Preschool children's ideas about floating: a qualitative approach
Ideas de niños de preescolar sobre flotantes: un enfoque cualitativo

DIMITRIS KOLIOPOULOS, SPYRIDON TANTAROS, MARIA PAPANDREOU, KONSTANTINOS RAVANIS

Department of Early Childhood Education. University of Patras, Greece. dkoliop@upatras.gr

Resumen

Se presentan los resultados de una investigación en niños de preescolar sobre las representaciones conectadas con el fenómeno de flotación / inmersión de cuerpos sólidos en el agua. Inicialmente se hizo un acercamiento a este problema mediante la bibliografía pertinente y se discutieron los términos bajo los cuales los niños pueden formar un modelo de precursor científicamente compatible de flotación / inmersión. Con base en la investigación planificada y en la estructura de entrevistas individuales se hizo que los niños predijeran la inmersión o flotación posible de cubos con materiales diversos y de tamaños diferentes. Después que ellos realizaron sus experimentaciones se les pidió que compararan los resultados experimentales con sus pronósticos iniciales y dieran sus explicaciones. Tras analizar las respuestas de niños, se observó que varios de ellos se condujeron en las dos direcciones, construcción de un modelo de precursor con base en la naturaleza del material y el mejoramiento cualitativo general de razonar.

Palabras clave*: representaciones de alumnos, flotantes, educación en ciencias, modelo de precursor.*

Abstract

In this paper we present the results of a research on the study of preschool age children representations connected with the phenomenon of flotation / immersion of solid bodies in water. We initially approach this problem through the relevant bibliography and we discuss the terms under which children can form in their thought a scientifically compatible precursor model of flotation / immersion. Based on research planning and in the framework of individual interviews we asked the children to predict the possible flotation or immersion of cubes made from different materials and of different sizes. After they had carried out their experiments we asked them to compare the experimental results with their initial predictions and give their explanations. On analyzing children's answers we realized that several children were led to both the construction of a precursor model based on the material's nature and a general qualitative upgrade of reasoning.

Key words: *Pupils' representations, floating, science education, preschool education, precursor model.*

INTRODUCTION

In the framework of Science Education a great part of the research concerns the study of concepts formation and phenomena representations of the physical world, for children of different ages. This choice, which actually formed the basis for constituting this scientific field, radically transformed the ideas about the evolution of teaching processes and scientific activities, since it revealed the decisive role the natural world's preteaching recognition models, which have been formed in the intellect, play in the learning process. With a view to this prospect, there have been several researches on both the study of representations of preschool children and the effort to transform them into representations with characteristics compatible with specific descriptive and functional characteristics of scientific models. As a result, and trying to meet the internationally realized needs for preschool education (KAMII & DE VRIES, 1978. CRAHAY & DELHAXHE, 1988), there have been researches on subjects such as gasification (RUSSELL, HARLEN & WATT, 1989. RAVANIS & BAGAKIS, 1998), light (RAVANIS, 1999. MENDOZA PÉREZ & LÓPEZ-TOSADO, 2000), electricity (SOLOMONIDOU & KAKANA, 2000), astronomical phenomena (SHARP, 1995. VALANIDES et al., 2000), magnetic properties (RAVANIS 1994), and biological phenomena (ZOGZA & PAPAMICHAEL, 2000).

Findings from all these projects have many things in common. In the reasoning of preschool age children we find a series of obstacles, which we have already known from researches concerning older students. Dealing with these obstacles can lead, under certain teaching conditions, to the construction of 'precursor models'. These are compatible with the scientific models since they are constructed on the basis of certain elements included in the scientific models, have a limited range of application and prepare children's thought (LEMEIGNAN & WEIL-BARAIS, 1993).

'These precursors are cognitive constructions (concepts, models, procedures, etc) generated by the educational context. They constitute the moulds for subsequent cognitive constructions that, without their help, would be difficult, or impossible' (WEIL-BARAIS, 2001).

On the one hand, in our research we tried to detect the cognitive obstacles of preschool age children and, on the other hand, to study the possibility of creating the conditions for the construction of a precursor model that deals with the phenomenon of flotation of solid objects in liquids.

The phenomenon of flotation / immersion of solid bodies in liquids is the objective mainly on preschool education level, because it is included in the usual activities concerning water. Most times, of course, activities concerning flotation only aim to enable children to sort various daily life objects in those that sink and those that float. These activities could lead to the construction of representations formed through a process of empirical abstraction (LEMEIGNAN & WEIL-BARAIS, 1993), such as the concepts of 'flotation' and 'immersion,' but they could not lead to suppositions about the reason why some bodies float while others sink.

A rough interpretation of the phenomenon of flotation / immersion could be based on two different conceptual frameworks. The first framework is connected with the comparison between the values of the forces of weight and buoyancy that act in the solid body. The second framework is connected with the comparison of densities of the solid body and the liquid, in which the body floats / sinks. The first conceptual framework is based on the abstract and mathematically based knowledge of the Newtonian Mechanics of the material point, while the second framework requires the definition of the concept of 'density' (or its close concept of 'specific weight'). On the one hand these two concepts do not represent the bodies themselves but the materials from which the different bodies are made and, on the other hand, they result from two other concepts: density results from the concepts of 'mass' and 'volume,' and the specific weight from the concepts of 'weight' and 'volume.'

Therefore, the question whether preschool age children are likely to build some precursor models, which explain the phenomenon of flotation / immersion of solid bodies in liquids, is posed. When PIAGET and his collaborators studied, from a developmental point of view, children's thoughts on the specific phenomenon, they came up with four phases in the explanations given by the children as regards the phenomenon of flotation of boats (PIAGET 1930/2001). During the first developmental phase, which finishes at about the age of 5, the reasons that explain flotation are of an animistic and moral nature. During the second phase, which extends from the age of 5 until the age of 6, children believe that boats float because they are heavy. However, at the third phase (6-8 years), children believe that boats float because they are light. At the fourth phase, around the age of 9, children begin to understand the actual connection between the weight of boats and the buoyancy of liquids. PIAGET, of course, remarks that the term 'heavy' is absolute and has the meaning of what the children conceive as hard to lift, while the term 'light' has the opposite meaning. In the same project, it is marked that preschool age children use the concepts of 'weight,' 'volume' and 'size' in the same way (big objects are heavy, small objects are light). PIAGET connects this reasoning with the development of the concept of specific weight and claims that this concept is not likely to be formed before the third developmental phase. More specifically, he notes:

'…to these three phases correspond three types of explanation concerning floating bodies. During the first (which corresponds to the first two of our phases), boats float because they are heavy. During the second, they float because they are light in the absolute sense, or because they are "lighter than water", i.e. lighter than the total mass of the water of the lake, etc. Finally, during a third phase (fourth phase), the boats float because they are "lighter than the water", this expression meaning lighter at equal volumes' (p. 161).

In other studies, PIAGET & INHELDER (1942/1974) come to similar conclusions about the relevant concept of density. During the formulation of the above reasoning, the lack of consistency from the children of the second and third phase should be pointed out (PIAGET 1930/2001).

These findings have been confirmed by more recent researches as well. However, these researches showed that children consider that factors such as cavities, holes and shape are connected with the ability of solid bodies to

float (PRAMLING & PRAMLING-SAMUELSON, 2001). The most important finding, however, appears to be connected with the supposition that preschool age children are likely to form a precursor model of density (or specific weight) without referring to the analogical model of 'density' / 'mass' / 'volume' (or 'specific weight' / 'weight' / 'volume'). Children between 4-5 years of age were asked to predict whether some geometrical objects, whose density, weight and volume regularly change, could float or not. KOHN (1993) realized that these children have some conception of density that allows them to make accurate predictions about the buoyancy of objects in water. Generalizing this outcome, KOHN (1993) claimed that

'it is plausible to argue that young children have a naive grasp of some higher-order concepts, an understanding that may be developed by attending to features of certain situations. If an experimental task allows children to draw regularities they have noticed (and the child understands what the experimenter is asking, the wording used etc), and the task has interesting, understandable consequences, then children may successfully solve problems whose solution depends on concepts that have appeared in the past to require formal, mathematical reasoning to be understood' (p. 1648).

In this case, the intuitive concept of density, which children use and directly connect with the material which constitutes the object, could be the central concept for the construction of a precursor, scientifically valid and descriptive model of the phenomenon of flotation / immersion, at the same time adapted to the cognitive possibilities of children of that age. The objective of our study presented in this paper is to realize whether and how preschool age children are able either to form in their mind a precursor model based on the perception of density or modify the usual representations of that age ('heavy bodies float, while light bodies sink' or vice versa) when they predict or describe the results of activities connected with the flotation or the immersion of geometrical solid bodies made from different materials in the water. As a result, this is a qualitative research aiming to detect and possibly transform representations of a limited number of children under special conditions. A teacher / experimenter asks then the children's predictions and leads them to carry out specific tests. As it becomes obvious in this qualitative process, the emphasis is placed on the opportunities of preschool age children and not on the statistical study of systematic processes of teaching interactions.

METHOD

Subjects

The study sample consisted of 20 preschool age children (13 girls and 7 boys), whose mean age was 5.6 years. The subjects were selected at random among the total number of 5-year-old children of a nursery school, from which some children, who were unwilling to participate, were excluded. None of the children had yet received any formal or informal instruction concerning the respective topics. The nursery school was in an urban area with a population of various socio-economic levels. Numbers 1-20 in the result analysis stand for the children of the sample.

Design

The experimental process was carried out at the end of the school year (in May) by the nursery teacher, who participated in the research team. The entire process was divided into two phases. In the first phase, the so-called 'preliminary,' which was carried out with the participation of all the children, there was a systematic preparation of children and all the essential conceptual clarifications were given to them. The main experimental process was carried out another day and that was the second phase. In a special and isolated place of the nursery school, the nursery teacher carried out individual interviews, whose duration was 10-15 minutes. All interviews were video-recorded and the material was later analyzed.

Materials

During the experimental process the nursery teacher used a glass transparent container, approximately 15 daily use objects from the nursery school (such as wooden and plastic little construction bricks, small toys – such as an iron little car, a plastic animal, a wooden house, a rubber pencil, a little ball and a stone), three cubes with an edge of 1 cm each and 3 more cubes with an edge of 3 cm, which were in pairs and were made from cork, wood and plaster. The wood used was so massive that the wooden cubes sank just like the plaster cubes, while the cork cubes floated. This choice enabled us to avoid the possibility of certain children knowing, from previous experiences, that wooden objects float.

Process and tasks

First Phase: the objective of this preliminary phase was to familiarize children with materials and their names and, mainly, make them understand and correctly use the terms 'floats' and 'sinks.' A group activity based on these objectives was then organized. At first, the nursery teacher presented the children with the glass container full of water as well as the 15 daily use objects, telling them that they will do an experiment to see what will happen when each of these objects falls into the water. More specifically, as the teacher was pointing to each object, she was asking the children to describe and predict what will happen to the container with the water. The expressions used by the children when they described the phenomena of flotation and immersion were recorded; at the same time, the correct terms were introduced and worked out. In this way, a framework of communication between the nursery teacher and the children was created regarding the use and the comprehension of both the above terms and relevant expressions such as 'sinks,' 'goes down,' 'sinks to the bottom', 'it touched down,' 'it is on the surface,' 'it is swimming,' and 'it didn't sink.' During this activity there were no discussions about the causes of the phenomena. When the children spontaneously formulated relevant reasoning or questions, the nursery teacher did not encourage further discussion. The six cubes were then presented and the children touched them with their hands, trying to guess the materials they were made from. In case they did not know the materials, they were asked to remember where they had previously seen such materials. Then the materials were presented and discussed. At this phase the objects were not tested in water.

Second Phase: The main experimental process as well as data collection was carried out during this second phase. At this phase, each subject participated in an individual session with the nursery teacher. At first, the nursery teacher invited the child to make predictions and then carry out together with the teacher a test in order to realize which cubes sink and which do not among the cubes examined the previous day. More specifically, in the introduction of the discussion the nursery teacher presented the child with the glass container full of water and asked the child to predict which cubes will sink and which will float. At the same time, she prompted the child to categorize the cubes according to their expected behavior in the water (she asked, for example, 'which objects of these do you believe will sink / immerse and which will float / remain on the surface' and 'divide them into objects that sink and objects that float'). Then the nursery teacher asked the child to justify their answer (for example, 'why do you think that they will sink?'). During the discussion the nursery teacher tried to clarify as many terms and expressions as possible. These terms and expressions mentioned by the child concerned the weight, the shape, the volume and the material, in order to exactly determine the kind of justification. The nursery teacher did not mention any of these terms unless the child used it. She was just posing suitable questions in order to give the child the opportunity to clarify their words.

Then the nursery teacher asked the child to have a try throwing the objects one by one into the container, in order to realize the precision of their predictions. At the final phase of the discussion the teacher once again asked the justification of the observed phenomena and this contradicted the prediction of the child (for example, 'what happened finally?', 'how many sank?', 'why did these sink and those didn't?'). This process allowed us to record both children's reasoning before and after the experiment and the possible development appearing in their justifications.

RESULTS

The qualitative analysis of the results, which is presented below, has two aspects. On the one hand, children's reasoning was recorded, formed and classified in categories. Typical answers of the children are also presented, just as they were formulated during the second phase of the research or in the introductive or the final period of the discussion. On the other hand, we attempt to keep up with changes in children's answers between the introductive and the final period of the second phase interview.

Children's Reasoning

Children's answers to the question why bodies sink or float present interesting differences. At first, some children's reasoning on flotation or immersion of bodies seems to be confused. No connection seems to exist between the concepts of immersion or flotation of bodies and some specific factor (such as the body's 'weight' or 'material'). For example, in the question '*why do you think the big piece of plaster and the big cork will float?*' we came up with answers such as '*because… I don't know,*' '*because… in this way... I think they will float,*' '*because… because… they will,*' '*because… because… eeehr… what's-its-name* (they mean plaster) *seems... seems that it will.*' In another case Constantina explains that '*most of them went down and these two went up.*' Nothing gives the impression that children that give such answers have any clear view of the problem posed to them. Their representations of the phenomenon are obviously confused and contradictory.

In other cases, the ideas of children seem to be connected with the factor of "bodies' weight," which is often with 'volume,' although children attribute to these concepts their own empirical-intuitive meanings. Therefore, in this framework, it is weight that makes bodies float or sink. However, the intuitive categories of 'light' and 'heavy,' do not seem to be clear as regards the categories of 'big' and 'small.' Thus, the big cubes will float because '*they are thick*' (Nikos), while small cubes sink because '*they are thin*.' When the experimenter asked what they mean by saying '*thick*,' the answer was (on second thoughts) '*big*.' In some cases, when such children attempted to categorize the objects they realized that float or sink, they referred to the weight: a body sank '*because it is heavier than these ones (the cubes that float).*' This is the case for the small piece of wood as well, which sank '*because it's heavy*.' Bodies that float do so because '*they are not heavy like these* (the sunken ones)'. This shows that there are children that discuss the weight and the volume of bodies as factors that determine immersion or flotation.

Different reasoning is connected with the weight of bodies as a factor determining immersion or flotation, though in a different way. Instead of referring to the volume of bodies, this reasoning is formulated in a way that could lead to the opinion that, after all, the decisive part of the reasoning that involves the 'weight' is the density of the material used each time. For example, when Dionysis categorized the bodies on the strength of their material, he realized that the cubes sink because '*they are heavier*,' while '*none*' of the other cubes '*is heavy*.' There is no reference to volume, which makes the difference from previous opinions referring to weight. When we study these children's justifications, we note that in their reasoning the reference to the bodies' kind, properties and composition plays a decisive role. Thus, '*these will sink because they are soft… because they are… these are not so heavy as to stay afloat…* (Andreas).' Bodies sink, '*because this is made from plaster and this is made from wood. That is, plaster and wood are the heaviest materials, while cork is the softest material*.' When the experimenter asked '*what do you mean by saying "soft,*" the answer was '*it is soft… it is not that strong*.' Later, and when the experimenter asked '*why do certain things sink, while others float?*' the answer was '*because they are the softest ones, because this one is "the most cork" and cork is soft*.' Therefore, there seems to be an implied reference to the density of bodies as a factor of immersion / flotation.

Finally, there were children that, in some cases, hesitated or even denied giving an answer, while in other cases their answer was '*I don't know*.'

When we attempted to categorize the entire range of children's reasoning, according to their answers, both in the initial period of the second phase of the experimental process and the final period, that is, their initial predictions and their final evaluations as well, we came up with the following categories:

1. *Precursor model, which connects either flotation or immersion with the bodies' material.* This category of reasoning refers to the factor 'material' of bodies, and is connected with the property of the body to 'resist' the liquid. Thus, a relation of objects that float with the concept of 'density' is created.
2. *Representations that connect flotation or immersion with weight or volume*. This category comprises the reasoning of children that used the intuitive categories of 'weight' and 'volume' as tools of interpreting various situations.
3. *Contradictory representations*. This category comprises the answers of children that did not use a fixed type of explanation but confused or contradictory representations.
4. *No answer*. Finally, there were children that did not answer but declared that '*they don't know*.'

The following Table 1 shows children's reasoning as it was recorded in both the introductive and the final period of the second phase of the experimental process as well as the incidence of relevant answers in the above periods. Each number corresponds to one subject of the sample. At the first phase, for example, child number 2 expressed contradictory representations, while at the final phase he or she had 'moved' to the category of children who believed that the factor 'material' was the decisive factor for the immersion or the flotation of bodies.

Here is being placed the table 1

Changes in Children's Reasoning

As we observe, several children's reasoning changed during the experimental process. Indeed, it appears that the denial or the confirmation of their initial predictions in combination with the empirical content of the experiments they carried out with different cubes, led children's thought either to rearrange or develop their reasoning. Thus, we attempted to study

Table 1.
Reasoning of subjects in the initial and the final period of the experimental process

	Introductive Period	*f*	Final period	*f*
Factor Material / Density	11	1	2, 4, 5, 11, 13, 20	6
Factor Weight / Volume	8, 9, 10, 15, 16, 19, 20	7	6, 7, 8, 9, 10, 15, 16, 17, 19	9
Contradictory Representations	1, 2, 3, 4, 5, 6, 12, 13, 17	9	1, 2, 12	3
No answer	7, 14, 18	3	14, 18	2

the possible changes in children's thought through a categorization based on the differences between the initial and the final reasoning. The categories are as follows:

1. *Construction of a precursor model, in which flotation or immersion is connected with the material*. This category includes the changes in children's representations. In the final period of the experimental process children connected flotation with the material, while in the initial phase they gave contradictory answers (subjects 2, 4, 5 and 13) or attributed flotation to the weight of the body (subject 20).
2. *Construction of a representation, in which flotation or immersion is connected with the weight or the volume*. This category includes the changes in children's representations. In the final period of the experimental process children connected flotation with the weight or the volume of the bodies, while in the initial phase they gave contradictory answers (subjects 6 and 17) or did not answer at all (subject 7).
3. *Immobility, that is, insistence in the initial reasoning*. This category includes the answers of children that both in the initial and the final period formulated reasoning of the same level. It is obvious that the satisfactory answer of subject 11 is included here. The answers of children that attributed flotation either to the weight or the volume (subjects 8, 9, 10, 15, 16, and 19), gave contradictory answers (subjects 1, 3, and 12) or did not answer at all (subjects 14, and 18) are all included here as well.

The following Table 2 shows the changes in children's reasoning between the initial and the final period of the second phase of the experimental process.

Here is being placed the table 2

Discussion

The results of this research seem to advocate the idea that children of ages between 5-6 years can build a precursor model as regards flotation or immersion of objects, which is based on an intuitive concept of density. As we realized in the presentation of the results, there were 5 children, that is, more than the one fourth of the sample that formed such a precursor model in their thought during the experimental process. Indeed, taking into account that a child already in the phase of the initial prediction considered material a factor connected with flotation, we could suppose that the orientation of an educational activity relative to the role of nature and/or the density of the material was effective even since the preschool age. Furthermore, we could plausibly argue that the results will be better in the case of a more systematic instructive intervention.

In our results, we should particularly point out a representation several children used, which concerned the problem of flotation of bodies and was based on intuitive approaches of the factors of 'weight' and 'volume.' A careful approach to children's answers led us to estimate that this is the

Table 2.
Changes in reasoning of subjects regarding immersion / flotation of bodies.

	Subjects	*f*
Precursor model	2, 4, 5, 13, 20	5
Representation weight/volume	6, 7, 17	3
Immobility	1, 3, 8, 9, 10, 11, 12, 14, 15, 16, 18, 19	12

basic type of reasoning. Indeed, before the experimental processes there were 7 children predicting that flotation depended on these factors, while after the experimental processes there were 9 children formulating a relevant reasoning. At the same time, it seemed that this representation was vivid enough in children's thoughts because only a child of this category was led to form a precursor model, while most of the rest, although after the test they described the situation better, explained their reasoning using a representation based on the weight or the volume. The adherence to such a representation led us to suppose that we had encountered an obstacle in children's thought (MARTINAND, 1986), which could be dealt through special instructive planning. Special planning is also required to deal with difficulties of children that hesitate or deny answering, and children that formulate contradictory reasoning.

However, in the research work we presented in this article, we realized that regardless of the type of representation a child uses, it is possible to exploit empirical data in order to form a precursor model concerning the flotation or the immersion of solid materials into liquids. This model is based on the material, that is, on an intuitive approach of density. The finding is compatible with several relevant researches we have carried out in the last decade. These researches have allowed us to study the formation of precursor models in preschool age children's thought. Although these models only allow simple causative correlations, they are scientifically compatible. As a result, we plan, carry out and evaluate relevant activities from Sciences, which apply to preschool age children, and we conduct them in the form of an individual or group instructive intervention and in the framework of Nursery School classes. Our research on the issue of flotation is now going in this direction, yet in differentiated educational conditions and using a greater number of solid and liquid materials than we have used in the present research.

BIBLIOGRAPHY

CRAHAY, M. & DELHAXHE, A., *Agir avec les rouleaux. Agir avec l'eau*, Labor, Bruxelles, 1988.

KAMII, C. & DE VRIES, R. *Physical Knowledge in preschool education: Implications of PIAGET's theory*, Prentice-Hall, Englewood Cliffs, NJ, 1978.

KOHN, A. S., Preschoolers' reasoning about Density: will it float? *Child Development*, **64**, 1637-1650, 1993.

LEMEIGNAN, G. & WEIL-BARAIS, A., *Construire des concepts en Physique*, Hachette, Paris, 1993.

MARTINAND, J.-L., *Connaître et transformer la matière*, Peter Lang, Berne, 1986.

MENDOZA PÉREZ, A. & LÓPEZ-TOSADO, V., «Light» conceptualisation in children aged between 6 and 9, *Journal of Science Education*, **1**[1], 26-29, 2000.

PIAGET, J., *The child's conception of physical causality*, Transaction Publishers, London, 1930/2001.

PIAGET, J. & INHELDER, B., *The child's construction of quantities*, Routledge & Kegan Paul, London, 1942/1974.

PRAMLING, N. & PRAMLING-SAMUELSON, I., It is floating "Cause there is a Hole": a young child's experience of natural science, *Early ?ears*, **21**[2], 139-149, 2001.

RAVANIS, K., The discovery of elementary magnetic properties in pre-school age. A qualitative and quantitative research within a piagetian framework, *European Early Childhood Education Research Journal*, **2**[2], 79-91, 1994.

RAVANIS, K., Représentations des élèves de l´école maternelle: le concept de lumière, *International Journal of Early Childhood*, **31**[1], 48-53, 1999.

RAVANIS, K. & BAGAKIS, G., Science education in kindergarten: sociocognitive perspective, *International Journal of Early Years Education*, **6**[3], 315-327, 1998.

RUSSELL, T. HARLEN, W. & WATT, D., 1989 Children's ideas about evaporation, *International Journal of Science Education*, **11**[6], 566-576, 1989.

SHARP, J., Children's astronomy: implications for curriculum developments at Key Stage 1 and the future of infant science in England and Wales, *International Journal of Early Years Education*, **3**[3], 17-49, 1995.

SOLOMONIDOU, C. & KAKANA, D.M., Preschool children's conceptions about the electric current and the functioning of electric appliances, *European Early Childhood Education Research Journal*, **8**[1], 95-111, 2000.

VALANIDES, N. GRITSI, F. KAMPEZA, M. & RAVANIS, K., Changing Pre-school children's conceptions of the day/night cycle, *International Journal of Early Years Education*, **8**[1], 27-39, 2000.

WEIL - BARAIS, A., Constructivist approaches and the teaching of science, *Prospects*, **31**[2], 187-196, 2001.

ZOGZA, V. & PAPAMICHAEL, Y., The development of the concept of alive by preschoolers through a cognitive conflict teaching intervention, *European Journal of Psychology of Education*, **15**[2], 191-205, 2000.

The project is supported by the "Programme Cognitique École & Sciences Cognitives" of the Ministère de la Recherche et de la Technologie (France). It title is: "Pratiques d'écriture et instrumentation du psychisme: approches psychologiques et didactiques" (Responsable scientifique: Annick Weil-Barais).

Received: 31.01.2003, **accepted:** 5.08.2003