

Are Our Teachers Learning?

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Abstract

In the last thirty years, drastic changes occurred in almost all domains of science and technology. In particular, the progress in information and communication technologies now allows a virtually cost-less access to huge amounts of data. As a consequence, one of the main concerns of the (traditional) teaching – information providing – is sharply losing importance. Consequently, students tend to consider an information-provider-teacher as just another source of information (mostly verbal, neither particularly reliable, nor especially effective).

Hence, the question is not whether teachers are effective information providers but whether students are learning how to learn and to adapt in a changing world.

The increasingly widespread use of information technology innovations (the personal computer, Internet, CD-ROM, cable and satellite TV, etc.) in recent decades has had repercussions on the work of the teacher - at all levels of schooling - that are far from having been assimilated and understood by everyone involved in teaching.

Until a few decades ago teaching was little more than the transmitting of information that only the teacher possessed (the results of the knowledge received from his teachers, books and experience acquired). The means were scant for pupils to have direct access to the information (books were expensive or difficult to obtain, photocopying was impossible or difficult, and access to quality technical libraries was unavailable, etc.). As the possessor of something rare and valuable, perfected through experience, teachers played an almost irreplaceable role that gave them a prominent position in society with unchallenged powers; they could, for example, assess and pass their pupils in a way that was discretionary and uncontested.

Nowadays, in a constantly changing world where information is ubiquitous and almost free of charge, experience is almost an impediment, at least on a first superficial analysis, which is in fact what society in general and students in particular subject it to. What is the role of the teacher in this new situation?

Although we see our students absorbing an incomparably larger amount of information than we assimilated only two decades ago, we notice that they possess significantly less

knowledge and understanding of the phenomena they are faced with. They have not only been intensively exposed to sources of information over the years (and devoted much of their study and leisure time to them); they have also been faced in their everyday lives with objects (toys, appliances, machines) whose technology was not discoverable through direct inspection: electronic technology, on which most of those objects are based, is not “apparent”, so that its “analysis” (or, more prosaically, the exposure and destruction of its innards) does not benefit the person who carries it out. One can imagine the frustration of a child stimulated by curiosity who tries to understand how a *tamagotchi*, video game or computer works. So it is not surprising that his future relationship with these objects is more in the realm of magic than mechanics; he perfects his skills as a user rather than as an “engineer”. As a result, of course, the average student attaches less value to the information and shows a reduced capacity for analysis.

It seems, therefore, inevitable that the days are numbered for the teacher as a mere disseminator of information: the biggest sacrifice to ask of young people used to hypertexts, 3D games and virtualities would surely be to attend a one-and-a-half-hour explanatory class of an informative nature in which the slate or, even worse, the overhead projector was the favored teaching aid!

The generation currently in higher education is the one that has suffered the most from the centuries old clash between the world that they are accustomed to and the school system imposed on them. So it is not surprising to see teachers waving their arms around at their students - supposedly adults! - who devote their time in class to the task of making paper airplanes, uninterested, incapable of concentrating on a lesson on Maxwell’s equations or Laplace’s transformation.

I think it can be truly said for the first time that *students are not what they used to be*. Teachers, on the other hand, have changed little or not at all.

But - and this is a recurrent consideration when we evaluate the change - it is no use criticising students for their supposed (or real!) lack of concentration, nor society for the inducements and distractions it suggests; it is necessary to reframe the role of the teacher by inventing the ways by which learning will take place in the future, and consequently, the correct way, one day, of teaching.

Above all, it is important to draw a clear distinction between information and knowledge: only a few years ago these two concepts were to such an extent interlinked that any attempt to differentiate between them would be seen as “Byzantine”. Nowadays, as we start to recognize the value of knowledge, whether for individuals or societies (in universities, companies, etc.), we see that an Internet connection, access to databases or a CD-ROM library is not a precondition - or even perhaps a necessity - for it to *exist*. Certainly the ways the knowledge is acquired depend necessarily on the availability of information. We must, however, recognise explicitly and fundamentally the capacity to process it according to a system of previously acquired models whose sophistication increases as the process of learning evolves. Hence, the fundamental difference between information and knowledge: while the former circulates and can be accumulated in data-recording systems, the latter is held by people - individuals or groups - and is not transmittable. When educators talk about the “transmission of knowledge” they actually mean the transmission of information which is subsequently

processed by the receiver. The fact that this knowledge results from information appropriately processed and structured is as true for what we ordinarily refer to as common sense as it is for scientific knowledge. There is no reason to suppose a student exposed to massive amounts of information will see an improvement in his capacity for processing, structuring and integration; on the contrary, given that these processes are time-consuming and require some time to mature, there is reason to believe a student subjected to a process of cognitive saturation will end up acting as a mere “repositor”¹ of information.

Given that the repositor’s essential characteristic is the capacity to reproduce what he has been supplied with, without creating anything new or deriving consequences from what he supposedly “knows”, we are led to notice that our students are increasingly incapable of *understanding* what they have (supposedly) been taught: the *meaning* of the observations they make depends a great deal on the capacity and time for processing, which they manifestly lack.

I think this has occurred for three reasons: first, students nowadays show a remarkable ability to absorb information compared to those of the previous generation. It is therefore not surprising that teachers “take advantage of” this ability to “unload subject matter”. Second, the quantity of new topics and disciplines deriving from research undertaken in recent years creates pressure by providing students with new subjects and “knowledge”. Finally, given that there is a great amount of ignorance among teachers about what is taught in other disciplines, partly due to a lack of interaction, the tendency to “manage” the amount of information transmitted, without a vision of the whole, naturally makes the situation² worse.

Successive restructuring has attempted to correct this problem by reducing the number of disciplines taught; however, the core of the problem is not the quantity of disciplines but the volume of their content and the way they are taught.

In short, given that information is almost free of charge and is constantly changing - and thus of little value - it has to be provided only as instrumental support for a system of models that will be useful for the whole of the engineer’s professional life.

The formative disciplines, then, must constitute the core of engineering courses. Subjects where all that is learned is, for example, various programming languages, should be banished from the curriculum.

Furthermore, the desire for completion in the teaching of a subject - to “give” everything “relevant” to a certain area of knowledge - , so beloved of certain teachers, is thus an act of stupidity, in the technical sense that R. Musil gives to this concept: it damages everyone, including the practitioner himself (Musil, 1994). Learning, as Jean Piaget points out, -including the understanding of the phenomena we observe - takes place in qualitative leaps (Piaget, 1970): sometimes starting from an explanation that takes no more than a minute.

¹ ‘Repositor’ is a neologism I introduce here to describe the individual constituted as a mere repository of data and information.

² Time nowadays is an ever scarcer commodity. Can we allow ourselves the luxury of inconsiderately wasting our students’ time?

This produces a result that would not have been foreseen even a few years ago: since teachers must give their students a sense of what is relevant in the discipline, they have an important role as “managers of ignorance”; they must teach them what subjects should not be studied, except in special cases. We have to abandon the ingenuous model of teachers who unload subject matter as if they were trying to fill a reservoir: as if the greater the torrent injected during the term, the more competent and successful the teacher.

The second role teachers must play is as motivator of their students. However - and contrary to certain ideas strangely defended even today - to motivate does not mean to transform oneself into a salesman of the subject taught, putting the students in the position of consumers. This model, more pernicious than the previous one and much to the taste of the liberalizing ideas of the eighties, leads inevitably to a professor/student relationship based on a convenient falsehood. Knowledge is not a product in the economic sense of the term, and teaching is not the rendering of a service. The aim of the teacher/learner relationship is to alter the way the latter sees the world (which, not infrequently, also happens to the former), giving the learner the tools to act within it. This relationship, which requires cooperation, mutual respect and sacrifices on both sides, in no way resembles, for example, selling cosmetics or repairing refrigerators. So, teachers should not transform their classes into multi-media performances in a ridiculous attempt to ingratiate; they should not try to compete with virtual reality and 3D games, in a senseless endeavor to produce a school that seems like leisure time; they should not give out smiles and high marks with the pointless intent of attracting students. What teachers must do is motivate their students towards the adventure of discovering and making contact with more and more complex models with a view to *understanding* reality, solving problems creatively and critically evaluating approaches and solutions. They must provide them with tools that do not become out of date or obsolete.

We are all aware that our best teachers, those we learned the most from, were not salesmen of gadgets, quite the reverse. So students' evaluations of their teachers (often done through questionnaires and most often answered before the final exams) in the short term, though they may provide useful information to be taken into account, must be carefully considered in context.

As Gregory Bateson points out (Bateson, 1987), it is not so important to supply students with the treasure as it is to give them the map to reach it. To learn to learn is actually much more motivating than to learn: curiously enough, the definition of ‘autonomous agent’, used nowadays in the context of Artificial Intelligence, shows that for this characteristic to be present in a system, the system must reveal a type of behavior determined by its own experience, as opposed to the prevailing idea that it must have a vast complete reservoir of absorbed knowledge (Russell, 1995). So one of the teacher's goals is to help students to become autonomous agents, able to meet the challenges they will soon face.

The teacher/salesperson and corresponding student/consumer models must, therefore, be rejected, not only because of their lack of dignity, but also due to their meager usefulness in turning out autonomous, responsible and competent citizens.

The third role of the teacher is related to aesthetics (according to Bateson's ideas) and to ethics. When we are seeking the solution to a new problem, the heuristic function must contain an aesthetic evaluation (as Fernando Pessoa pointed out when talking of Newton's binomial and the Venus de Milo), and an ethical one.

An elegant solution to a problem presupposes simplicity, parsimony and regularity, as opposed to complication (not to be confused with complexity!), brute force and exceptionality. How can a student find the demonstration of a theorem or the solution to a complex problem without this notion of beauty?

Ethics supplies other elements fundamental to the search for solutions: the correction of reasoning, the analysis of what is and is not permitted and what a false solution is (when, for example, restrictions are relaxed and the solution found violates fundamental aspects of the problem in question).

Teachers, through their conduct in approaching the problems, must show that aesthetics and ethics exist as fundamental heuristic tools without which no truly useful or innovative solution can be found.

Many of the concerns I have expressed here are not new; in an article in *the Diário de Lisboa* in 1973, entitled "Higher Education in Psychology: The Pedagogy of Teaching or of Learning?", Gouveia Pereira wrote:

"(...) We only really learn what we discover. When we learn something discovered by others, there is only one way of retaining that learning:- by making a new personal and creative synthesis of the diverse fragments of the knowledge.

People do not learn logically/deductively; they need the logical/deductive method to explain and communicate economically what they have already learned. We do not learn in order, or by rote or precedents - contemporary psychology has amply demonstrated this. Learning is the continuous restructuring of mental schemes. Into each current scheme is incorporated what the senses filter from the information obtained, and a new scheme emerges. Students do not follow the pages of a book, they follow the structuring of their current schemes.

So a pedagogy of learning must leave the freedom of incorporation to the student; it must reorder itself continuously according to the student's needs and not according to the structure of knowledge in the abstract, nor according to the teacher's mental schemes. It is into this freedom that risk is inserted, and on account of this freedom that teachers must efface themselves, returning to the etymological meaning of the word 'pedagogue' - one who leads the child. The teacher will be the conduit not the content; the teacher will be the catalyst, not the active element of the reaction (...)"

Contrary to what may appear on first analysis, the teacher's role in the future will be incomparably more important and rewarding than it has been up to now: I think a teacher who is able to provide the feeling of relevance, is dedicated to motivating his students and strives to reintroduce the notions of aesthetics and ethics will certainly enjoy a position of enhanced prestige and importance in tomorrow's world.

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