# How Teachers Can Observe Children at School: from Naïve Approaches to Expert Competencies

# Öğretmenler Öğrencileri Okulda Nasıl Gözlemleyebilir: Doğal Yaklaşım-lardan Uzmanlık Yaklaşımlarına

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**Abstract**

In training students of Infant and Primary Education programs at the University of Macerata, we designed a Workshop for Observing Children at School. The participants to the Workshop were asked to look at different videos in which children doing things at school were taped, then writing down observational written reports. From the beginning to the end of the Workshop, differences were identified in the observational texts, moving from deterministic approaches of explanation to probabilistic attitudes to comprehend children's behaviours. Probabilistic approaches are as well stated as the most suitable in the current century, within the field of Developmental and Educational Psychology.

**Keywords:** Observation process; deterministic vs probabilistic approach; teacher training; learning by doing activity.

**Öz**

Macerata Üniversitesi okul öncesi ve ilkokul programlarına devam eden öğrencilerin yer aldığı okulda yapılan öğrenci gözlemlerine dayalı araştırmamızda; araştırmaya katılan gözlemcilere çocukların sınıftaki davranışlarını içeren videolar gösterilmiş ve gözlemcilerden gördüklerini raporlaştırmaları istenmiştir. Araştırmanın başlangıcından sonuna kadar gözlemlere dayalı farklılıklar çocukların davranışlarının yorumlanmasında deterministik yaklaşımlar çerçevesinde ele alınmış, tanımlanmış ve yorumlanmıştır. Araştırmanın sonuçlarına göre olasılık yaklaşımları günümüzde "Gelişimsel ve Eğitimsel Psikoloji" alanında kabul edilebilecek yaklaşımlar olarak belirtilebilir.

**Anahtar Sözcükler:** Gözlem süreci, deterministik yaklaşımlar ve olasılık yaklaşımları, öğretmen eğitimi, yaparak- yaşayarak öğrenme

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**Introduction**

Along the last ten years we were involved in conducting the *Workshop for observing children at school* (WOCS). WOCS is aimed to train students preparing themselves to be future teachers at infant and primary school.

In this paper we will describe the Workshop training design and the results that the trainees obtained. We will show the principal characteristics of observational qualitative texts passing from a naïve to an expert way to conduct paper and pencil observation on children.

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In this paper we will describe the Workshop training design and the results that the trainees obtained. We will show the principal characteristics of observational qualitative texts passing from a naïve to an expert way to conduct paper and pencil observation on children. We found that the naïve approach tends to be *deterministic and uni-causal*, whereas the expert approach mainly shows a *probabilistic and multifactorial* attitude in observation processes.

### The Workshop for Observing Children at School

The Workshop for Observing Children at School (WOCS) is a mandatory practical course organized in the Department of Educational Sciences at Macerata University (IT), both in presence and in online modality. It is intended for students who will be teachers in their professional lives at infant and primary schools. The aim of the course is to promote the transition from naïve approaches to expert ones in observation methodology.

### The WOCS learning design

The Workshop consists of a series of progressive activities, both individual and collective. To organize the WOCS learning design the same guidelines were followed (Nicolini & Moroni, 2006; Nicolini et al., 2007) both in the in presence and in the online edition. In the Table 1 the structure of the online course activities is shown.

**Table1.** The Learning design of the online WOCS

| WOCS 2012/2013 |
| --- |
| Write down your idea of "observation" and then an observation text, after downloading the available videotape. Publish it |
| 1st web forum: within your own group find similarities and differences in the individual observational texts |
| On the basis of both your own and of the other participants written observation texts, create an individual table containing the necessary and sufficient indicators to make a complete and correct written observation text |
| Read the recommended handbook |
| 2nd web forum: in your own group discuss and negotiate a list of evaluation criteria. Publish it |
| Based on the completed activities and realized concepts write an observation text using the available videotape. Publish it |
| Write a self assessment of your two observational texts using the evaluation criteria developed. Write an assessment of the whole Workshop, as well |
| Send a personal dossier to the Faculty composed of written texts of every activity (exercises, forum interventions, observation texts, individual and collective tables, assessment of the workshop, self-assessment). |

In the first activity the participants have to write their observation text using the available online video. The video reproduces a real school situation, in which a group of children are building a tower. The video lasts 60 seconds. The goal of the first observation task is to activate students' own knowledge and competences before the meeting with the scientific theories explained in the textbook. According to Gardner (1991) we assume that every person uses naïve theories to explain the various aspects of the reality. These spontaneous constructions are difficult to modify, especially when in adult subjects and socially shared (Farr & Moscovici 1984). In order to move to a new vision of reality, it is fundamental not only to show other possible visions, but also to demonstrate the inaccuracies and/or the limits of the old beliefs, thus creating a desire to look for more satisfying solutions (Posner et al., 1982).

To promote this kind of conceptual change, the students are requested to discuss analogies and differences originating from the individual observation texts (activity 2). Discussion among peers is aimed to the recognition of differences, in terms of strengths, potential limits or possible errors in the subjective point of view (Chinn and Brewer, 1993). Doubts can arise during this phase about the personal report of the

video, taking into consideration other versions and interpretations of the same situation. Moreover while the students are discussing their different points of view to support their own opinions, at the same time they build a new and stronger structure of ideas (Nussbaum & Novick, 1982; Ajello et al., 1991).

At this point (activity 3) the base to activate a negotiation of meanings is available (Bruner 1990; Brune 1996; Scardamalia & Bereiter, 2002; Mitchell & Andrews 2000). In the third activity the students are asked to negotiate a shared list of indicators for child observation, looking for a possible agreement and reaching new solutions (Doise & Mugny, 1981; Carugati & Selleri, 2001).

Now the students should read the recommended handbook (activity 4). The approach to scientific theories is facilitated by the naïve theories recognition and activation.

In the fifth activity the participants must write a new observation text based on another video, using the apprehended concepts (activity 5). This task aims to enable the students to experience professional practice in the light of the concepts they have just assimilated. The delivered video is similar to the first one: it shows two children collecting a puzzle in an infant school.

The students are then invited to talk about the completed observation texts within their group on the web forum. They also have to express an assessment on the Workshop and to formulate a self-evaluation of their own learning process (activity 6).

To conclude the course, the students are requested to send a personal dossier (activity 7) made up of written texts about every activity. Collecting and composing a personal dossier is a further strategy planned to promote meta-cognitive thoughtfulness[2]

### Methodology and Data Treatment

During more than ten years we collected hundreds of written texts in which the trainees described what they observed in the videos we adopted for the first and the fifth activity of the WOCS. Through the linguistic analysis of the written texts, we had the possibility to identify the main differences in the way to write down the reports at the beginning and at the end of the course, passing from a naive way to observe to an expert one, as a result of the training activities.

We will illustrate two examples of observational texts. The first one refers to a video shown at the beginning of the course, the second is related to a video used at the end, the author being the same participant to WOCS.

### *Example 1*

*The videotape presents two children playing together with a table, in a free context, in an Infant School. They establish a cooperative atmosphere, both of them are*

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[2] The in presence edition of the Workshop has the same activities: there are 7 meetings of 2 hours each, during two months. The only difference is in the third activity, that is replaced with a lesson, in which the teacher gives the students information which the online students can find in the handbook. The interactions in web forum are substituted by face to face discussion.

*engaged and both are helpful, trying to attain the same result/success: to put some pieces on the table following a criterion. Actually it seems none of them dominates the other, although there is always a leader in every situation, in this case the child who adds the toy pieces. This way of playing expresses cooperative intelligence, or rather the child skill of cooperating with others, of helping, of receiving help, and of accepting or asking for it, consequently respecting the other. This situation leads the children to know themselves, since they can discover their limits. At the same time, it expresses bodily kinesthetic intelligence which is the skill of using the body to work with objects that require fine finger movements. The atmosphere is characterized by joy, cheerfulness, curiosity, hope for mutual success, and empathy.*

We consider the first example to be naïve not only because it was written at the beginning, but also for the following reasons:

• the student produces generalizations not scientifically demonstrated, such as – *there is always a leader in every situation*;

• the personal point of view is expressed as an absolute one – *the atmosphere is characterized by joy, cheerfulness, curiosity, hope for mutual success and empathy.* Actually, feeling an atmosphere is a very personal process, meaning that different people might experience a different atmosphere in the same situation;

• there are references to unobservable data such as thoughts, feelings, and intentions of the observed subject, like in the phrase – *joy, cheerfulness, curiosity, and hope for mutual success and empathy*;

• overall there is no separation between description and interpretation – *This kind of playing expresses cooperative intelligence, or rather the child skill of cooperating with others, of helping or receiving help, and of accepting or asking for it, consequently respecting the other*; or *This situation leads the children to know themselves, since they can discover their limits.*

### Example 2

*Scene: Two children are playing with a kind of puzzle, that they have to construct in order to compose a series. The videotape is probably recorded in a section of an infant school, where I can see a low yellow table used by the children as a base for the puzzle.*

*Observation Modality: Video camera*

*Observation Duration: 1 minute and 14 seconds. I don't know the starting and ending time of the play activity.*

*Contemporaneous Factors: In the section I can see other children engaged in other activities. A child wears a mask with a long skirt and a bag; other children are running in the room, and some are busy at the yellow tables. I couldn't distinguish the dialogue among the children, because there are voices and noises.*

*Behaviour Description: At the beginning, the video camera frames only a child (A) wearing a light t-shirt. He's busy completing a puzzle. After a few seconds, a child with a red t-shirt arrives (B), holding a piece of the puzzle in her hand. She puts it in the first line of pieces. A observes the object placement, saying something and then he places other pieces. A collects all of the elephant figures in the third line, while B is*

*moving to his left, keeping in her hand three other pieces of the puzzle. B observes the composition, waits a little and then shows the pieces in her hand to A. B points to the puzzle on the table, saying: "You have to put this piece here." A tries to take the piece that B is keeping in her hand [. . .]*

*Hypothesis and Conclusions: The atmosphere seems to be positive; the children seem to appreciate the activities; my opinion is that they are collaborating.*

Considering the differences between the first and the second example, the last one can be evaluated as an expert observational text not only because it was written at the end of the course, but above all because it shows the following features:

- it is a structured text;
- details are provided about duration and observational method adopted;
- there is a clear separation between description and interpretation of data;
- conclusions are supported by descriptive and concrete elements;
- there are references to observable data such as actions and language;
- the student seems to be aware of the personal point of view, as in the expression *in my opinion.*

**Findings**

As a result of the observational texts analysis, we could identify and list the main differences between a naïve and an expert approach to observational tasks. They are synthesized in the following Table 2.

**Table 2.** The most important differences between a naïve and an expert approach to observation

| Naïve observation text | Expert observation text |
|---|---|
| **Text structure** | |
| Short and free text | Long and structured text (titles, paragraphs, bullet points, tables) |
| **Context** | |
| Absence of information about the focus of attention and the aim of the observation | Presence of information about the focus of attention and the aim of the observation |
| Absence of personal hypothesis about eventual aims of observation | Presence of personal hypothesis about eventual aims of observation |
| Mishmash of description and interpretation of data | Separation between description and interpretation of data |
| Use of daily language and incorrect use of technical language in adequate contexts | Correct use of technical language in adequate contexts |
| **Linguistic expressions** | |
| The text shows generalizations, abstractions, deductions without argumentations, all-encompassing conclusions | The text shows analysis of events and concrete objects with argumentations; conclusions supported by descriptive and concrete elements, with reference to details and intermediate passages |
| Use of his or her own point of view as an absolute one | Use of his or her own point of view as a relative one |
| References to unobservable data such as thoughts, feelings, intentions of the observed person | References to observable data such as actions, language of the observed subject and observer's internal world |
| Use of impersonal linguistic forms | Use of personal linguistic forms |
| Absence or deficiency of cognitive verbs | Presence and explicit use of cognitive verbs |

Expressions of doubts and uncertainty seem to be strictly linked to an expert way to conduct and write down an observation text. In fact this shows the awareness of the observer to be an interpreter of the reality and not just a limpid mirror or a clear witness.

We showed how WOCS can facilitate the passage from a naive approach to an expert one in observation process through the proposed activities. In this learning process, when comparing their different observation texts of the same video, the possibility for the trainees to deal with doubts and uncertainty about their way to observe was fundamental to allow a modification of their former conceptual disposition. Learners moved from viewing truth in absolute terms of right and wrong, good and bad, to recognizing multiple, conflicting versions of truth, representing legitimate alternatives so that, as a second result, we realized that the naïve approach is more similar to a *dualist way of thinking*, in which the representation of knowledge is given as an absolute model, where truth is not problematized and there is not any space for doubts. On the contrary, the expert approach seems to be more characterized by the assumption of a *relative way of thinking*, in which complexity is considered as a general condition and knowledge is supposed to be relative and linked to the context (Perry, 1981).

**Conclusions**

During the last few years a deep change within scientific theories in the field of Developmental and Educational Psychology has been implemented, passing from deterministic and uni-causal models to probabilistic and multi-factorial approaches. The deterministic and uni-causal models explanations about human behaviour and development are mainly based both on environmental or biological factors. An example of a deterministic conceptualisation is Psychoanalysis. Sigmund Freud stated in fact that the kind of relationship with parents definitively impacts every future search for a partner and the kind of sentiments affecting the relationships, as described in Oedipus complex dynamics (Freud, 1915-17). In the same way, Jean Piaget's theory (1936), according to which intelligence is based on the work of universal cognitive structures, offers a uni-causal model of development explanation. Deterministic and uni-causal models are made up of clearly stated propositions suggesting relationships, often of causal nature, between events and things under study. They also try to explain and predict some class of events.

On the other hand, probabilistic and multi-factorial models attempt to understand human behaviours and actions on the base of reciprocal modifications and interactions of different factors along time. The complexity of the relationships among different causes does not allow to predict with certainty possible outputs of actions, processes, etc. In fact, human acts often result from the interaction of many factors, specifically the interaction of several genes and the involvement of environmental factors (Bronfenbrenner, 1979).

The naïve approach to children observation seems to better fit the characteristics of a deterministic and uni-causal explanation, while the expert approach is more suitable to a probabilistic and multifactorial vision. As the probabilistic-multifactorial approach currently seems to better interpret human development and its complexity, then the training results of WOCS seem to be fruitful. To adopt doubt, to raise questions, to reflect deeply, to use a problem posing approach rather than simply evaluate or try to have an answer, is also very important in the professional field of educating and teaching, above all when professionals need to deal with people coming from different cultures. This is currently, and this will be, the real challenge of education in a global world.

**Özet**

*Giriş*

*Çocukları okullarda gözlemleme atölye çalışması* (ÇOGAÇ), geçtiğimiz on yıl boyunca tarafımızca yürütülen bir çalışmadır. ÇOGAÇ, anaokulu ve ilkokullarda öğretmen olmayı hedefleyen öğrencilerin kendilerini geliştirmelerini amaçlamaktadır. Bu çalışmanın temel amacı, gözlem yaparken "doğal" (*naive*) yaklaşımlardan "uzman" yaklaşımlarda yeterliğe geçişin sağlanmasıdır. Atölye çalışması hem bireysel hem de toplu olarak yapılan aşamalı etkinliklerden oluşmaktadır (Nicolini ve Moroni, 2006; Nicolini, Lapucci ve Moroni, 2007). İlk etkinlikte katılımcılar çevirim içi bir videoyu izleyerek gözlem raporlarını oluşturmak zorundadır. Bu gözlem görevinin amacı, ders kitabında belirtilen bilimsel teorilerle karşılaşmadan önce öğrencilerin kendi bilgi ve

yeterliklerini aktif hale getirmesidir. Gardner'a (1991) göre her birey, gerçekliğin farklı boyutlarını açıklamak için doğal yaklaşımlarını kullanır. Bu anlık yorumlamaların, özellikle sosyal ortamda paylaşıldığında ve yetişkin deneklerle çalışıldığında, değiştirilmesi zordur (Farr ve Moscovici, 1984). Yeni bir bakış açısı kazanmak için farklı seçeneklerin sunulmasının yanında eski inançların sınırlılıkları ve/veya hatalarını göstermek de önem taşımaktadır. Böylece daha tatmin edici çözüm arama arzusu oluşturulmuş olur (Posner vd., 1982). Kavramsal değişikliği sağlamak adına öğrencilerden, bireysel gözlem metinlerinden elde ettikleri farklılıkları ve benzerlikleri tartışmaları istenmektedir (Etkinlik 2). Böyle bir tartışma ile olası sınırlılıkların ve öznellikten kaynaklanabilecek hataların fark edilmesi sağlanmıştır (Chinn ve Brewer, 1993). Öğrenciler tartışırken diğerlerinin katkılarını kabul ederek yeni ve daha güçlü bir düşünce yapısı oluştururlar (Nussbaum ve Novick, 1982; Ajello vd., 1991). Üçüncü etkinlikte öğrencilerden çocuk gözlemlemede ortak bir göstergeler listesi üzerine tartışmaları beklenir. Bu tartışmayla gözlemcilerden, bir anlaşmaya varmaları ve yeni çözümler yaratılmaları beklenmektedir (Doise ve Mugny, 1981; Carugati ve Selleri, 2001; Bruner, 1990; Bruner, 1996; Scardamalia ve Bereiter, 2002; Mitchell ve Andrews 2000). Bilimsel kuramlara göre yaklaşımlar, doğal yaklaşımların tanımlanması ve etkinleştirilmesi ile desteklenir (Etkinlik 4). Beşinci etkinlikte ise katılımcılar, başka bir video izleyerek anladıkları kavramlarla birlikte yeni bir gözlem metni yazmalıdır (Etkinlik 5). Bu ödevle hedeflenen, öğrencilerin özümsedikleri kavramlar ışığında profesyonel uygulamaları tecrübe etmeleridir. Öğrencilere verilen video ilk videoya benzerdir. Bu videolarda anaokulunda bulmaca parçalarını toplayan iki çocuk yer almaktadır.

### Yöntem ve Verilerin Analizi

Bu yöntemle bu eğitimi alan kişilerden videolardan gözlemlediklerini belirttikleri yüzlerce yazılı metin toplanmıştır. Metinler dilbilimsel bir analize tabi tutulmuştur. Bu sayede eğitimden önce ve eğitimden sonra gözlem raporlarının yazılış biçimlerindeki temel farklılıkları belirleme fırsatı elde edilmiştir. Atölye çalışmalarının bir sonucu olarak, gözlem raporlarının yazılmasında doğal bir yaklaşımdan daha uzmanlaşmış bir yaklaşıma doğru bir geçişin olduğu görülmüştür.

### Bulgular

Gözlem metinlerinin analizi sonucunda, çocukları gözlemlemede doğal ve uzman yaklaşımlar arasındaki temel farklılıklar belirlenerek bir liste oluşturulmuştur.

*Doğal gözlem metinlerine* bakıldığında gözlemcilerin, kısa ve özgürce yazıldıkları görülmektedir; gözlemin amacına ilişkin bilgi verilmemiştir. Verilerin betimlenmesi ve yorumlanması karışıktır. Günlük dilin kullanıldığı ve terimlerin kullanımında hataların olduğu görülmektedir. Genellemelerin, özetlerin ve tartışma yapılmadan tümdengelim yoluyla ifade edilen genel sonuçların çok olduğu görülmektedir. Gözlemcinin bakış açısı kolayca anlaşılmaktadır. Gözlemlenen kişilerin düşünce, duygu ve niyeti gibi gözlemlenemeyen verilere göndermeler bulunmaktadır. Dil kullanımında kişiler belirtilmemekte ve bilişsel fiillerin sadece bir kısmı kullanılmaktadır.

*Uzman gözlem metinlerine* bakıldığında başlıkların, paragrafların, maddelerin veya tabloların yapılandırılmış olduğu ve uzun oldukları görülmektedir. Gözlemin amacı belirtilmiştir. Kişisel varsayımlar belirtilmektedir. Verilerin betimlenmesi ve yorumlanması arasındaki ayrım nettir. Terimler uygun bağlamlarda ve doğru kullanılmaktadır. Olayların analizi tartışılmaktadır. Elde edilen sonuçlar betimleyici ve kesin unsurlarla ayrıntılara göndermeler yapılarak desteklenmektedir. Gözlemcinin bakış açısı uygun koşullarda belirtilmektedir. Eylemler anlatılırken gözlenen deneğin kullandığı dile ve gözlemcinin iç dünyası gibi gözlemlenebilir verilere göndermeler yapılmaktadır. Dil kullanımında birinci tekil şahıs tercih edilmekte ve bilişsel fiiller yeterli bir şekilde kullanılmaktadır.

Bunlara ek olarak, gözlem yaparken ve gözlem metnini yazarken, şüphe ve belirsizlik içeren ifadelerin, kesin bir biçimde uzmanlaşmış yaklaşımlara özgü olduğu belirlenmiştir. Aslında bu durum gözlemcinin bir ayna ya da tanık olmaktan ziyade, yaşanan gerçekliğin bir yorumlayıcısı konumunda olduğunu fark ettiğini göstermektedir. Doğal yaklaşımın, gerçekliği problem haline getirmeyen ve şüpheye hiç yer bırakmayan *ikici düşünme biçimi* ile benzerlik gösterdiği görülmektedir. Uzman yaklaşımın ise, karmaşıklığı genel bir durum olarak kabul eden ve bilginin göreceli olduğunu ve bağlama göre değiştiğini söyleyen *göreceli düşünme biçimi* ile benzerlik gösterdiği görülmektedir (Perry 1981).

### Sonuçlar

Çocukları gözlemlemede doğal yaklaşımın, psiko-analizde (Freud S. 1915-1917) ya da Jean Piaget'nin bilişsel teorisinde (1936) olduğu gibi *determinist ve nedensel açıklama*nın karakteristik özelliklerine daha uygun olduğu söylenebilir. Uzman yaklaşım ise, *olasılıkçı ve çok boyutlu bakış açısına* daha uygun görünmektedir. Olasılıkçı ve çok boyutlu kuramlar, insan davranışlarını ve eylemlerini zaman içerisindeki farklı etkenlerin etkileşimi ve karşılıklı değişikliklere dayandırarak anlamaya çalışır (Bronfenbrenner, 1979).

Günümüzde insanın gelişimi ve bu gelişimin karmaşıklığını, olasılıkçı-çok boyutlu yaklaşımlar daha iyi yorumluyor gibi görünmektedir. Bu nedenle ÇOGAÇ eğitiminin sonuçları yararlı görülebilir. Şüpheci bakabilmek, sorular sormak, düşüncelerini yansıtmak, bir yaklaşımı hazır bir şekilde kullanıp cevap almak yerine problem çözebilmek diğer alanlarda olduğu gibi eğitim ve öğretimde de oldukça önemlidir. Özellikle bu alanın uzmanları farklı kültürlerden gelen insanlar ile baş etmek zorundadır. Küresel bir dünyada günümüzün asıl zorlu görevi budur ve gelecekte de bu olacaktır.

## References / Kaynaklar

Ajello, A. M., Pontecorvo & C., Zucchermaglio C. (1991). *Discutendo si impara.* Roma: Carocci.

Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Cambridge (MA): Harvard University Press.

Bruner, J.S. (1990). *Acts of Meaning.* Cambridge (MA): Harvard University Press.

Bruner, J.S. (1996). *The Culture of Education*. Cambridge (MA): Harvard University Press.

Carugati, F. & Selleri, P. (2001). *Psicologia dell'educazione*. Bologna: Il Mulino.

Chinn, C.A., Brewer, W.F. (1993). The Role of Anomalous Data in Knowledge Acquisition: A Theoretical Framework and Implications for Science Instruction. *Review of Educational Research*, 63, 1, 1-49.

Doise, W. & Mugny, G. (1981). *Le développement social de l'intelligence*. Paris: InterÉditions.

Farr, R.M. & Moscovici, S. (Ed.) (1984). *Social Representations*. Cambridge (UK): Cambridge University Press.

Freud, S. (1915-1917). *Vorlesungen zur Einführung in die Psychoanalyse*. Wien: Internationaler Psychoanalytischer Verlag.

Gardner, H. (1991). *The unschooled mind. How children think and how schools should teach*. New York: Basic Books.

Mitchell, S. & Andrews, R. (Eds). (2000). *Learning to argue*. Portsmouth, NH: Boynton/Cook.

Nicolini, P., Lapucci, T. & Moroni, C. (2007). The role of cognitive conflict and peer interaction in conceptual change: a course on child observation practices. *Gestalt Theory*, 30, 4, 447-454.

Nicolini, P. & Moroni, C. (2006). Il laboratorio di osservazione del bambino nel contesto scolastico: un'esperienza di formazione a distanza. *Annali della Facoltà di Scienze della Formazione dell'Università di Macerata*, 1, 383-418.

Nussbaum, J. & Novick, S. (1982). Alternative Frameworks, Conceptual Conflict and Accommodation: Toward a Principled Teaching Strategy, *Instructional Science*, 11, 183 – 200.

Perry, W. G.(1981). "Cognitive and Ethical Growth: The Making of Meaning". In Chickering Arthur W. and Associates. *The Modern American College*. San Francisco: Jossey-Bass, 76-116.

Piaget, J. (1936). *La naissance de l'intelligence chez l'enfant*. Paris: Delachaux et Niestlé.

Posner, G.J., Strike, K.A., Hewson, P.W. & Gertzog, W.A. (1982). Accomodation of a scientific conception: toward a theory of conceptual change, *Science education*, 66, 2, 221-227.

Scardamalia, M. & Bereiter, C. (2002). Knowledge building. In Deighton L. C. (Ed)., *Encyclopedia of education*. New York: Mac