentrated his research on environmental issues. Based on his famous input-output models, which are the most direct way to determine direct and indirect impact (assuming you have the right information and if you accept linearity in the production coefficients), he calculated ecological impact by inverting the Input-Output-Matrix.

The current authors simulated a small calculation by inverting a 3 x 3 matrix with three dimensions: coal, electricity and CO₂. The result was clear: it is easier ('cheaper') to save CO₂ by limiting the electricity consumption of the households than to directly save CO₂ in the coal to electricity generation process.

The other famous and also convincing tool that can be used to get a fuller picture of total environmental impact is the **ecological footprint**. Its determination is not as elegant as by using Leontief's method, but it is transparent and can be done by hand. Google delivers a lot of interpretations, benchmarks and comparisons of footprints and students can leverage their creativity and inspiration to come to their individual results.

The message from both methods – input-output and footprint – is basically the same. The end product structure is key to determining the consequences on the environment. Consumption itself becomes more and more dominant – and not only via interminable value chains but also by the direct impact it has on sustainability through heating, transport and lifestyle activities. To be more concrete: the export-import balance of emissions is highly negative in the most developed countries and consequently is positive in China and Russia. We complain about China and Russia's CO₂ emissions, but we are part of them.

Incomprehensible politics and science treat the consumer with kid gloves and shift the blame onto primary industry and energy suppliers. We, consumers, are the greatest enemies of sustainability – an excellent topic to deliberate with students.

We have already mentioned that the attention span of students and their ability to learn is significantly raised by the use of unexpected anecdotes, parables, fables and analogies from a range of different disciplines. They represent novel ways to illustrate matters and can provide other visual information.

Here is an exemplary episode from a lecture hall in Dresden, nearly a hundred years ago: The famous expressionist Oskar Kokoschka tended to teach his class using live models. The students did not show much eagerness. Kokoschka secretly asked the model to pretend to be suffering a fainting spell. Accordingly, the model collapsed on the floor, and Kokoschka rushed to his assistance. He listened for a heartbeat in vain and then announced the death of the model to the distressed students. After a short while, the model got back up and assumed his previous pose. 'Now draw him' announced Kokoschka 'as if you knew that he lived and was not dead.' After this theatrical interlude the students took up their work with much more enthusiasm. (Berger)

A similar way to get attention is also to work with pictures which are not so easy to interpret. The split between causality and change in further two dimensions (full/direct respective regulative/communicative) can be easily incorporated into a matrix, or a portfolio, and allows for easy visualization. Such illustrations are ideal for displaying arguments with clarity. They are shown in an example in Fig. 1. Question marks indicate which parts need to be filled in to bring the illustration to life.

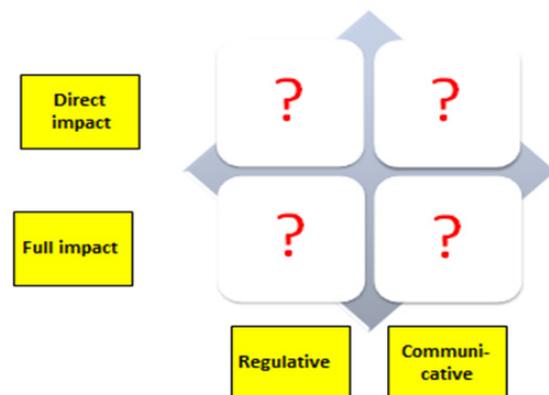


Figure 1. The split between causality and change

II.IV. SUSTAINABILITY AS EXAMPLE. FOURTH STEP: SUBSTANTIATING FACTS WITH ANALYSIS

We have produced a simple definition and a clear structure for our topic of sustainability but do not claim that there are no alternatives to our definition. It is important to note that from a didactic standpoint it is more convenient to start with simple definitions and structures instead of lexicographic detail. The latter was never that useful and is even less so after the advent of the ‘Age of Google’.

Our task is to flesh out our structure and definitions with facts and questions, and to bring them to life. Ideally, these facts will lead us to make statements and reach generalized conclusions. To do this, we will complete our example with its four combinations and will attempt to synthesize our results.

i). Direct Sustainability - how can it be strengthened by regulative means?

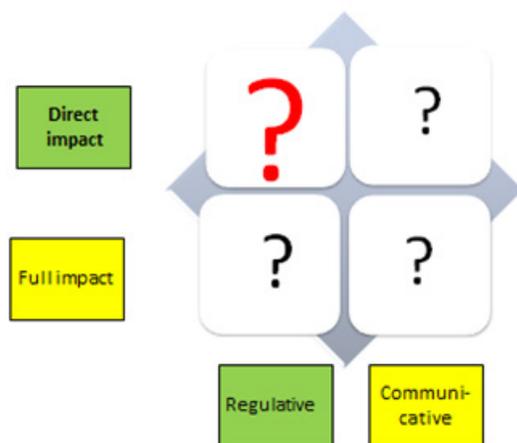


Figure 2: The direct impact of regulation?

The first, most transparent structural section is the combination of direct impact (**causality**) and moving (**change**) by regulative measures. (Fig. 2) This element of our structure matrix is conspicuously evident to everyone. Regulatory measures range from taxes imposed on gas to carbon dioxide quotas, to subsidies aimed at improving the energy efficiency of homes. Most students tend to be averse to regulatory measures and by a large margin (>90%)² would prefer to use alternative energy sources instead, since that seemingly solves the problem at the source. The general question, if sustainability should be advanced more easily using regulatory measures or by making convincing arguments has consequently been unanimously answered: the latter is of more importance.

In conclusion, we could argue that the best way to promote sustainability is to persuade, as this is the best way of reaching out to young people. Having an open discussion and allowing students to propose unorthodox methods bypasses their innate aversion to regulatory measures.

Some of the more innovative ideas of students:

- Tracking energy use at home relative to household size and enforcing fines or providing of incentives which directly impact bank accounts. Based on utility invoices this could be a relative simple but potentially very effective tool. We have had long discussions about whether this should be a progressive, linear or regressive system and also about the question of whether it should be bonus malus system or if it should only use penalties
- Similarly to this, a household energy credit card could be introduced, connected to

² Sample of more than a hundred students of a Master class at the Corvinus University of Budapest

a household energy account with a fixed balance, with fines to be imposed if the credit limit is exceeded

- Worldwide energy standards for household equipment, similarly to the regulation of defense systems
- Much more intensive introduction of energy reduction systems which are cost free to the owner of the house or apartment. The savings generated by the investments into the energy system refinance the investment itself

Students felt, at the end of the lesson, that regulatory measures for managing direct effects on the environment are in the short term the most efficient way of promoting sustainability.

This question should take up important time in our lessons. Basic questions (market vs. regulation, sovereignty of the consumer) need to be incorporated.

ii). **Full Sustainability- how can it be strengthened using regulatory measures?**

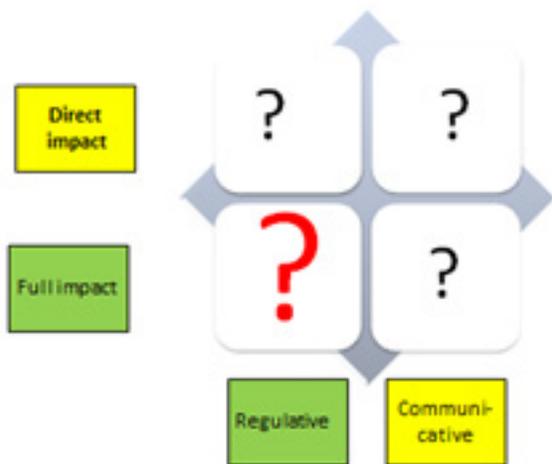


Figure 3: The full impact of regulation

The approach to examining the full impact (Fig. 3) on the environment is effortlessly made clear to everyone. It is the sum of effects through the value chain, from raw materials to consumption. Full sustainability is clearly less easy to measure than direct effects alone.

Nevertheless, there are two impressive tools – the abovementioned Leontief matrix and the ecological footprint – that are available to use for the detailed study of full ecological sustainability, which make them ideal case studies for students. The notion of full sustainability leads to lively discussions in study groups, especially when it comes to the responsibilities of end customers.

Our students quickly came up with unconventional ideas for regulatory management of full sustainability:

- Taxes for end customers or retailers depending on the size of the ecological footprint of the product
- Identifying and communicating about ecologically dangerous products (furniture made using wood from rain forests, beef, plastics) by putting the footprint information into the product description
- Awarding household credit based “on the ecological footprint balance sheet”, and imposing fines and offering incentives

Using regulatory measures to affect the environment based on consumer end products is more of a hypothetical effort and currently plays no actual part in economic policy. Initial efforts have been made to this end (e.g. a level of taxation of critical resources which is perceptible in the pricing of the end product) but market economists remain vehemently opposed to this since it distorts the end price. Price-driven, artificial shortages of resources are seen to be normal market responses, but regulatory measures are rejected and are seen as undue interference by

the state. ‘Importing CO₂’ is less of a topical issue than the issue of producing CO₂ at home. This topic offers a great opportunity for fundamentally important dialogue to be stimulated and for a lively exchange of opinions during the course.

iii). **Direct Sustainability - how can it be achieved using communicative methods?**

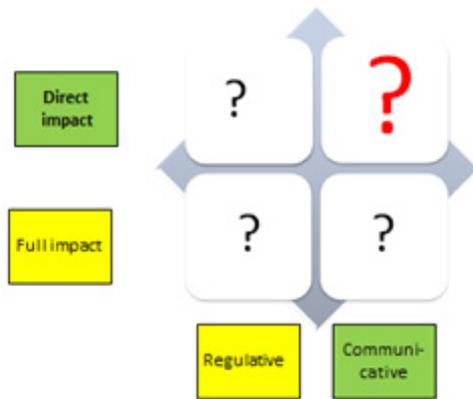


Figure 4: The direct impact of communication

It took some work to come up with creative ideas and potential solutions for the topics we described under (i) and (ii). Topic (iii) is “softer” and still more subjective. Its specific attribute is that it is easy to speak about, it but it is difficult to put into practice.

This topic is ever present in the media and politics, and is propagated by NGOs and grassroots movements. Mostly it seems to appear in the form of complaints and finger wagging, but rarely in the context of positive examples of sustainability and successful protection of the environment.

The problem lies in the vast gap between theory and practice, which most students readily identify. The fact that happiness and affluence are statistically negatively correlated with ecological sustainability raises the question if the discussion of sustainability is pure rhetoric for western cultures. We claim to cherish sustainability but we do not live in a sustainable manner.

The paradox – students that favour communication of the need for sustainability over tougher regulation but notice that affluence hinders

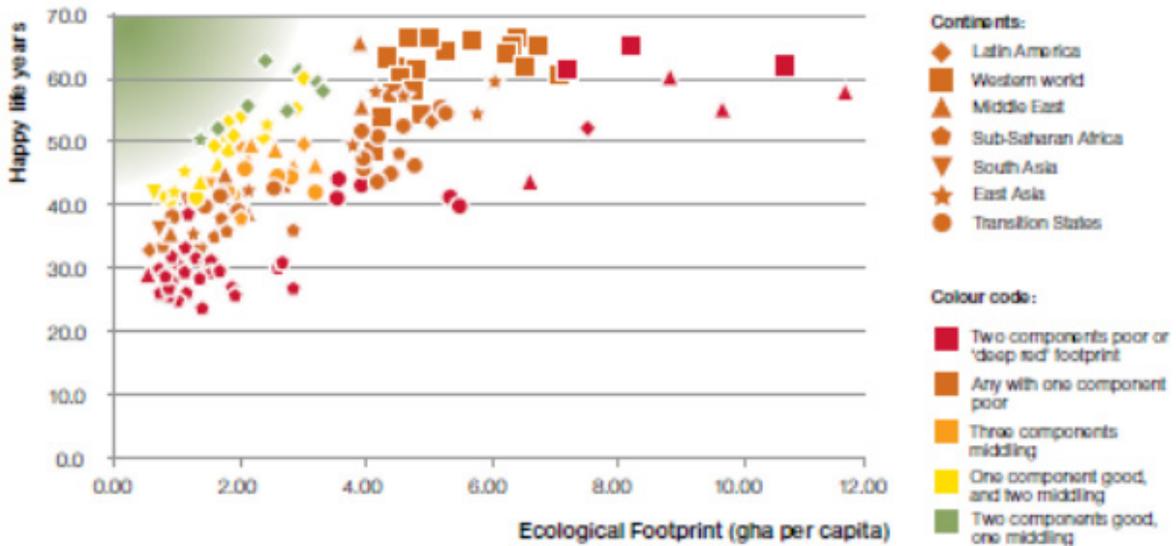


Figure 5: The green target. Happy life years and Ecological Footprint for 151 countries, and world average (The New Economics Foundation, 2012)

actual progress towards sustainability – leads to animated discussions on the topic.

Students notice that affluence and sustainability are not very compatible. They realize that higher prices for energy do more for energy conservation than kind words. Humans are egotistical beings and are not likely to take the necessary steps to improve their environments simply based on the insight that it may be better to do so. He who does not want to listen will have to experience. And this makes regulative measures necessary.

There is a high level of distain among the population for traditional classical sources of electricity, especially coal and nuclear plants. Environmentally friendly energy sources are in. But individually, these encounter a lot of opposition.

Wind energy is great, but by no means build turbines where I like to spend my seaside holiday – they spoil the view. Promote use of the railway to lower CO2 emissions and save burning fossil fuels, but do not dare to build a new track in the forest behind my house.

Coming down from the level of philosophy and human behaviour, we have had good discussions about how convincing communication can be used to support sustainability – accepting “Darwinian” limits.

We arrive at a lot of options. The following ideas are quite popular with students:

- Provide sustainability-focused education from Kindergarten and primary school level onwards
- Require that private media spend a certain amount of time on the subject
- Ensure easy access for parents to sustainability teaching materials (e.g. books, videos, games) and enhance ecologically-oriented parenting skills
- Maintain a positive attitude, based on

achieving and communicating about successful environmental projects (such as river clean ups, upgrading power plants or animal conservation projects). Use more positive examples

- Establishing product-based information systems about sustainability-driven behaviour.

How to improve the environment using communicative methods is a very popular subject of discussion, but ideas remain in reality an untapped resource. This is an ideal topic for an educator, and allows them to combine practical questions with high level ethical ones. It allows discussion of educational policy as well.

iv). **Full sustainability - how to promote it using communicative methods?**

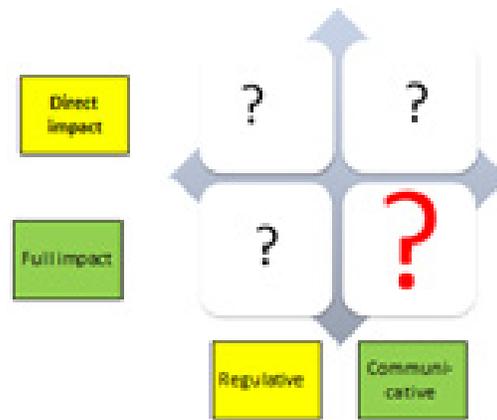


Figure 6: The full impact of communication

This is the most complex of our four structural elements. The difficulty of grasping it can be attributed to the indirect causes of environmental impact and the poorly defined levers of change. On the one hand, it can be seen as an ‘ideal sustainability’ approach: conviction leading to

contemplation of the consequences of our actions and the impulse to consider their environmental impacts, and the finding of optimal solutions to them. Conscientiously avoiding purchasing furniture made from tropical wood, consideration of the CO2 footprint of a steak dinner, of limited fossil fuel resources before taking the car, or of the environmental impacts of fabric production prior to buying clothes. Not because prices dictate our behaviour, but simply based on the desire to make better choices. This represents a wonderful way to instigate a wide-ranging discussion with students – from Plato to Daniel Kahneman, Adam Smith to Hayek, pros and cons.

In speaking about this very fuzzy – soft on both sides – topic, we arrive at a number of solutions about how to deal with full environmental impact in a communicative way. The following ideas came to the surface; some of them are similar to the direct effect mentioned under (iii):

- Provide sustainability-focused education from Kindergarten and primary school level onwards which incorporates considerations of the full life-cycle impacts of consumption
- Require that private media spend a certain amount of time on the subject – which incorporates discussions about the full life-cycle impacts of consumption
- Establish footprint based information systems about sustainability driven behaviour.

Ultimately, everybody has the feeling that this area is still a relative black box. For the relevant (very concrete) question of how can we avoid buying import products with a “dirty background” or a relatively high footprint it is difficult to find an answer, but it makes a lot of sense to discuss the topic.

III. ASSEMBLING THE BIG PICTURE. WHAT CONCLUSIONS CAN BE DRAWN?

Will the notion of ‘personal responsibility’ define the next century or will it be rather ‘perfect regulation’? The modern age does not limit access to information and a lack of it will not be a defining factor. It is likely that we will experience both approaches, but it is worthwhile spending time deliberating their weight and impact.

There are many ways to define the complex term ‘sustainability’ didactically. The five typical approaches we mentioned at the beginning were these:

- i). The deductive approach.
- ii). The inductive approach
- iii). The definition-driven “lexicographical” approach
- iv). The tool-driven analytical approach
- v). The illustrative and well-structured approach

As mentioned, as educators we decided to employ the well-structured approach (option v). The utility of this **method** and how the four structure elements can be assembled to see the big picture (**content**) are now summarized.

IV. THE METHODOLOGICAL BOTTOM LINE

The well-structured approach helps us to get to the core of a complex problem. Lively discussions with students lead us to creative solutions and we have made a step towards reflecting the specific requirements of our epoch – leveraging the move towards digitalization, strengthening the teaching of right brain skills and teaching techniques for dealing with complexity and uncertainty.

We believe that this way of structuring and the following two approaches are beneficial to our method:

- Comparing direct/indirect drivers of environmental change
- Comparing regulatory/communicative approaches to dealing with environmental issues

These kinds of dialectic comparisons have been used in philosophy for centuries. (Hegel, 1998) Their practical application in education is not commonly appreciated. Our students were initially hesitant and had difficulty discussing conflicting ideas. In the end their curiosity gained the upper hand, and they were able to contribute with novel ideas (see above).

We learned that our students like parables and surprising stories and they are open to the 'illustrative' way of working with pictures and case studies. Parables and fables provide useful analogies for illustrating and broadening principles or lessons. They foster a way of thinking which the internet does not deliver, and they are right brain oriented and simplify complexity.

Well-structured cases motivate students to contemplate the problem. On their own, most students struggle to illustrate a problem using a case.

It is interesting to note that some students were not very keen on the "well-structured approach". It is not always easy to comprehend, and requires the ability to reflect and deliberate for an extended period of time.

We link our well-structured approach to "open book" exams – without exception. A significant number of students prefer the "closed book" form on the grounds that they offer more protection from surprises and do not necessitate as much creativity in thinking.

In the age of the Internet we are of the opinion that the majority of exams given for advanced courses should be "open book." The

Internet relieves us of having to do a lot of rational thinking (e.g. left brain hemisphere related) and learning by rote, but open book exams require this information to be synthesized and applied.

V. SUBSTANTIVE CONCLUSIONS FROM THE COMBINATION OF THE FOUR STRUCTURAL ELEMENTS

A well-structured approach has been beneficial for our understanding of the problem in three different ways:

- Addressing consumption is key to achieving sustainability. Everyone consumes; by dealing with this issue we directly influence sustainability and do not remain analytical bystanders
- It is an illusion that a sustainable world can be created simply by holding positive convictions about it. Laissez-faire is not a valid option
- There are still many unexploited options – communicative and regulative – for promoting sustainability. Wider and more creative discussion in the media and in politics would be beneficial

We think this approach is consistent with the educational targets mentioned at the beginning:

- We consequently do not try to mimic the internet – we do what can't be done by using the internet
- We strengthen right brain skills by avoiding focusing entirely on purely 'rational' approaches to problem solving. We try to be as much Andy Warhol as Plato
- We deal with the complexity of a globalised world without getting lost in it
- We hope this presentation of our approach

will provoke more discussion about how to teach better in the ‘e-society’.

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