

# LEARNING STYLES AND METACOGNITION

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## Abstract

In this paper we introduce the results of a research that involved 60 primary school pupils. Attention is drawn to a relevant issue in instructional research: the potential value to learners of metacognitive awareness. Some implications of these issues for learning styles research are then discussed. The purpose of this study was to investigate how students perceive learning and their learning styles preferences. Through a reflection on relations between the personalization of education and knowledge of learning styles, we will emphasize how the very important issue, for a teacher, is to create his own working knowledge on his students' learning styles, if he really wants effectively stimulate their learning process through activities normally done at school. We will consider Kolb's learning styles model and will analyze how a teacher, minding the diversity of students' learning styles, will be able to make his own teaching more effective. Regarding the pupils, we will try to show how the awareness of one's learning style can help to guide the self-regulation on learning and personal development. Research about metacognition and its implications for learning and instruction has become a central issue in education.

The call for teaching metacognitive skills is considered one of main implications for instruction that emerged from over three decades of research about how people learn. Learning how to learn has been identified by the EU as one of eight key competences. This study is aimed to compare how students think what they learn to their learning styles preferences. The metacognitive model is used to describe how fundamental concepts of experiential learning theory can guide metacognitive monitoring and control of learning. Metacognitive strategies to help pupils to improve their learning effectiveness are outlined. We will analyze relationship between learning styles and teaching methods, highlighting how one of the teacher's educational role is helping each student to find the right balance between intellectual abilities and learning style. Learners can chart their path on the learning way by developing their metacognitive learning capacities, and educators can pave the way for placing learning about learning on the agenda of their educational programs.

Keywords: learning styles, metacognition, primary school.

## 1 INTRODUCTION

Students' individual learning strategies have been identified as important skills in order to succeed in school as well as important for lifelong learning. Learning styles are often added to the concept learning strategies. Finding a definition of learning strategies is no easy task. However, it is frequently emphasized that it is important for students to develop their own learning, that they become autonomous, acquire awareness and good "tools" for lifelong learning, etc. The 2009 PISA report highlighted that students with well-developed ability in self managing their learning, are able to select the appropriate learning outcomes, using their prior knowledge and skills to focus and select useful strategies for different tasks.

New socio-cultural instances strength school to apply an education not just as delivering information or as skills teaching, but as an action aimed mainly at promoting the ability of learning to learn [1]. This results in a more marked attention towards teaching methods that activate the students' operational and experiential dimensions and foster their progressive autonomy. The educational programs designed and implemented by teachers should develop in the students the ability to deal with problems, stress critical thinking, stimulate personal creativity, freedom of choice and accountability. The school, therefore, has to offer each student a wide range of opportunities for the development of the intellectual skills that will allow him to live in a satisfactory manner in the immediate and in the future and, at the same time, to be realized as a unique person. Instruction oriented to promote in students a meaningful and motivated learning, requires a design of personalized programs, which, aiming the enhancement of originality, autonomy and communication skills of the student, are oriented to acquire knowledge and skills but especially the accrual of basic skills. The flexibility of learning programs and the significance for pupils of cultural offerings are the constitutive features of an

education project qualified as "personalized"<sup>1</sup>. Knowledge of the student-person is a needful prerequisite for effective educational work; since the profit of a pupil is not based just on his cognitive abilities, but also on various dimensions of his personality, it's not possible to program adequate educational activities before having a concrete understanding of the characteristics of the people in the class [2]. The comprehension of the style preferences of the students and their learning needs, helps teachers on developing a more suitable awareness of all pupils' expertise and, therefore, stimulates the development and implementation of personalized educational interventions [3], [4], [5]. Instruction that is paced to learning needs, tailored to learning preferences, and tailored to the specific interests of different learners. In an environment that is fully personalized, the learning objectives and content as well as the method and pace may all vary (so personalization encompasses differentiation and individualization).

## 2 THEORETICAL BACKGROUND

The elements that help to explain the different results on studying concern skills, strategies, metacognition and motivation. A further element of difference on learning comes out from the "style", an element that affects especially on the way to deal the different tasks and the solutions chosen rather than the achieved results. Many labels and definitions have been given and applied to the general concept of "style" (for the full reviews, please consult: Kozhenikov [6]; Zhang & Sternberg, [7]). In this paper, we refer in particular to the specific concept of learning style.

### 2.1 Intellectual abilities, strategies and learning styles

Several pupils' difficulties are originated from mismatch between the teacher's way of teaching and the way of learning of the student, and from the disposition, both of teachers and pupils, to confuse the divergence of styles with the lack of intellectual abilities. The research [8] has detected as concepts of learning style, of learning strategies and intellectual abilities are easily misunderstood and has tried to clarify their meanings<sup>2</sup>.

Generally the style, as mentioned above, refers to how a person likes to do something. In particular, learning styles involve a typical inclination, a tendency to learn in a certain way. The styles are individual differences in usual ways of organizing and processing information; so are constant and are often free from any critical examination.

Strategies are consciously controllable, adaptive, modifiable and vary according to the particular situations that gradually face. Learning strategies' importance has also been highlighted by international surveys, that have stressed the need for pupils to develop their ability to learn, to become independent, to become aware of their own cognitive functioning and to learn how to master the "tools" appropriate for a lifelong learning. The report of PISA 2009 [1] has shown that students having well-developed ability to self-manage their own learning are able to select the appropriate learning outcomes, using their knowledge and skills on focusing and distinguishing most useful strategies for different tasks.

The skill refers to the degree to which a person is able to do something. Intellectual skills come directly into play when performing schoolwork; we say that a student is more proficient in verbal reasoning, another one in calculation, another one in spatial perception, and so on.

Learning styles are placed among the motivations and intellectual abilities and are configured as an individual and habitual way of organizing information: they are a particular way to deal with problems and tasks, a constant and permanent attitude to use a specific class of strategies. The conceptual development of learning styles is based on the assumption that style and intelligence are two different constructs [9]. The essential difference is that learning styles refer to the preference of using specific processes in processing the information, otherwise the intelligence consists in the production of such processes and elaborations [8], [10]. The differences in learning outcomes often are not related to different levels of intellectual abilities, but to their way of using, depending on the learning style of each

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<sup>1</sup> Personalized teaching is not just the application of individualization of teaching, neither the design of individual learning: it is the developing of environments and conditions for learning, suitable to support the processing of knowledge and skills oriented to the growing of creative potential and enhancement of personal excellence for each student [11].

<sup>2</sup> They are distinct and equally important operating modes to define the behavior of a student. The confusion between style, strategies, and skills can result to consider pupils incompetent, not for a effective lack of intellectual abilities, but for the difference between their learning style and the learning stile expected by the evaluator, or because they do not use the appropriate learning strategies.

student. Recently, Zhang, Sternberg and Rayner [12] have considered learning styles as an interface between intelligence and personality, different from them but, at the same time, interacting with them. The teacher has to take care of these differences, because if he confuses constructs substantially different, he could marginalize students having a learning style different from his own, mistaking them for students with limited abilities.

## 2.2 Learning Styles and Experiential Learning Theory

Learning style, as several times mentioned, is the individual way to learn and process information. Among all existing learning styles classifications we think that Kolb classification is the one particularly compliant to school world. The model described by Kolb [13] is a reference for the study on the learning style and it has gained a great interest among researchers and a wide application by teachers. Kolb's learning style classification is placed in a theoretical framework based on experience and therefore called Experiential Learning Theory (ELT).

Kolb [13], [14] describes learning styles, deducing them from the way a correct modeling of reality goes from the concrete experience to the active experimentation. The Author has introduced in literature the concept of experiential learning, a process in which knowledge results from the combination of grasping and transforming experience. This theory is contrasting with other theories assuming that the student is as a "tabula rasa", that passively captures the concepts and their relationships. According to Kolb, learning is the result of a circular process that begins with the concrete experience and increases with reflective observation leading to formulation of abstract concepts and generalizations having the goal of creation of hypotheses testable through action. The action is an opportunity for new experiences and the recursive cycle starts again at an advanced level of complexity.

The four steps are listed and ordered by succession and temporal logic, following the actions to be taken. For a complete learning, the subject should perform all four steps at least to a minimal extent. ELT defines learning as a process whereby knowledge is created through the transformation of experience. The ELT model portrays two dialectically related modes of grasping experience-Concrete Experience (CE) and Abstract Conceptualization (AC) and two dialectically related modes of transforming experience, Reflective Observation (RO) and Active Experimentation (AE). These four steps are mutually supportive: no one on its own is effective for the learning process, each step feeds the next. Each step has the same importance within the overall process and requires different skills and competencies that students need to be able to apply depending on the situation. The four steps of learning are valid for the whole course of life, beginning with learning in kindergarten. As mentioned above it is possible that a pupil privileges one of the four steps of learning and, by this way, he develops a particular learning style: this happens for the interaction of genetic and environmental factors. Kozhevnikov [6] reached the conclusion that styles, although relatively stable, are malleable, can vary according to different environmental and situational needs and can be modified by life experiences.

The four steps of learning give rise to four learning styles, depending on accentuation of one of them, made by the student for genetic, environmental or experiential reasons. The styles are: *Divergers* have a strong imaginative ability, are good at seeing things from different perspectives, are creative, and work well with people. *Assimilators* have abilities to create theoretical models, prefer inductive reasoning, and would rather deal with abstract ideas. *Convergers* have a strong practical orientation, are generally deductive in their thinking, and tend to be unemotional. *Accommodators* like doing things, are risk takers, are in the here and now, and solve problems intuitively.

Each outlined learning style offers advantages for features mentioned above, but if one or more processes are carried to excess, they become counterproductive to learning goals themselves.

Kolb [13], [14] has developed, validated and revised over the years a self-assessment questionnaire, the Learning Style Inventory (KLSI), that can be used as a tool to study the characteristics of individual learning styles. This tool has been designed not for selective or discriminatory scopes, but as a means able to provide a valuable self-analysis and to initiate the discussion that recognizes the uniqueness, complexity and variability in individual approaches to learning. The KLSI has been designed as an educational tool to enhance students' awareness on their learning process and the uniqueness of their approach to the study. Increasing awareness of how they learn, students' ability on metacognitive control of their own learning process is improved. By this way, students are able to monitor and select the most effective learning methods in different situations [15], [16]. The tool can promote dialogue between teachers and pupils about styles, their differences, their enhancement and more effective

learning modalities. By an operational perspective it is appropriate, for the reasons mentioned above, do not submit the inventory to the students as a test or an assignment, but as an experience to promote understanding of how each student learns. Results of the inventory and related profiles should be considered as a starting point for the study of their learning mode. It's important that teachers know the learning styles of their students and act with the goal that everyone is aware of their own style [17].

## 2.3 Learning styles and metacognition

As the student's learning style has to be known by the teacher, metacognitive skills need to be strengthened. Learning styles are related to the metacognitive skills: a recent research [18] identified three different relationships between learning styles and metacognitive skills. The first relationship has been identified on how knowledge involves the processing of information; this implies the active monitoring and the consequent regulation of the activities of information processing, in order to achieve a certain concrete goal, as learning. Further, the awareness of own habitual and stable preferences for certain processes and certain learning modalities, is a prior condition for acquiring meta-cognitive skills. Finally, the teacher's awareness of his own learning style and of his students' learning style, has a significant impact on teaching of learning.

Kolb and Kolb [16] have applied the metacognitive model to the Experiential Learning Theory, in order to describe how the concept of learning style is able to lead the monitoring and control of learning and the personal development, basing on the development of Flavell's theory made by Nelson<sup>3</sup> [19].

According to Kolb and Kolb [16], the ELT cycle can operate at the two levels identified by Nelson: at the objective level, when applied to the learning experience itself; at the meta level, when it is applied to the model of learning itself, i.e. both when a comparison is performed between what is happening at objective level with a cycle described in a theoretical model (CE, RO, AC, AE), both regarding how the pupil's style fits with what's happening at the objective level [18]. In this model, levels are connected both by monitoring the objective level over the meta level, when the monitoring object is a specific case of the learning process; both by monitoring the meta level control over the objective level. The learning cycle at the objective level is the real concrete experience of learning for the student. The same cycle, at the meta level, describes the normative model of the learner on his learning as it should be. The monitoring and control phases among their own model of experiential learning and their own learning experience, create a third cycle of learning, describing how pupils develop their learning model to the meta level, i.e. the way they know their learning process.

Depending on the perspective of learning styles, the research [18] shows that metacognition has the following attributes and performs the following functions: a) compensatory, metacognitive skills can compensate for the lack of an appropriate capacity for a given task, coming from the stylistic preferences; b) anticipatory, anticipating the likely outcome of learning to suit their own stylistic preferences, and taking actions in advance to avoid any learning difficulties; c) moderating, reducing the effects of potential extremisms of style provisions, by introducing strategies for improvement; d) transferable: the ability on monitoring and control the learning process, and the development of knowledge based on knowledge of styles, are transferred from one learning situation to another; e) integrative: enabling students to develop a holistic mental model of themselves, of their usual approaches to learning and thinking.

If we recognize the importance of learning styles, we need also recognize that it is not possible to promote metacognitive strategies without a well-founded knowledge of the usual and favorite learning modalities and information processing (styles), i.e., without the knowledge of styles, we cannot have metacognitive teaching truly focused on the student and practically useful.

Several times the research [16], [20], [21] has highlighted the importance of educating pupils according to their individual preferences for learning. The best understanding of our own learning process and the way in which we learn more effectively, improves the students' perception of their learning ability, promotes the empowerment of results of the learning process, provides greater motivation to learn and helps to overcome potential difficulties [16], [22]. By learning to recognize the most effective methods to complete the learning activities and to master new knowledge, students "learn to learn" and are more likely to become able to learn throughout life and to maximize the their

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<sup>3</sup> In his theory, Nelson [19] has distinguished an *objective* level (where learning is monitored) by a *meta* level (where the comments made on own learning are connected to a mental model of learning). He focused attention over monitoring meaning and metacognition's control: in *monitoring*, the information flow runs from the objective level to the meta level; in *controlling*, the information flow runs from meta level to objective level.

true potential. The research [23] has highlighted that teaching based on learning styles is an effective strategy to ensure the success of students and to promote their motivation. Awareness of learning styles affect the students' choice of the learning strategies best suited to the tasks they have to perform. The consciousness of their own improvement provides students new perspectives about their learning potential.

### 3 THE OBJECTIVES AND HYPOTHESIS OF THE RESEARCH

According to theoretical assumptions explained in the preceding pages, we have questioned what could be a tool that would allow primary school teachers to easily diagnose the learning styles of their students. Therefore, we begun a process of research aimed to adapt a suitable tool and easy to use by teachers for the detection of different learning styles. By this research, we intended to detect the learning-styles profiles of sixty students of the fourth primary grades and find the correspondence between learning style and metacognitive awareness of the pupils. For this research we used a mostly qualitative methodology, integrated with quantitative elements.

### 4 METHODOLOGY

The research experience was divided into two phases: the first one involved the adapting and validation of a questionnaire for the detection of learning styles; the second one was focused on the verbalization of cognitive and metacognitive processes involved in carrying out a task. In this second phase, looking at results obtained by the administration of the questionnaire adapted, we worked in the involved classes in close collaboration with teachers, properly sensitized and trained on the subject. The students were asked to reflect on their learning styles and how these are translated into strategic options, with the help of the teaching-organizer "concept map"<sup>4</sup>.

#### 4.1 Adapting and validating Kolb's LSI

To identify the learning styles of each student, we adapted for primary school a diagnostic tool already widely used and we made an initial validation of it: the Kolb's Learning Style Inventory [24]. The questionnaire presented has been validated on a population of 60 students attending four classes fourth in a primary school in Palermo. The population consisted of pupils aged between 8 and 10 years and composed of 35 male and 25 female students.

The questionnaire was dispensed with the aim of obtaining information on the prevailing learning styles of the students. The Kolb Learning Style Inventory (KLSI) is an instrument 'designed to measure the degree to which individuals display different learning styles'. It contains 12 items that ask the respondents to rank four sentence endings that correspond to the four learning modes-CE, RO, AC and AE. Because of this forced choice format, the cumulative ranks reflect the relative preferences among the dialectic modes. The combination score AC-CE (i.e., cumulative rank for CE subtracted from the cumulative rank for AC) represents the preference for abstract conceptualization over concrete experience and AE-RO (i.e., cumulative rank for RO subtracted from the cumulative rank for AE) the preference for active experimentation over reflective observation. The combination scores may range from -36 to +36. A higher AC-CE score implies a relatively greater inclination for abstractness (AC) and lesser inclination for concreteness (CE), whereas a lower AC-CE implies the opposite. Similarly, a higher AE-RO score would mean preference for action (AE) over reflection (RO) and a lower score the reverse. One's learning style type can be determined by taking both combination scores together and comparing them with the cutoff values from the normative group.

Once data was collected, we drew up profiles of learning-styles of each student involved in the research, marking the preferred study strategies. As the questionnaire is self-assessing, the tool reflects what the students think about their own person and provides partial data. Therefore, the data collected by the questionnaire were supplemented by systematic observations conducted in the classroom and with the dialogue conducted with each student about the personal construction of concept maps. The information collected by questionnaire were processed according to a descriptive approach (average, frequencies and percentages).

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<sup>4</sup> Maps can draw thought in its dynamism, in his rational, deductive, inductive, associative and imaginative activities. They lead students to trace and reconstruct the thought processes done before, or done by others. They also help to share with other thought processes, making them more meaningful [25].

#### 4.1.1 Contents validation

A meticulous, analytical and critical work has been done in order to adapt the original questionnaire to the peculiar features of primary school pupils, making constant reference to theoretical models that underlie each construct. We wanted to check, for each of the 36 statements in the questionnaire, if it was representative of what we wanted to bring out in students. We also tried to check if each item was compliant with the age of the students and their education level and then if the whole items content constituted a proper sampling for the detection of signs of the corresponding learning style of each student. Our aim was oriented to promote the student contact with actions similar to those found at school. Items refer to situations that invite to reflect on the lack of motivation, the relationship with teammates, the lack of attention, the difficulty on understanding the task and the organization of time and space to dedicate to study. These items can still be enhanced with using and with the feedback occurring between them and the student. The check ensures that each item matches the assigned function and that it is effective to lead the student in the analysis and in the expression of their cognitive and learning styles.

A first experimental check wanted to ensure that items were matching the assigned function, in order to give teachers a tool expendable in their work with students. Research on validity of questionnaire was conducted on the sample examined. The item difficulty was tested by discussing about each of them with the students and promoting in each student the development of self questioning, which is a form of thought for problems. Later, we proceeded with the analysis of the feedback from students following the reading and comprehension of each item. Each item was easy to understand because the pupils answered with no doubts and choosing soon the right alternative corresponding to the proposed situation. This analysis allowed us to reflect on the importance of the item's shortness without diminishing the quality and quantity of information that must be collected and analyzed by the pupil. Scale's homogeneity was evaluated by calculating Cronbach's alpha coefficient. In addition, for each scale has been evaluated the possible presence of non-homogenous item compared to the other ones. For this purpose, for each item we calculated item-total correlation (corrected with exclusion of the item in exam) and the value of Cronbach's alpha coefficient which would be obtained by omitting the item from the scale.

#### 4.2 Verbalization of cognitive and metacognitive processes involved in carrying out a task

In order to verify the correspondence between the learning style and the strategies of the students of one of the four classes, to which, previously, KLSI had been submitted, eighteen pupils (12 males-6 females) were interviewed right after the execution of a task for the construction of a concept map (discipline history): participants need to recall what they were thinking while they were involved in the process of completing that task. Retrospective self-reports were elicited on an individual basis so that strategies suggested by one pupils would not unintentionally stimulate another pupils. Study participants were asked to report retrospectively on their concept mapping strategies following the reading of a short history article. Protocol analysis is an accurate methodology for eliciting verbal reports of thought sequences and is a valid source of data on thinking [26].

"What is, for you, the map?" This was the first question when starting the dialogue. Dialogue with individual students of Class IV, concerned the method of construction of concept maps by appealing their will and commitment to reach an improvement their school situation. Survey aimed to make both the pupil and the teacher aware of the pupil's mental reality. In dialogue with the students, we intended to highlight the habits and the mental strategies implemented by the pupil when constructing of concept maps, in order to enable the pupil awareness and their transferability in different fields of knowledge.

Pupils were not asked "How did you do?" but "How do you proceed?". Answers provided by pupils during the dialogue were stimulated with "specification questions" aiming to find out the mental procedures used (e.g., "What do you do when you build a map?", "What does 'I order the concepts?' mean?", "What do you need a map for?"), so the questions asked varied according to the development of the conversation. At the end of the answers, the explanations provided by the pupil have been reformulated by the teacher, according to the criterion of reflection, in order to check if the mental steps investigated were well understood. The teacher never anticipated the answers and never helped the student during his presentation, even if some students had difficulty in communication. Suggestions or anticipation of the answers could disorient the interviewee and make the dialogue invalid. The person conducting the dialogue has helped the student to progress in exercising of a

reflective thinking paying attention to the metacognitive aspects of the learning process. Interview was recorded in order to draw, in a second time, information useful to better think over the profile of each student.

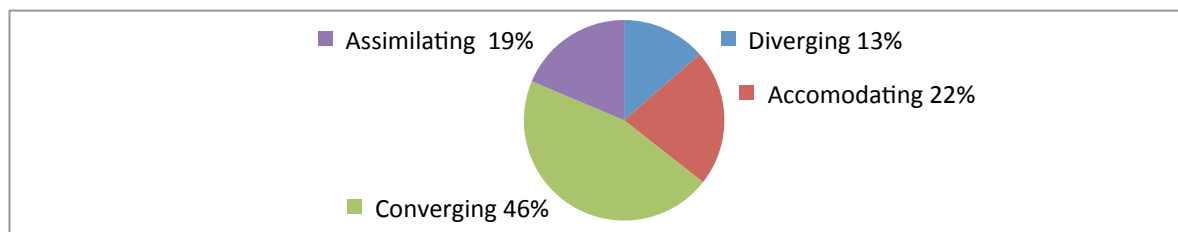
## 5 DATA ANALYSIS AND DISCUSSION

### 5.1 Learning styles detected

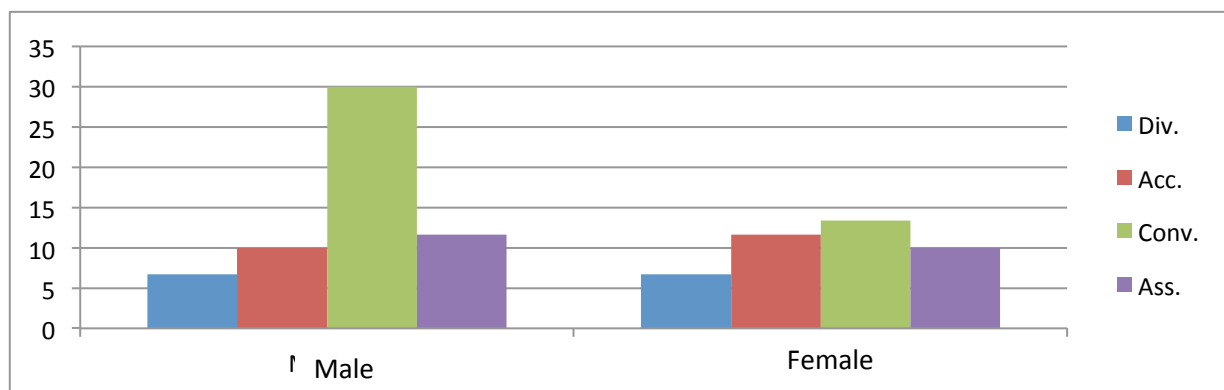
Analysis aims to take a snapshot of learning modalities and information processing performed by students. Regarding the identification of learning styles, questionnaires' data were submitted to various statistical analyzes and mathematical calculations. For data collected on each class, each questionnaire was internally analyzed, in order to have an indication on the distribution (frequency and percentage) for the different dimensions. We also checked if one or more learning styles were more represented than others. In the analysis of the results each class of pupils examined has been analyzed.

Cronbach's coefficients of the four learning modes were found within the acceptable range of  $\alpha=0.83$  to  $\alpha=0.85$ . The correlations matrix also shows that, consistent with the theory, the abstract conceptualization scale is negatively correlated with the concrete experience scale at a statistically significant level, as is the active experimentation scale with the reflective observation scale. For most of the items, we found moderate or high item-total correlations and, only in one case, the item 9, we found an item-total correlation less than 0.40 (with a still acceptable value of 0.36).

The chart below shows how, for students, preferred learning styles are, in order: Converging, Accommodating, Assimilating and, finally, Diverging. Students are characterized by a preference for scientific reasoning, hypothetical-deductive, prefer immediate action and are inclined to put ideas into practice as quickly as possible. They prefer the situations with a single correct answer or a single solution to a problem.



The chart below shows the percentage differences between males and females about the prevailing style. Chart analysis shows a marked preference for the Converging learning style by males compared to females. Female pupils, despite prevailing style is the converging one, present high percentage on Accommodating style compared with males. For both genders, for a lower percentage of students prevails the divergent style.



The results presented in this paper are to be intended as a starting point for new researches. The results reached, in fact, cannot be generalized, because of the small population size.

## 5.2 Verbal protocol analysis

Verbal protocols, along with the teacher's notes on non verbal aspects of performance, were recorded and later analyzed using the content of each complete proposition (i.e., stand-alone idea) as the unit of analysis. The 18 protocols obtained from conversations with students are then segmented into units for analysis (N= 437) analyzed according a coding scheme (Whitebread et al., 2009), consisting of 7 verbal indicators of metacognition and Self-Regulation in pupils. This 7 categories are subdivided into two areas, representing the Nelson classification described above. The following table shows the frequencies detected for each student, regarding to the indicators of the coding scheme ...

gender	male												female					
Learning style	di	di	di	ac	co	co	co	co	co	co	as	as	di	ac	ac	ac	ac	co
<b>Metacognitive knowledge (meta level)</b>																		
<i>Knowledge of persons</i> <sup>5</sup>	8	5	6	4	1	4	3	3	0	1	5	7	5	2	1	2	2	2
<i>Knowledge of tasks</i> <sup>6</sup>	8	7	4	4	0	3	2	2	2	0	5	5	5	0	2	1	4	0
<i>Knowledge of strategies</i> <sup>7</sup>	5	6	6	3	1	3	0	3	1	3	3	4	3	3	4	2	2	3
<b>Metacognitive regulation (objective level)</b>																		
<i>Planning</i> <sup>8</sup>	4	3	4	11	3	5	4	4	3	4	2	3	2	8	7	5	6	6
<i>Monitoring</i> <sup>9</sup>	1	0	3	6	2	5	3	3	3	5	0	3	0	6	6	4	4	5
<i>Control</i> <sup>10</sup>	2	1	2	4	3	4	4	5	2	5	1	1	0	4	5	4	5	4
<i>Evaluation</i> <sup>11</sup>	0	2	2	4	4	6	5	5	4	3	4	2	1	4	5	6	6	5

A first analysis of the results shows a substantial consistency between the frequency data and the learning style of the student. In particular, in 4 children with divergent style, having a prevailing preference for concrete experience and reflective observation and that, according to Kolb (2009), are able to see problems from different points of view, can organize content in significant structures and have a vivid imagination supported by a rich emotionalism, meta level prevails over the objective level. In 5 pupils with accommodating style, having a prevailing preference for the concrete experience and active experimentation and which are more inclined to action than to reflection, and which are able to synthesize theoretical principles and practical situations, the objective level prevails over meta level. In 7 children with converging style, more inclined to conceptualization and active experimentation, which are able to assimilate a lot of information and organize them into coherent structures and explanatory, which proceed in work with a consistent methodology and precise, the objective level prevails over meta level. In 2 pupils with assimilating style, having a prevailing preference for abstract conceptualization combined with reflective observation, which like to create logical theoretical models and use inductive reasoning, the objective level prevails over meta level.

Data collected need to be repeated on a larger sample and require further statistical inferences. We are aware that these data could be influenced by the following variables: the type of task, the gender difference and the recording method of the metacognitive processes, made exclusively through the oral modality.

<sup>5</sup> A verbalization demonstrating the explicit expression of one's knowledge in relation to cognition or people as cognitive processors. It might include knowledge about cognition in relation to: self, others and universals. Self: refers to own capabilities, strengths and weaknesses, or academic/task preferences; comparative judgments about own abilities; Others: refers to others' processes of thinking or feeling toward cognitive tasks; Universals: refers to universals of people's cognition.

<sup>6</sup> A verbalization demonstrating the explicit expression of one's own long-term memory knowledge in relation to elements of the task.

<sup>7</sup> A verbalization demonstrating the explicit expression of one's own knowledge in relation to strategies used or performing a cognitive task, where a strategy is a cognitive or behavioral activity that is employed so as to enhance performance or achieve a goal.

<sup>8</sup> Any verbalization related to the selection of procedures necessary for performing the task.

<sup>9</sup> Any verbalization related to the ongoing on-task assessment of the quality of task performance (of self or others) and the degree to which performance is progressing towards a desired goal.

<sup>10</sup> Any verbalization or behavior related to a change in the way a task had been conducted (by self or others), as a result of cognitive monitoring.

<sup>11</sup> Any verbalization related to reviewing task performance and evaluating the quality of performance (by self or others).



## 6 CONCLUSIONS

As presented in the previous pages, the role of schools and teachers is not just the styles testing in order to conform themselves to the features of each student, but it is to know the range of potential differences and to assume an attitude of respect when dealing with them, avoiding to override using a rigid methodology and unique and, at the same time, helping the students to better know themselves, exploiting the unique features and unique configuration of their own learning styles. The recognition of individual differences in learning styles, forces teachers to set their teaching activities and related students' learning activities in an articulated methodology. The knowledge of the major styles and meditation on how students learn, on their own personal characteristics, on their own learning style and how all these factors impacts on teacher's methods is an important element of the teaching profession. Only considering the differences between the students and the ways in which each student learns, the teacher can enhance the inclinations of each and adapt them to situations and contexts in which those inclinations may cause difficulty.

As we highlighted the previous pages, although styles resist as stable feature over time, anyway they are flexible and malleable to be adapted to changing environmental demands and modified by the life experiences. This brings out two considerations about learning styles, having important consequences for teaching. The first considerations is that the styles, like skills, are fluid and dynamic entities: it is important that the students know that their own personality is developing and therefore there are potentialities to be explored and some features of their own learning style to be cultivated and furthered. The second consideration is that styles can be taught. We believe that pupils, at school, should also learn to perform tasks that are not quite congenial to their learning style. In other words, since the ability to recognize situations as more or less compliant their own learning style depends on the level of students' metacognitive skills, it is important that they know and rather adopt their style, but they need also to experience different styles, with the help of their teacher, learning to recognize the features of the task for which it is more appropriate to adopt a style rather than another.

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