

1.1 Learning as a construction



1.2 A certain idea of teaching

To understand what the word “didactics” has meant for centuries, a good starting point might be Giotto's Bell Tower, part of Santa Maria del Fiore (Florence Cathedral). In particular, a detail of the bell tower.

On the four sides are many panels attributed to Andrea Pisano's workshop. On the eastern side there are three lozenge-shaped panels, dedicated to the Arts of the Trivium, or the humanities of the time. What interests us is the panel "Grammar", as it perfectly shows what was then the approach to teaching.

The teacher takes up most of the scene: he has probably been talking for hours, conveying his knowledge. And the pupils are listening with deference. They are small, very small, almost insignificant. One can almost see the knowledge that is going into their heads, layer by layer, until they are full, following a process that many still consider a valid goal to aim for.

Yet there is a minor detail: the whip held by the teacher in plain sight, in his right hand. It had to be an essential part of the method.

1.3 From teaching to learning

Things have not changed so much since then. To describe our profession we can speak of "formation", a term that derives from "giving form".

A process in which someone (the teacher) moulds the mind of another (the pupil) from the outside, like a potter does with clay.

The main tool used is teaching, which entails providing the necessary information, usually encoded using language. It is an extremely efficient model, because in a short time it condenses millennia of history, research, experiences, attempts to understand the world.

But is it also effective? Does it work?

The most honest answer is "no" or, at least, "not very". Otherwise a whip would never have been needed.

Because today we know that the mind is much more complex than a clay pot. And it is not at all a passive receiver of information.

1.4 Transmission, construction, participation

The image of the Renaissance teacher, Grammar in person, is the starting point to understand how teaching methods have evolved, in theory and in practice.

It is a journey in three stages, with as many paradigm changes. These are revolutionary changes that we can represent as a sequence of metaphors:

1. First metaphor: transmission

we have just spoken about this form of teaching, which has lasted for many centuries and is still present today.

In short, knowledge is viewed as a kind of fluid that a sage can convey to his pupils. The main method: presentation, through teaching, of information considered to be of universal value, abstract and independent of the context. The acquisition of knowledge has two important traits:

- it is passive
- it is individual

2. Second metaphor: construction

The focus shifts from teaching to the way the mind processes information. That is, to learning.

Knowledge, therefore, is the effect of an active building process, in which the

learner uses the stimuli and experiences offered by the environment as raw materials.

It is the advent of the constructivist model: an epochal shift in learning theories.

3. Third metaphor: participation.

In this recent evolution of constructivism, learning is no longer merely an individual fact, it arises from relations within a social group, whose culture is shared and evolves.

They are profound and potentially productive conceptual changes. Even though, in the school, university and training worlds there are still many contexts in which the transmission metaphor continues to prevail...

1.5 Listen or play?

There have always been those who, completely ignorant about the dominant model in educational institutions, learn very well and quickly without being taught: mother tongue, material culture, social relations, notions of elementary physics, the foundations of "our place in the world".

They are preschool children. They are very active and, even if in our eyes they are continually "playing", theirs is actually a very serious game. If they could, they would say:

"I'm not playing, I'm working!"

A job that consists of constructing a mental image of the world.

It is by studying the way children play that Jean Piaget has helped us to understand how learning works, and how we have moved from the metaphor of transmission to that of construction.

1.6 Building knowledge

Jean Piaget is well known as the founder of genetic epistemology, a current of thought based on a revolutionary idea: knowledge is not acquired from the outside, ready to use, it must be reconstructed time after time.

In 1921, at the age of just 25, Piaget took charge of the Rousseau Institute in Geneva, where he began his life's work: watching children learn, in order to understand how this reconstruction takes place.

Children, from birth, learn through interacting with the world around them:

- they use their own mental patterns (cognitive and behavioural) to interpret the

information they receive from the outside, in a process called "assimilation";

- they use information that is not part of their own mental patterns to modify the patterns themselves, in a process called "accommodation".

They are little scientists who learn by "trying again and again", as Galileo might have said...

1.7 Constructivism

The dynamic balance between assimilation and accommodation is the practical application of the scientific method to everyday life. Over time, according to Piaget, this balance evolves, moving from "concrete thinking" based on acting in the physical world, to abstract, formal thinking typical of adults.

Piaget is considered to be one of the fathers of an approach that allows us to plan for and carry out educational experiences that are more complete than a classroom lesson. This is constructivism which, as we have seen, considers learning as an active process, a concept underpinning all subsequent constructivist theories.

It is difficult to imagine a change with more radical consequences. It means admitting that the learner autonomously builds his knowledge, which is no longer "decided" from the outside and transmitted by "explanations" and "tasks" assigned by the teacher.

From this moment, the main actor is no longer the teacher, but the pupil, who learns by interacting with the environment.

But exactly what is meant by "environment"?

Here Piaget does not say much, leaving it to other researchers to highlight the different aspects of what we generically call "environment": objects and tools, social interactions, culture. And, of course, technology.

1.8 A mechanical tortoise roaming around the room

Seymour Papert is a researcher with a very particular curriculum, making him a pioneer of digital technologies applied to teaching methods. He is a mathematician who worked for years with Piaget, at the Center for Genetic Epistemology, before moving in 1964 to MIT - Massachusetts Institute of Technology - where he was in charge of the Artificial Intelligence Laboratory.

Papert has made a great contribution to spreading the idea of "learning objects".

Very concrete objects, like the famous tortoise, which children could move by programming it in Logo, a simple but very powerful language.

By programming the tortoise to have it draw a square, a circle or more complex figures, children are prompted to ask themselves new questions:

- from: "How can I trace a square in the room?"
- to: "How can I explain this to a mechanical tortoise that understands only formal, precise and very detailed instructions?"

Papert has passed down to us, in addition to Logo (widely used in schools), some particularly effective ideas, such as educational robotics and the use of algorithm coding for educational purposes.

As well as an interesting theoretical contribution.

1.9 Constructionism

Papert calls his own personal elaboration of constructivism, born of the experience with children playing around with tortoises and other robots *constructionism*.

Constructionism gives prime importance to "actual constructions", to acting in the physical world, a building block towards mental constructions. Unlike Piaget, Papert believes that concrete thought plays a central role among adults too, who employ it even in purely intellectual work. In keeping with this idea, he disputes the "overestimation of formal abstract thinking" which he believes to be an obstacle to the development of pedagogy.

For all these reasons, Papert believes that teachers now have a great ally in the PC. A concrete object that interprets formal languages and incorporates human intelligence, allowing us to see it in action. Papert already had these thoughts with the rudimentary machines of the 1960s.

1.10 Social constructivism

Lev Vygotsky, born in 1896 (the same year as Piaget), is the father of social constructivism, which forms the basis of the second great paradigm shift. That which leads to the idea of learning as participation.

Vygotskij held that x ". For the child, these people are both adults and other children.

If we observe a child on his own, we can see that he is able to solve a number of

problems. But if the same child collaborates with a peer group or he is guided by an adult, his ability to solve problems rises considerably. Vygotsky calls this difference the "zone of proximal development". This is a key concept of our project.

Within this framework, the key factors of learning are dialogue, peer collaboration and the guidance of an expert. Guidance in our case however means "indications", "suggestions", "stimuli", "support", not the transmission of knowledge through a "lesson"!

Vygotsky also argued that another key factor for learning and for developing mental functions, is Activity. His reflections, developed in conjunction with the slightly younger Alexej Leont'ev, start with a question: "Where does awareness come from"?

The answer lies in the Theory of Activity. And this is of great interest to us...

1.11 The Theory of Activity

Put very simply, according to the Theory of Activity awareness arises when man begins to carry out intentional productive activities.

The activity is first conceived, then designed and planned. Then it is realised, using or creating tools, acting on the concrete environment, coordinating one's actions with others. Finally, the outcome of the activity is perceived and evaluated, in order to fine-tune the thinking, making it more effective. In other words, making the mind capable of designing more effective actions.

The planes of thought, of mental structure and of action are, therefore, isomorphic, and evolve together.

This vision has a direct consequence for us. It means that if we cannot act directly on the mind by transferring knowledge, as we once thought, there is another possibility: to work on concrete activity, on the social aspects of this activity and on the tools that are used.

1.12 Tools that talk

Vygotsky and, in general, the Theory of Activity, assign a central role to the cultural artefacts that each society creates unceasingly. These artefacts belong to two categories:

- conceptual artefacts, including language

- material artefacts, like a quill pen, a pencil or a tablet

They are tools with which man brilliantly solves two problems:

- Overcoming the quite narrow limits of his biology.
- Creating a communication channel between one generation and the next. A communication made of "things" that talk, of technologies that change the environment and thus contribute to changing the mind.

Vygotsky died at the tender age of 38, on 11 June 1934. His works remained almost unknown in the western world until the 1980s, but many have taken up his work, making it a cornerstone of the new way of conceiving learning and teaching.

Among these, a point of reference is Jerome Bruner...

1.13 Sociocultural constructivism

Jerome Bruner is an American psychologist who, more than any other, gives us the idea of what constructivism has become today. In his long research activity, developing the work of Piaget and Vygotsky, he has developed an original integrated vision known as socio-cultural constructivism, which focuses primarily on the culture we are a part of, considered as the cause and effect of our learning.

It is said that a circular relationship of negotiations is established between the individual and culture:

- Culture is a complex set of knowledge, relations, practices, social structures and tools, including technologies.
It is not only the environment that surrounds and permeates individuals but also a resource that helps them to live better.
- Individuals appropriate the culture they live in. But they can also transcend it, and change it for themselves and for future generations.

Clearly, with this vision learning acquires new meanings...

1.14 Learning to transform

Learning, according to Bruner, does not mean just "building". It is a complex process that includes:

- learning to fine-tune the mental process with which knowledge and skills are built

- learning to be part of a social group
- learning to use mediation tools, including technologies, to give meaning to things, interpret the world and interpret one's place in the world.

What does "interpret one's place in the world" mean?

It means that we all give a meaning to life by building what we might call an "individual story", one that includes emotions, feelings, values, experiences and plans. A story steeped in the culture we live in, built to be shared, to become a "narrative" with which we present ourselves to others and play a part in changing culture.

In this respect, Bruner assigns to schools and other educational establishments a dual task, very ambitious and demanding, mirroring the circular nature of the individual-culture relationship:

- to transmit to new generations the values of the culture they live in
- to educate them to be able to transform and renew this culture

But in tangible terms, how can we act to transform the daily practice of learning in schools and elsewhere? Some ideas arising from intense reflections and research deserve to be mentioned, having very interesting practical implications:

- Knowledge Building
- the learning community
- the community of practices
- the dialogical approach

1.15 Knowledge Building

Knowledge Building, first theorised in the 1990s by Canadians Carl Bereiter and Marlene Scardamalia, is a particularly original model in the world of school education, because it considers knowledge as a social object, and as socially distributed. The class is a veritable scientific community engaged in studies to build said community.

Unlike what has always happened in schools, Knowledge Building is therefore not based on the mere acquisition of knowledge by the pupil, subsequently presented in tasks, discussions or oral tests.

Instead, the focus is on increasing students' ability to build knowledge (hence the name) in an increasingly advanced and effective way, through intense research, discussion and assessment activities. Each student is at the same time a pupil, a

teacher and a researcher. The teacher is the expert of the construction process, helping to organise research paths, choosing suitable ideas, materials and means. The overall goal of the community is to continually advance knowledge, starting from initial ideas, comparing them with authoritative sources and accepting or rejecting them. In all of this, all opinions and contributions are welcome. A diversity of ideas is indeed actively encouraged.

Technologies are an essential part of the method, as they offer environments for discussion, making the group's ideas and ability to improve them tangible. An example of such an environment is the Knowledge Forum, created precisely to help with the construction of knowledge and reflection around a process carried forward by the pupils.

1.16 Learning Communities

The learning community is a pedagogical model drawn up in the 1980s by Ann Brown and Joe Campione, espousing the idea of learning as active participation.

The salient points of this model relate to the learning method, relative contents, inclusion and openness:

- Each participant has an active role not only in learning, but also in facilitating learning for others, providing stimuli, information and answers. In short, knowledge is acquired above all through dialogue.
In these classes multiple "zones of proximal development" are created, as Vygotsky might say, in which roles are interchangeable.
- Learning is not limited to subjects in the curriculum, but includes reflections on learning processes themselves, requiring autonomy and, therefore, responsibility.
In these classes pupils learn to learn.
- The diversity of skills, culture of belonging and methods of participation are respected and valued. Pupils initially marginalised are accepted and gradually involved to a greater extent.
In these classes no one must be left behind.
- There is a link between school and out-of-school activities, between formal and informal learning.
These classes are really open.

The learning community has the potential to radically transform all the settings in which the primary objective is learning: school, university, training contexts.

But something similar can happen in settings that pursue other ends.

1.17 Communities of practice

The idea of "community of practice" derives from the observation that people are sometimes able to share skills and produce new knowledge in organisational and professional settings. Compared with the learning community, there are two important differences:

- there is a common goal that is not learning per se, but generally relates to work
- there is no figure comparable to that of the teacher (although a "facilitator" may be present)

Jean Lave and Etienne Wenger, who first proposed this model in the early 1990s, underline some aspects of the organisational culture from which a community of practices can emerge:

- a repertoire of habits, languages (including slang), rituals, memories, expectations and veritable myths, which reflect the history and future hopes of that community
- a commitment, strongly felt by everyone, to perform their task to the best of their ability

In a community of practice, the tools of the trade are shared, newcomers are integrated and, physiologically, information is exchanged with neighbouring communities, which may for example be colleagues from other departments or other businesses, customers and providers. They are the so-called border practices, so important in allowing virtuous contaminations of procedures and competences. In this way it is easier to produce knowledge, which may be a faster way to repair a photocopier, or a new cure for a rare disease.

1.18 The role of technologies

At this point we might ask: what role does technology play in all this? Already at the time of Andrea Pisano's Grammar, technology was an essential element of culture. It supplied the quill pen for writing, parchment as a medium, illuminated manuscripts for reading, even the whip to make the boys behave.

With the advent of digital technologies, there has been not one but two important quantum leaps:

1. The first is the spread of low-cost "smart" machines: PCs and, to a lesser extent, robots capable of interacting with people.
Papert was the first to perceive the enormous potential of digital technologies for teaching from a constructivist perspective.
 2. The second big leap is the Internet, which, by making machines communicate in ways never seen before, has created new possibilities for communication between people, overcoming the limits of time and space.
And while the Web has made all the information in the world instantly available to everyone, constructivism, in its socio-cultural meaning, has acquired powerful new tools: forums, chats, multimedia archives, e-learning platforms, social networks. And learning and practice communities can now become "virtual" too.
Technological mediation however does not seek to eradicate face-to-face and classroom interaction. Quite the contrary in fact: the construction of "virtual" communities is designed to increase the advantages of the two ways of relating and learning, thus enhancing both.
- It is a constantly evolving world, one we are still exploring.

1.19 Nothing will be the same

Our brief review has looked at the evolution of learning and teaching paradigms which, after centuries of little change, have undergone drastic changes in recent decades, revolutionising what we think of as learning, while teaching practices (in which technology is playing an ever growing role) have only partially been regenerated.

Here the theoretical models we have spoken about are positioned in the "space" consisting of the metaphors of transmission, construction and participation.

By clicking on the appropriate icons, it is possible to enter in this space the different visions of learning and some of the teaching practices we have encountered, together with the technologies that make them possible.