

01.3 Study on transfer possibilities of teaching methods

Study on Pedagogical methods



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Introduction

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Pedagogical methods consist of procedures for implementing teacher teaching or student learning, theoretically or practically. We use it to manage, explain, discover, evaluate. Accomplishments matter more than principles. In this sense, the maieutic of Socrates (known as the interrogative method), project-based pedagogy (project-based learning), contract pedagogy, differentiated pedagogy, programmed teaching (Skinner, 1958¹), pedagogy by objectives, pedagogy by situation-problem (problem-based learning), computer-assisted teaching are teaching methods.

For others, there is no single and unanimous definition of pedagogical method since this "science" is constantly evolving to the point that pedagogical engineers are developing new pedagogical concepts based on new research.

For Philippe Meirieu², French researcher and specialist in educational sciences, there are 3 definitions of a teaching method:

- A pedagogical trend serving to promote certain educational goals and suggesting a coherent set of practices.
- An activity whose purpose is to enable learners to develop certain abilities and thus enable learning.
- A pedagogical tool or instrument used to fulfill specific objectives

In general, let us remember that a teaching method is a means used to develop learning and to fulfill a specific educational objective.

The first part of this document will make it possible to highlight pedagogical theories in training, in which we will see the place of these 5 major theories, i.e. the 5 known pedagogical methods: the transmissive method, the demonstrative method, the interrogative method, the active method, and the experiential method. The second part will present tools for application in adult training, and different forms of environmental education. And in the third part, we will discuss (eco-)systemic thinking or eco-literacy, the challenge of education.

¹ Burrhus Frederic Skinner (1904-1990), was an American psychologist and thinker. An influential thinker of behaviorism (especially "radical behaviorism"), he was strongly influenced by the work of Ivan Pavlov and that of the early behaviorist John Watson.

² Philippe Meirieu, born November 29, 1949 in Alès (Gard), is a French researcher, essayist and politician, specialist in educational sciences and pedagogy. Professor of educational sciences at the University Lumière-Lyon 2 since 1985, he has carried out extensive research, in particular on pedagogical differentiation and the philosophy of education. He has directed and defended 49 theses.

1 – Pedagogical theories in training

According to the White Book - The place of the 5 major learning theories in training - (Sydology).

It is often said today that the place of the trainer is changing: he is no longer (or in any case should no longer be) the knower who provides his knowledge to passive learners, but must head towards a mission of animation, in which he will organize interactive activities, games and times of reflection to make the learners work and think.

This role change can very easily be related to learning theories.

What are learning theories?

Before talking about theories, let's talk about learning. Depending on the field (psychology, cognitive sciences, etc.) this definition may change. In psychology, for example, learning is defined as "an adaptive change observed in the behavior of the organism which results from its interaction with the environment".

The definition proposed by Koizumi, a Japanese neuroscientist, also makes a lot of sense: "learning is a process by which the brain reacts to stimuli by creating neural connections that serve as a processing circuit and allow the storage of information".

Since the end of the 18th century, researchers and pedagogues have tried to understand the "how" of these definitions, that is to say what mechanisms will come into play (on the learner side as well as on the teacher side) to enable learning. They then defined models, which over time and experimentation have become the 5 major theories of learning that we know today:

- ◆ behaviorism or the transmissive method
- ◆ cognitivism or the demonstrative method
- ◆ constructivism or the experiential method
- ◆ socio-constructivism or the interrogative method
- ◆ connectivism or the active method (of discovery)

Each of these theories presents the mechanisms in place in the learner, but also the role that the trainer or teacher takes.



1.a. Behaviorism

Behaviorism is not directly derived from research on training and pedagogy, rather it finds its origin in psychology, and in particular in work on conditioning.

Behaviorism in psychology

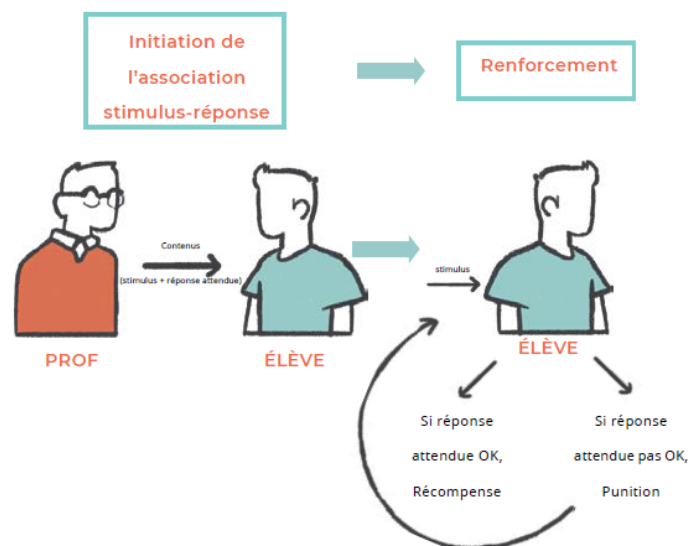
Behaviorism, is a kind of rule of psychology, which requires the study of visible behaviors and not mental states. Indeed, for behaviorists, observable behavior is conditioned by stimulus and response mechanisms, which may be innate or acquired through experience.

And it is this last point in particular that will be interesting in training: any individual has the ability to provide the expected response for a stimulus, if the stimulus/response couple is presented to him enough times. We no longer speak of conditioning, but of learning: for behaviorists, learning is therefore a change in behavior.

The caricature of behaviorist training

In pedagogy, behaviorism is a transmissive model: the trainer is the knower who masters all the content and all the knowledge, which he will try to transmit to learners whose head is considered to be completely empty before the teacher's intervention.

This transmission will be done through positive reinforcement (rewards) and negative reinforcement (punishments). In summary, learning seen by a Behaviorist³



³ One of the best known is undoubtedly Burrhus Frederic Skinner (seen in note 1) who was the first to make links between conditioning according to Pavlov and human learning.

Behaviorism applied to training

If we limit ourselves to its caricature, behaviorism appears as a very basic model, even largely outdated. However, it has had a very strong impact on pedagogy and still imposes certain very useful, even necessary practices today:

- 1 – The object of learning must be broken down into a series of short elements to allow for the fastest possible reinforcement. This is particularly the case in e-learning.
- 2 – We must always start from the simplest contents, to gradually increase the level of difficulty until arriving at the most complex elements.
- 3 – We must always encourage positive reinforcement to promote learning. This can go through encouragement, unlocking badges at the end of modules, etc.
- 4 – There is no learning without repetition!

This model, only top-down, can quickly become monotonous and therefore completely lose the attention of learners.

The limits of behaviorism

The goal of behaviorism is above all to create "reflexes" in the learner: confronted with a specific stimulus, he naturally and very quickly gives the expected response. And to do this, he does not need to think at all. Behaviorism will therefore not be at all suitable when it is necessary to transmit to trainees capacities for analysis, reflection or synthesis, for example.

1.b. Cognitivism

One of the limits of behaviorism is its inability to take into account what is going on in the minds of learners: it is precisely against this that cognitivists have emerged!

Cognitivism or the can-opener theory

For cognitivists, the behavior of an individual depends on the stimuli of his environment, but also on certain internal mechanisms: they will therefore seek to understand what is happening in our brains, and especially to study the way in which information is processed there.

Cognitivism is above all a model of information processing: it will seek to understand which mechanisms are activated when we are confronted with new information, or when we have to call on stored information.

Cognitivism and learning

For cognitive scientists, learning means adding information to the information already present in memory. The learner who arrives for training does not have an empty head just waiting to be filled



with all the knowledge that the trainer will pile up there. On the contrary, the learner already has a lot of knowledge that must be taken into account.

Thus, the job of the trainer in this model is to transmit new knowledge to learners, but also to help learners put this information in the right place.

Cognitivism applied to training

Here are different best practices from cognitive models that can be implemented in training:

- 1 – Carry out, at the start of each training, an activity to assess the level of knowledge of the learners on the topic addressed (for example with a kahoot).
- 2 – Provide activities and tools to help learners make connections between what they are being taught and what they already know. (for example the mind map).
- 3 – Analyze the errors made by the learners: why such a learner made such an error, and what does this tell us about his understanding of the subject?
- 4 – Playing on metacognition: if you know your own way of building your knowledge, you will be more effective in this construction. This is the famous “learning to learn”.

The limits of cognitivism

Cognitivism, in its desire to focus on information and its processing, tends to miss the context in which that information is used. This can cause what are called transfer problems: the learner has memorized the new information well, but will either be unable to call on it at the right time, or unable to call on it if the conditions of the new issue are too different from the issue that served as an example for the introduction of the information.

1.c. Constructivism

If behaviorism and cognitivism had their origins outside research on learning, constructivism is very clearly attached to it: constructivism is a theory of learning, and nothing else!

One of the theorists of constructivism is undoubtedly Piaget⁴: for him, behaviorism was on the wrong track by focusing only on the principle of stimuli/response, reality being more complex. Indeed, for Piaget, to learn is to construct representations of reality. He focuses on the child, in whom intelligence is not an innate faculty but is built up as it develops.

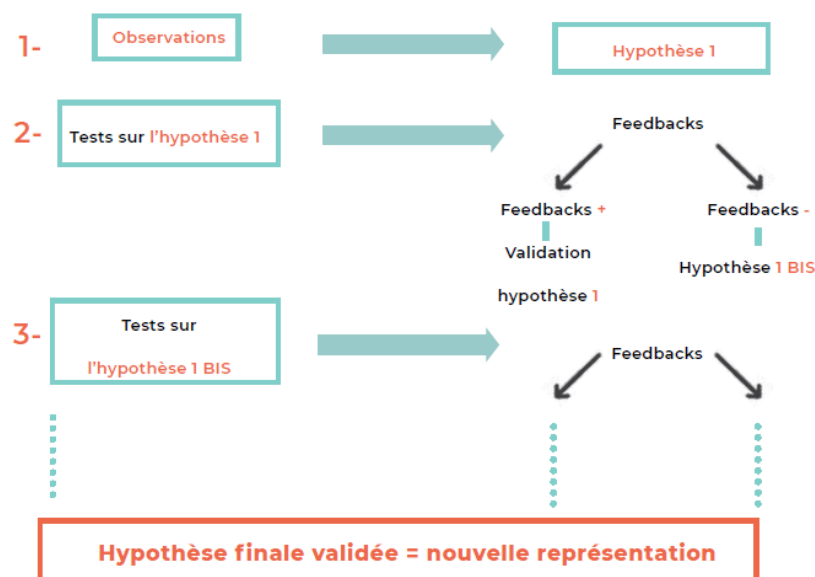
⁴ Jean William Fritz of his first names. He was a biologist, psychologist, logician, epistemologist and Swiss. He died at 84: https://fr.wikipedia.org/wiki/Jean_Piaget

Constructivism in adults

Piaget's theory has undergone many developments⁵, but we are going to see here an essential element that has its place in adult education.

For Piaget, we construct our knowledge by manipulating objects, by experimenting. The latter will cause the creation or modification of action schemes, i.e. repeatable action structures in similar circumstances.

To put it more clearly, one learns through an iterative process of trial and error:

Remarks :

1 – The hypotheses made in relation to the observations made depend of course on the representations already present in the individual – a bit like for cognitivists, where each new information is added to the information already in memory.

2 – The final hypothesis which is validated and becomes a new representation or a new action scheme is not immutable: new observations can lead to new hypotheses and therefore to modifications of existing representations.

Constructivism applied to training

Two fundamental lessons can be drawn from constructivist theories:

1 – If the learner works by trial/error, it is precisely necessary to leave place for error. While the error is an integral part of learning, it is still too often seen as harmful and is not considered at its fair value: an error is sanctioned but is only too rarely studied. Yet it is this negative feedback and

⁵ See works of Vygotski, Bourdieu or Schütz.

the analysis that is made of it that allows the learner to move forward towards a new hypothesis, and therefore ultimately towards the understanding and appropriation of the concept⁶!

2 – A learner who arrives in training is not a blank page on which everything is to be written: even if he knows nothing about this training, he has already read/seen/heard things allowing him at least to make assumptions about elements that the trainer will present to him.

The limits of constructivism

As a theory of learning, constructivism has no real "limits". However, from a very practical point of view:

- ◆ Doing constructivism takes longer than doing behaviorism or cognitivism;
- ◆ This model is not necessarily suitable if you want to have learners learn things by heart quickly.

1.d. Socio-constructivism

Thanks to the previous point on constructivism and knowing the prefix "socio", we can understand the essentials of socio-constructivism (and writing that is precisely constructivist).

Humans are social mammals

For socio-constructivists, the individual creates his representations according to his experiments, but also and above all according to the social environment in which he evolves.

Thus, the more the individual can compare his representations with those of his peers, the more quickly he will be able to arrive at a coherent and strong representation. This is called sociocognitive conflict.

Socio-constructivism applied to training

Thus, socio-constructivism offers the same pedagogical solutions as constructivism, with the difference that all exploratory activities are carried out in groups. So we have :

- ◆ Start by asking a question or presenting a problem to the learners.
- ◆ Then give them time to brainstorm a solution either in small groups or in collegial discussion.
- ◆ In the case of work in sub-groups, ask each group to quickly present its solution.
- ◆ If not, propose a solution based on input from all learners.

⁶ For more information on the subject of errors in learning: Stanislas DEHAENE, professor of cognitive psychology at the Collège de France and President of the Scientific Council for National Education, he is particularly interested in the primordial role of error in learning.

The objective here is to "restore the human" in teaching methods that have long been devoid of it.

1.e. Connectivism

Connectivism is, in a way, socio-constructivism pushed to the extreme thanks to new information and communication technologies (the famous NICT).

Connectivism, learning theory and collective intelligence

For connectivists⁷, learning is not just an individual and internal activity but also depends on exchanges with the environment in which we evolve and the means of communication at our disposal: networks (in the broad sense: internet, social networks , etc.) give access to a set of resources (articles, videos, specialized sites, etc.) already allowing learning.

This learning is then reinforced by the exchanges that individuals have around these resources, knowing that the people with whom we can exchange via the networks can be very different from the people we meet "physically".

However, for connectivists, one of the keys to learning and knowledge is the diversity of opinions. Thus, the more the individual can have exchanges with different people, whether in terms of academic background, culture, or references for example, the more learning will be facilitated.

In addition, various connectivist experiments⁸ have shown that children were able to learn alone and without a teacher, if they had access to the Internet and certain course materials. This theory therefore goes hand in hand with a certain idea of self-training.

Connectivism applied to training

Connectivism made a sensational entry into the world of training a few years ago with MOOCs – Massive Open Online Courses. These courses, online and open to all, are deeply connectivist:

- Exchange spaces such as chats, forums, etc. allow participants to learn from each other;
- Some mechanisms put in place, such as peer correction or access to the productions of all participants, give less weight to the role of the teacher and allow each learner to participate in the construction of collective knowledge.

⁷ Connectivism was notably theorized by Georges Siemens and Stephen Downes

⁸ The best known is undoubtedly that of Sugata Mitra, who studied the learning of children from slums in India and Cambodia who were given access to the Internet in complete autonomy.

Finally, more and more companies are relying on NICTs to promote the self-training of their employees. There are formal solutions, such as MyMooc⁹ or Unow¹⁰, which offer online courses and resources, free or otherwise, to which employees have independent access.

The limits of connectivism

The main intrinsic limit to connectivism is the temporality in which it is inscribed: a "pure" model of connectivism, in which several thousand learners are involved to do research and debate, necessarily causes inertia and a certain distortion time. Learners can then become demotivated, and ultimately give up learning.

In addition, connectivism is often incompatible with the framework of in-company training, due to the number of trainees, who have the same profiles, and the same academic background (and therefore undoubtedly generally the same opinions and references), naturally we cannot do connectivism.

Learning is a very complex process, which would be very badly summarized by one and only one of these models. No doubt the "truth" is precisely at the crossroads between all these theories: there would then be no theory better than another, but they could all be applied according to the needs, objectives and constraints of each training activity.

2. Tools for application to adult training and different forms of environmental education

2.a. Tools for application to adult training

Because it is not always easy to design a good training course or to lead it effectively, there are many tools that can make life easier: free and paid tools, drawing or video tools, tools very focused on "New technologies" or on the contrary based on game mechanisms that we all know from childhood.

These tools are not used just anyhow! Each tool is associated with a methodology and must be used at a specific time during the training and to meet a well-defined objective. Here we will describe some of these tools.

⁹ MyMooc : <https://www.my-mooc.com/fr/>

¹⁰ Unow : <https://unow.fr/>

POPPLET

What is this?

Available online or as an iPad application, Popplet is a tool for creating diagrams. The objective is to link frames with each other, using arrows.

Each frame can be filled with text, drawings drawn with the mouse or imported visuals. It is possible to customize the frames to create, for example, a typology of objects according to the colors. It is also possible to size each frame differently, in order to prioritize the ideas.

In which context to use it?

Popplet can be used when trying to check the correct understanding of learners on a content. This tool also allows learners to reclaim content, since they are forced to structure what they have learned, in their own way.

The main advantage of Popplet lies in the speed of handling. It is very easy to create a diagram and the application is particularly ergonomic.

PREZI

What is this?

Prezi is an online software for creating presentation materials. The concept of Prezi is simple: replace the successions of PowerPoint slides that never end with a large structured diagram in which we will walk around and zoom.

In what context can it be used?

Prezi is above all an animation support for the trainer or teacher. It must therefore be very colorful, and only present the essential textual content, such as keywords.

Prezi is a "Must Have" in terms of training animation: it is the only tool today that combines ease of use and relevant presentation. Indeed, the diagram is more in line with the functioning of our brain: it highlights the links between the ideas of a concept and allows to have a global vision.



HAIKU DECK

What is this?

Haiku Deck is a completely free online solution for creating presentation materials.

The concept ? Each slide is actually a single image, on which we can add a keyword. The idea is to make short, effective and pretty presentations.

In what context can it be used?

Haiku Deck is a presentation tool: it will be used to animate speeches, conferences or any type of short intervention. It is too simplistic for a one-day training, but it can be used to introduce or conclude a long training.

Haiku Deck is a very good compromise between PowerPoint and Prezi. Haiku Deck's philosophy: "one idea, one image"!

PLICKERS

What is this?

Plickers is a tool that allows you to interview participants during face-to-face training, using printed QR codes. These are distributed to each participant who can brandish them to answer a question asked by the trainer. The trainer then only has to scan the room with his smartphone to collect the participants' answers, by name or not.

In what context can it be used?

This technique can be used to:

- Check the correct understanding of a concept.

- Test the learners' knowledge before starting the training.

- Orient the training according to the points that the learners wish to address or dig into as a priority.

- Ask participants for their opinion on a subject, with a view to a "survey".

Plickers is a very good tool. It is easy to set up with a group.



POWTOON

What is this?

PowToon is an online software that allows you to create animated videos in a very simple way, either by using the image banks offered on the site, or by using your own drawings.

In what context can it be used?

Done well, a video can be a tool of choice for teachers or trainers. It allows you to explain or present a concept in a clear, attractive and fun format. PowToon can thus be used to make videos, introduction, conclusion, or evaluation.

VIDEOS SUBTITLES

What is this?

The principle is to make videos without sound available to learners so that they can recreate the corresponding voiceover. To do this, they will have to rework the content so that it “sticks” to the proposed excerpt: they will thus have to create appropriate dialogues, depending on what is happening on the screen.

In what context can it be used?

This technique can be used to:

- Check the correct understanding of a concept or the knowledge of certain steps.
- Create a common language,
- Summarize a seminar.
- Testing a commercial language, etc.

Making subtitles for existing videos can be a relevant activity in the context of training. Be careful, however, to frame it well.

DIXIT

What is this?

Well known to all, the Dixit allows you to associate concepts with illustrations, from illustrated cards. At each turn, one of the players is a storyteller, that is to say that it is he who will launch a word related to one of his cards. He then places his card face down on the table, and the other players must find an illustration among their own cards that makes them think of the word spoken by the storyteller, then also place it on the table face down. The storyteller then picks up all the cards, shuffles them and lays them face up next to each other. For the players, the object of the game is



to find the card that the storyteller placed. For the storyteller, the goal is that at least one person has found their card, but not all of them.

In what context can it be used?

You can use Dixit:

- To reveal the representations of employees, on a project or on their company for example.
- To stimulate creativity.
- To learn languages.

Dixit is an easy game to set up as part of a training: the rules are quickly explained and the material is not very important (the deck of cards)

CONCEPT

What is this?

Concept is a board game whose goal is to make people guess expressions, movie names, or even the names of dishes using only pictograms.

In what context can it be used?

Concept can be used for:

- Identify the representations of each employee.
- Create a common language.

Concept is a very interesting training game: it can be used on any subject and, even if it is a little scary at first, it is quickly understood by the trainees!

SPEECH

What is this?

Speech is a game made up of 60 double-sided illustrated cards. These cards allow 4 different game modes, which are played by two, on the principle of a verbal game.

For each game, the audience must assess who was the most relevant and the most convincing.

In what context can it be used?

It is possible to use one of the four Speech game modes to make learners work on constructing a speech. Speech cards can also be used by inventing new game mechanics.



The main advantage of Speech is the number of cards available (120 visuals in all!). In addition, the cards offer simple drawings, easy to interpret, with few things represented.

THE THIAGI FRAMEWORKS

What is this?

A game is traditionally composed of content, i.e. the elements of the game, and procedures for playing, i.e. the rules of the game. can be filled with different contents. In other words, the rules remain the same, but the content differs according to the needs and target audiences.

In what context can it be used?

There are many framework games, which can be used to solve a complex problem in a group, to test the knowledge of learners, to break the ice at the start of training or to learn in cooperation, etc.

The framework games are adaptable according to the time or the material available but also to the number of people present.

The tools presented here have different educational objectives: to create a link with learners, to empower them, or to validate that knowledge has been assimilated. But in any case, they above all make it possible to pace the training and reach as many people as possible.

Using a wide variety of tools maximizes the chances of engaging all learners. Everyone learns differently: there are what are called “learning profiles”. The use of tools in training thus makes it possible to stimulate preferences, according to the profile of the people present.

So, which educational tool to choose and use? Should we even appeal to the tool or do with the human being that we are and with the environment which is already in itself an educational support? No ready-made recipe but a multiplicity of paths, detours, shortcuts and variants. And the need to keep a critical mind and ask the right questions to guide your approach and make informed choices.

2.b. Environmental education

In this part we can cite the School and Nature Network, a French association linking a large number of actors in environmental education towards sustainable development in order to work better together in the direction of sustainable development. In their practical guide to Environmental Education: between humanism and ecology, they outline different forms of environmental



education. In particular, they explain that there is not a single form of environmental education but several tendencies which may or may not be combined.

Environmental education, the most common form, is “content-oriented: it is the acquisition of knowledge about the environment and the skills required to acquire this knowledge. The environment is the object of learning. (Sauvé, 1994)

Through environmental education, “we learn to solve and prevent environmental problems as well as to manage collective resources. The environment becomes a goal. (Sauvé, 1994). This form of education suggests two opposing currents distinguished by Robottom and Hart (1993): “a positivist approach where it is a question of adopting the behaviors and gestures which seem most favorable to the environment and which are dictated by experts and politicians; the current of social criticism which invites learners to make their own social choices based on investigations carried out on problems that directly concern them. (quoted by Girault and Fortin-Debart, 2006).

Education in the environment “corresponds to a pedagogical strategy: it is a question of learning in contact with the environment, either through the environment outside the school or through the biophysical or social context in which one lives”. In environmental education, “the environment is both a learning environment and an educational resource. (Sauvé, 1994). The objective, centered on the person, is to connect the participant with the environment. The environment, thus closely encountered, makes it possible to learn about oneself, promotes the emergence of values and capacities, leads to situating oneself in relation to the Other (humans and other living beings).

This last form of education will interest us here. Education by and in the environment is an interpretative approach which aims to build a solid link between the person and his environment, develop values, promote empathy. It focuses on the person and his relationship to the environment. Either, the actor participant... it is the one who is an actor of his learning, the one that the environmental educator brings to be active rather than passive in his process of discovery. It is also the one that the educator invites to know, to be able and to dare to act as a reflective citizen, in favor of the environment, of Man, of biodiversity, of his district, of his territory...

We can rely on these 2 examples to illustrate how our environment helps us to learn or how we can use the environment to transmit.

Example of agriculture:

A message given to participants in a conference room will have less impact than if the participants are taken to a field to show them the difference between land cultivated with pesticides versus land cultivated in an environmentally friendly way, with humus, insects and living soil. Awareness will be much stronger when the participant has been an actor in the proposed environment

Example of Advisor:

It is the same with a person who goes to the office of an energy renovation advisor, to ask for help and advice. Against the advisor who goes to the home of the individual to show him the renovations



to be carried out and the actions to be taken for energy sobriety. The individual becomes an actor in his environment and will find it easier to implement good practices.

According to the text of the Tbilisi conference. UNESCO. 1977, environmental education aims "to lead individuals and communities to grasp the complexity of the environment, both natural and created by man, the complexity due to the interactivity of its biological aspects, physical, social, economic and cultural. This environmental education also aims "to acquire the knowledge, values, behaviors and practical skills necessary to participate responsibly and effectively in the prevention and solution of environmental problems and in the management of the quality of the environment. »

3. Eco-literacy: towards an education in systemic thinking

"A sustainable community is designed so that its lifestyles, businesses, economy, physical structures and technologies do not interfere with nature's inherent ability to sustain life.»

Eco-literacy: the challenge for education in the next century

In one of his essays published more than 20 years ago, Fritjof Capra, an American researcher who has worked for more than 47 years to popularize the notions of systems thinking, invites us to reflect on the importance of teaching ecosystem thinking, to develop an "eco-literacy". What is eco-literacy? It is an ability to understand and use the operating principles of living systems and the ability to embody them in the daily life of human communities.

For a long time, Cartesian/Reductionist thought has enabled our societies to make breathtaking technical progress. However, this way of seeing the world in terms of objects and which ignores everything that is not immediately measurable/quantifiable leads to a destruction of the subtle links of the living. However, there is another path, that of systemic thinking and complex systems (systems thinking). This thinking that focuses on relationships more than on elements and interprets the world in terms of interconnected systems seems more relevant than ever.

According to Fritjof Capra, the great challenge today is to build and maintain sustainable communities - social, cultural and physical environments in which we can meet our needs and aspirations without diminishing the chances of future generations. What is sustained in a sustainable community is not economic growth, development, market share, or competitive advantage, but the entire web of life upon which our long-term survival depends.

Ecosystems in the natural world are enduring communities of plants, animals and micro-organisms. There is no waste in these ecological communities, the waste of one species being the food of another species. The energy that powers these ecological cycles comes from the sun, and the diversity and cooperation among its embers is the source of community resilience.



In this essay, several concepts related to eco-literacy are discussed, such as:

- Life systems or the theory of living systems, i.e. integrated wholes whose properties cannot be reduced to those of smaller parts. Systems theory involves a new way of seeing the world and a new way of thinking, known as systems thinking (“systems thinking” or “systemic thinking”). It is about thinking in terms of relationships, connections and context.
- The web of life: an ecosystem is not a simple collection of species but a community, which means that its members depend on each other and are all interconnected in a vast network of relationships, the web of life . Understanding ecosystems therefore leads us to understanding relationships, which is an essential aspect of systems thinking.

> relationships cannot be measured and weighed; relationships need to be mapped.

- Matter and form: these are two very different lines of investigation that have been in competition with each other throughout our scientific and philosophical tradition. Most of the time, the study of matter – quantities and constituents – has dominated. But in recent decades, the rise of systems thinking has brought the study of form—patterns and relationships—back to the fore. Chaos and complexity theory mainly emphasizes patterns.
- Art and education: To understand the patterns, one must visualize and map. This is the reason why, whenever the study of patterns was at the forefront, artists contributed significantly to the advancement of science.

There are few more effective than the arts – whether visual arts, music or performing arts – for developing and refining a child's natural ability to recognize and express patterns.

- The principles of ecology, sustainability or community, or even call them the fundamental facts of life, are the basic principles that can be recognized.
- Systemic school reform is essentially based on two ideas: a new understanding of the learning process, which suggests corresponding pedagogical strategies, and a new understanding of leadership.
- The school garden: gardening allows children to reconnect with the fundamental principles of food – in fact, with the fundamental principles of life – while integrating and animating practically all the activities that take place in a school.
- A sense of belonging: the experience of ecology in nature gives us a sense of belonging. We become aware of how we are integrated into an ecosystem, into a landscape with particular flora and fauna, into a specific social system and culture.
- Growth and development: In the garden, we experience growth and development on a daily basis, and understanding growth and development is essential, not only for



gardening, but also for education. As children learn that their work in the school garden changes as plants develop and mature, teachers' methods of instruction and overall classroom discourse change as students develop and mature.

- Shared Leadership: Systemic understanding of learning, teaching, curriculum design and assessment can only be implemented with corresponding leadership practice. This type of systemic leadership is not limited to a single individual but can be shared, and responsibility then becomes a capability of the whole.

To sum up, in his essay, Fritjof Capra tries to show us how systems thinking constitutes the intellectual core of eco-literacy, the conceptual framework that allows us to integrate its different components.

These different components are:

- understand the principles of ecology, by experiencing them in nature, and thus acquire a sense of belonging;
- incorporating ideas from the new conception of learning, which emphasizes the child's search for patterns and meaning;
- implement the principles of ecology to nurture the learning community, facilitate emergence and share leadership;
- design an integrated curriculum through project-based learning.

Conclusion

Through this study on pedagogical methods, and in particular through the 5 major learning theories in training, we have been able to see that the place of the trainer has changed, that he is no longer the knower who provides his knowledge to passive learners, but the one who animates, thanks to pedagogical tools, to make the learners work and think. We have also seen that education is transmitted by, with, or in the environment. And that these forms of education are increasingly used, so that the participant is an actor in his learning. Finally, we talked about eco-literacy, or the need for ecological communities, systems and the need for the arts, in education.

In terms of teaching methods and for the BREATH project, inspiration by nature seems to be similar to an "eco-socio-construction of knowledge", in which the environment makes it possible to facilitate learning in the same way as human society.

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