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CURRENT TEACHING AND LEARNING STRATEGIES[1]

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A b s t r a c t

Methods, planning, and strategies have represented three distinct phases of didactic and pedagogic research. Current trends tend to focus once again on the importance of the teacher, and give preference to procedures that help pupils grasp the significant elements of the teaching contents. Current didactic strategies include Rogers' "non-directive learning", "research-action" "teaching to think"; "problem solving" Ausubel's "bifactorial teaching-learning" model; and more recent strategies such as the Bruner-inspired "meaningful teaching" and "peer education" (a sort of mutual teaching between peers, or between older and younger children). Each of these strategies has aspects that are different from the others. More generally, each one of them stands in opposition to transmissive teaching, which forces pupils into a passive condition and imposes mnemonic learning. The most extensive research on this issue was conducted in the field of mathematics teaching and dates back to the 1980s. This research has highlighted the fact that the key condition for a successful outcome is the direct classroom work carried out by the Teacher, and not the procedure in and of it self. There are a wealth of experiences and suggestions in this regard. The teacher must take on the role of mediator, guide, or learning facilitator; this role should include suggestions, reports, reprimands, and demonstrations along with overall and initial teaching units, and should constantly provide tools for re-structuring the knowledge that has gradually been acquired. It must also avail itself of the art of "problem solving" and the ability to frame a problem, formulate new conjectures, and add variables. However, it would be mistaken to contrast heuristic and transmissive teaching strategies. Another thesis which needs to be revised is that which maintains that a good strategy, in order to be successful, must establish links with a pupil's life experience; on the contrary, pupils need to be able to think through problems that are not related to their experiences.

Key words: *Teaching, didactic methodology, transmissive strategies and heuristic and interactive strategies, the role of the teacher*

Rather than presenting new didactic procedures, I propose to discuss the relationship between methods, planning, strategies, and the role of the teacher, in order to come up with potential guidelines for the current situation, in which some see the need for universally valid, good – as opposed to bad – teaching procedures in schools, and others feel that, much like in science[2], in teaching every procedure, new or old, is valid as long as positive results are achieved. I shall try to proceed in the right order.

[1] Translation: The Office, Trieste

[2] P.K. Feyerabend, *Contro il metodo,* Feltrinelli, Milano, 1984.

Historically, the need for a teaching method had emerged as early as 1600 with Comenius. It was reiterated by Pestalozzi and taken up again by the positivist movement, which maintained that schools required objective, scientific, and "fact-based" teaching methods. The leading lights of the active school and American pragmatism in the late 1800s and early 1900s all agreed on the priority need for methodology. From Reddie to Cousinet and, respectively from Washburne (Project Method) to Parkhurst's Dalton Plan, the method was held to be the cornerstone of every aspect of teaching. Some of the most recent model methods include the so-called "expert models" [3], including the Feuerstein model, for overcoming cognitive difficulties[4].

Broadly speaking, the term 'method' indicates a practice based on solid theory, and which is clearly defined in its constituent principles and its practical implementation procedures. It gives the idea of a standard procedure valid for all disciplines. Indeed, this is how Decroly[5] saw it when he proposed a universal learning method for all subjects, from reading and writing to history and mathematics. However, method can also refer to a specific procedure for a given subject, or even for a specific teaching problem. Teachers are responsible for knowing the method and applying it correctly: the method comes first, the teacher second. As such, the role of the teacher is diminished, as he or she is merely a faithful and steady follower.

With the theory of didacting planning, which originated in the United States and was transferred to Europe in the 1970s[6], the problem of the method took on a different aspect. The two key issues became school curricula and the taxonomy of educational objectives. The basic intention was not to provide teachers with a "method" in the strict sense, but rather with a classroom procedure that could be adapted according to the difficulties encountered, the type of pupil in question, and learning goals. The latter were to be defined on the basis of the pupils' pre-existing skill sets, the national teaching programme established by the Ministry of Education, the school's environment and resources, and finally the individual characteristics of pupils and the school's social and cultural background. The necessary intermediate evaluations were intended to gauge the progress made by pupils as well as the suitability of the procedure adopted; they were to be used as a new starting situation. In such a framework, planning was flexible and was more akin to a strategy than to a method. It did not mandate "how" to teach, which was up to the individual teacher, but rather identified the most efficient modalities for drafting a successful work plan. The central role was no longer played by a mandatory programme issued by the ministry, but by the pupil with his or her needs and skills, with the teacher's main role being to adapt the national education programme to the specific needs of his or her school and pupils. In other words, the pupil was no longer working for the programme, but the other way around. Additionally, planning emphasized the role of the teacher much more than method did; indeed, the teacher became the true engine of the school.

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[3] Tessaro F., *Metodologia e didattica dell'insegnamento secondario*, Armando Editore, Rome, 2002.

[4] M. Martinelli, *Mediare le conoscenze. Formazione e apprendimento in Reuven Feuerstein,* SEI, Turin, 2008

[5] O. Decroly, *La funzione di globalizzazione e l'insegnamento,* La Nuova Italia, Florence, 1963.

[6] A. & H. Nicholls, *Guida pratica all'elaborazione del curricolo,* Feltrinelli, Milan, 1976; L. Stenhause, *Dalla scuola del programma a quella del curricolo,* Armando, Rome,1977.

However, the intentions behind planning were not respected in its implementation, and planning became a mere *a priori* list of learning goals and sub-goals which had to be achieved by classes in the order in which they were rigidly listed by the teacher: Goal A could only be achieved after a series of sub-goals were completed: A1, A2, A3, etc. There were even teachers who felt that classes should not move forward until all pupils had achieved all of the sub-goals, thus slowing down the overall learning process. In other words, teachers betrayed the real nature of planning, removing the pupils as the focus of attention and replacing them with teaching subjects, each of which was sub-divided into a series of minuscule steps. In the latest "Guidelines for Kindergarten and Elementary School Curricula" of the Italian Ministry of Education (2007), the term "programmazione" [planning] disappeared and was replaced by "progettazione" [project design]. The intention is to put pupils back in their rightful place at the centre of education policy.

I shall turn now to strategies. Strategies are the third step in the development process for efficient teaching practices. The term "strategy", which has military origins, has a different meaning than "method", because it indicates choices that arise in the field. These choices go beyond the concept of planning and tend to make the pupil the key player in the learning process. Strategies highlight the fact that it is not enough to merely implement learning methods, but that teaching needs to come back to the forefront. After a lengthy period in which learning had taken centre stage, current trends, centred on strategy, tend to place teaching back in its rightful place[7]. In other words, successful learning cannot only rely on the qualities of the pupil and on the cognitive modalities highlighted by learning psychology; it can only happen if the conditions above are accompanied by effective teaching, which takes into account the epistemology of the subject being taught and attempts to implement a shared research strategy between pupil and teacher that goes beyond mere transfer-of-knowledge modalities.

The list of these new strategies is long, with many different names. Some strategies are recent, others less so. They include Rogers' "non-directive learning" [8], "research-action" [9], "teaching to think" [10], "heuristic teaching-learning" or the more hands-on problem solving[11], Ausubel's "bifactorial teaching-learning" model [12] or the more recent, Bruner-inspired "meaningful teaching" or "mastery strategies", or learning-by-doing and peer-education (a sort of mutual teaching between peers, or between older and younger children). In general, these strategies tend to stand in opposition to transmissive teaching models, which are accused of being repetitive, encouraging

[7] Cfr.: L. Guasti (ed.), *Insegnamento e apprendimento,* V&P, Milan, 2002.

[8] C. Rogers, *Libertà nell'apprendimento,* Giunti-Barbera, Florence, 1973.

[9] C.Scurati & G. Zaniello (eds.), *La ricerca azione, contributi per lo sviluppo educativo*, Tecnodid, Milan, 1993.

[10] M. Striano, *Insegnare a pensare,* Naples, La Commerciale, 1998; M. Lipmann, *Educare al pensiero,* V&P, Milan, 2005.

[11] G. Polya, *Come risolvere i problemi di matematica,* Milan, Feltrinelli, 1982; M. Ranieri, *Problem solving, pensiero critico, metacognizione,* in A. Cavani, *Tecnologia, scuola, processi cognitivi. Per una ecologia dell'apprendere,* FrancoAngeli, Milan, 2007.

[12] D. P. Ausubel, *Educazione e processi cognitivi, guida psicologica per gli insegnanti,* edited by D. Costamagna, F. Angeli, Milan, 1988-2004.

passivity in pupil, and generating non-meaningful learning. Transmissive teaching leads to the rote memorization of the knowledge acquired, which is not truly assimilated by the pupil and does not translate into applicable skills. The limits of the transmissive method most clearly emerge when the pupil is asked to discuss the knowledge acquired, and struggles to recall it. The course contents are trotted out one after the other, linked by a series of "...and then", but an overall understanding is lacking, connections and comparisons are overlooked, and the pupil struggles with discussing what he or she has learned in an order different from that which they have studied. In other words, knowledge is memorized, but it is meaningless and does not translate into thought.

A shared aspect of the new strategies is that they all attempt to make learning meaningful, so that pupils may be able to understand problems holistically and fully grasp their meaning. In essence, didactic research, after swaying at length between methods, plans, and behaviouralist and/or cognitivist learning procedures, seems now to be oriented towards an approach to schooling in which the teacher must try to enable pupils to give meaning to what they learn. The differences between each strategy lie in the modalities used to make learning meaningful. Briefly put, there are two modalities to obtain such a result: linking course contents to a pupil's life experience in order to achieve "personalized knowledge", or relating course contents to the epistemology – or structure – of the subject being taught, so that meaningful learning can be achieved by understanding the logic behind the subject, without the need to recur to experience.

All the strategies listed here share a second element: the active involvement of the teacher. In all these approaches, the teacher abandons their role as a transmitter of knowledge to become a *mediator, guide*, or *facilitator* of learning. This role should include suggestions, reprimands, reports, and demonstrations, along with initial and overall teaching units and the constant provision of the adequate tools to help students re-structure the knowledge they gradually acquire. Teachers must also avail themselves of the art of *problem posing*[13] or framing a problem, formulating new conjectures, adding variables, and asking pupils to discuss the consequences and evaluate the feasibility of new solutions. These are individual moments, because they involve a single pupil or a small working group, but at the same time they are also, necessarily, face-to-face moments that inevitably take on transmissive aspects. In this search for meaning, the teacher must be able to seize the moment in which the pupil is showing good initiative, which must be rewarded and built upon, or to continue along the knowledge acquisition process while establishing new links between acquired knowledge and new knowledge, asking questions that help students frame and rethink what they have learned, re-examining acquired knowledge from a different point of view, and building knowledge systems that are increasingly rich and interconnected. The teacher must also help pupils get used to re-constructing knowledge, re-formulate it, and disassemble reference texts and re-assemble them in a different order. Concurrently, the utmost attention must be paid to the language used by pupils, who must be trained to make a constant effort to adapt their words to the thoughts they are trying to express. Teaching to think also means teaching to talk, and to compensate for the constant contrast between thought and language, which results in language being able to convey only a faction of what thoughts are trying to express. The same holds true for teaching to

[13] S. Brown, M. Walter, *L'arte del problem posing*, SEI, Turin, 1988.

read, another important element of meaningful teaching; reading skills must be carefully appraised and improved.

These strategies have been studied most extensively in the teaching of mathematics, with the help of university math professors. The leading European universities had sounded the alarm in the 1970s. There was a sharp drop in the number of students who were enrolling in math classes, and the notion was being spread that only the most skilled students could tackle this subject. Math professors, however, believed that falling interest in their subject was caused in part by an incorrect approach to teaching mathematics at all school levels. They also pointed out that the math being taught in schools was centred on outdated concepts and overlooked the most recent research in the field. A movement thus emerged to teach "new math", as opposed to "old math", in schools. A thesis also emerged which held that it was enough to introduce new contents in school curricula tor force teachers to update their methods. The teaching of "old math" was accused of being "traditional", "repetitive", "transmissive", "paradigmatic", and "deductive". "New math", on the other hand, was "fun", "creative", "magical", "inventive", "imaginative", and had "a human face". In other words, the goal was to improve, in one fell swoop, the contents and teaching of mathematics. A social sciences argument was also cited, which held that traditional math – arithmetic, algebra, and geometry – did not meet the needs of the "underprivileged" [14]. This new math was to be taught as early as elementary school. This came the years when set theory was taught in schools, as expounded by the Bourbaki group with the authoritative support of Piaget[15].

However, research on how math was being taught in schools also highlighted a series of aspects that are very useful for understanding the current debate on strategy and the relationship between transmissive strategies and heuristic/ meaningful strategies. First of all, it showed how the conflict between "new math" and "old math" had to be overcome. Polya maintained that it wasn't so much a question of old versus new contents, but rather of how math was being interpreted. He disagreed most strongly with the idea of math as a "perfect science, complete in all its parts, mummified, in front of which one can only bow down to learn it or, at most, perform a certain number of routine exercises to ensure one had correctly understood what one had learned" [16]. Instead, math was to be taught "in the way it develops, and showing how mathematical thought is essentially creative" [17], because every time a pupil "is able to identify a problem, frame it, and work on it independently", or "uses the solution to a problem to solve others", or "realizes that a problem implies the existence of other problems", or

[14] P.Hilton, *Insegnamento moderno della matematica e delle scienze, la diffusione delle false dicotomie,* in C.Sitia, *La didattica* della *matematica. Problemi ricerche orientamenti,* Pitagora Editrice, Bologna, 1979, p.131.

[15] C. Sitia, *La didattica della matematica oggi Problemi, ricerche, orientamenti,* Pitagora Editrice, Bologna, 1979.

[16] G. Polya, *La scoperta matematica, Capire, imparare e insegnare a risolvere i problemi,* vol. 1*, Premessa all'eduzione italiana,* Feltrinelli, Milan, 1971. p.VIII.

[17] Ivi, p.VIII.

"shows to have understood how a given result has been achieved, even at an elementary level, then he or she is doing creative work at an appropriate level" [18].

Another researcher, Thom, argued that although there was certainly a need to solve the age-old problem of updating math curricula and teaching in schools, it was also important to avoid assuming that all of the findings of recent scientific research could and should have been transferred to teaching in schools, whose basic task was to teach the fundamentals. Pupils were not to be thrown into the fray without adequate preparation; they needed to master a series of basic principles and techniques without which it would be impossible to approach math and attempt problem-solving. Additionally, Thom questioned the modernist argument that "by making conscious and explicit the mechanisms or techniques implicit in thought, one makes the techniques themselves easier" [19]. According to Thom, this was mistaken, because it was akin to saying that "in order to walk, it is necessary to know the anatomy of the leg". Furthermore, he argued that interest in mathematics should not originate outside the field, but from mathematics themselves. True interest could emerge when a teacher was able to bring a pupil to a mental state in which he or she "could satisfy his or her intellectual curiosity" [20]. Finally, Thom, examined the relationship between the teaching of math and the pupil's life experience, and concluded that this relationship is not always applicable, in that in order to teach objective mathematics it is necessary to separate pupils from their life experience and lead them to "areas of thought that are not directly linked to current experience"[21].

After Thom, E. Fischbein studied the relationship between discovery teaching and transmission teaching. He began by acknowledging the advantages of a heuristic methodology. Discovery teaching "facilitates the transfer and the hierarchical generalization of the procedures learned". Effective teaching must thus "aim at structures – rather than simply influencing – and bring about research efforts on the part of the child" [22]. He notes that school pupils are not usually put in the condition to discover the unknown. In most situations, pupils must arrive at the knowledge that has already been organized by the teacher as part of the subject being taught. The pupil's discovery is thus merely a "pre-determined" discovery to achieve pre-defined goals. The pupil must discover what the teacher already knows. This condition limits the concept of discovery in a school setting, and brings it into a dimension different from the conceptual one. Fischbein also relates how, along with several other colleagues, he proposed to help elementary school pupils discover "certain basic concepts of probability theory" [23], but had been forced to lower the level of teaching from "a more general, formal level to which the pupils have access" to a "more rudimentary level of

[18] Ivi, p.VIII.

[19] Ivi, p.115; italics in the original text.

[20] P.Hilton, *Insegnamento moderno della matematica e delle scienze, la diffusione delle false dicotomie,* cit. p.136.

[21] Ivi, p. 141.

[22] E. Fischbein, *Insegnamento matematico e sviluppo intellettuale,* in C. Sitia, *La didattica della matematica, Problemi ricerche orientamenti,* cit. p. 51.

[23] E. Fischbein, *Intuizione, struttura e metodi euristici nell'insegnamento della matematica,* in C.Sitia, *La didattica della matematica oggi*. *Problemi, ricerche orientamenti*, cit., p. 188.

notion as objective" which, inevitably, one way or the other (but usually by transmission rather than by discovery) had to be grasped by the pupil in order to access more complex content. Fischbein and his colleagues agreed that, strictly speaking, such an approach to teaching could not be called "heuristic method" or "discovery teaching", but more simply "teaching through planned discovery".

Another criticism was levelled at the thesis according to which heuristic strategies rely on pupils' intuition and reasoning, while transmissive strategies rely only on memory. Fischbein pointed out that it was not possible to always trust in the intuition of pupils, because it could sometimes lead them in the wrong direction. With his colleagues, he thus had to stop the scholar, and indicate some things to him or remind him of some of the aspects of the problems he had overlooked, or even quickly provide him with basic information[24]. In this regard, it has been remarked that in the classroom, memory is an important factor not only for transmissive strategies, but also for heuristic ones. There is one final remark to make on Fischbein's notions as objectives, which regards time. Time is an important variable in teaching/learning, but it has generally been taken into account by one methodology only, that of *mastery learning*[25], which has been ignored in subsequent research. Yet time is a fundamental element in schools. It generally takes longer to achieve learning goals with heuristic strategies than with transmissive ones. This means that each teaching process includes a series of notions-as-objectives that can be achieved much faster using a transmissive strategy rather than a heuristic one. Schoenfeld does acknowledge that during a heuristic procedure certain pupils can raise unforeseen objections, suggested in original initiatives or given in non-routine answers[26]. In other words, he argues that in discovery teaching one must work within the problem rather than within a method, and that surprising or unpredictable elements can always emerge. The same argument has been applied to rigour, which had been considered peculiar to transmissive lessons, but which instead is also present in research and discovery methodologies.

The outcome of this research on teaching mathematics brings about this final conclusion. Any rigid conflict between transmission and discovery evaporates when put to a practical test. Current teaching/learning strategies, even the best of them, are not decisive in and of themselves, but they can be effective whenever there is a good teacher who can apply them in an intelligent, common-sense manner.

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