

## **APPROACH TO THE CONCEPT OF SCALE IN THE EARLY YEARS OF PRIMARY EDUCATION. PRESENTATION OF A GAME TO WORK THIS CONCEPT FROM ACTIVE TEACHING**

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The main objective of the present paper is to introduce a didactic game designed in order to help the students of early years of primary education the understanding of the concept of scale. Understand this concept prepares them to the correct interpretation, in further years, of this conventionalism in plans and maps. Empirical research we have conducted on the effectiveness of this material, testing in schools in the city of Madrid, has shown a high degree of usefulness for teaching and learning the subject. The use of this material in the classroom has been done from active teaching, giving a central role to the ludic methodology, and has allowed the achievement of meaningful learning by the students from their previous ideas and conceptual representations.

Through its use in the classroom we can bring a conventional and abstract concept to the cognitive capacity of these students, their interests and their motivations. Understanding this concept requires a series of conceptual assumptions that students do not have, as well as the performance of some operations of abstraction at which children of this age -six and seven years old-fail. With this game we try to enrich and accelerate the processes of teaching and learning of the subject, focusing the work on three key factors: a) enhance logical thinking of children through the inductive method, b) do so by using the playful methodology, which has an important role in active learning as a strategy particularly suited to this age and d) increase the creativity of these students.

We start from the consideration that a very participatory strategy, especially suitable to work the concept of scale \_ with elementary students, especially with the smallest-is to do it from the idea of size (that they already know) establishing the parallelism between size and scale. This allows to introduce children to the theme from the beginning of the first cycle of this educational level and achieve positive results. The practical implementation of the game that we have carried out in different primary schools of Madrid has obtained these results. With the game we try to introduce children in the development of spatial

understanding linked to the concept of scale, using sizes, shapes and colours. Through the game, children must reproduce a series of images, which are initially present in real scale and then at different scales. Shapes, sizes and colours are combined in designs of objects with iconic format, with which children are very familiar, and in different abstract forms very attractive for these ages. The activities, which arise through the game, have been sequenced with increasing degree of difficulty, rigorously established. Ultimately, the goal is to bring the child to the concept of scale through a procedure that, while he enjoys, forces him to think and helps him to comprehend.

This paper is structured in four sections. The first is dedicated to reflection on the difficulties the students have with the interpretation of cartographic conventionalisms, especially with the scale. In the second we address the importance of carrying out the teaching and learning of the subject from active teaching, with special attention to the ludic methodology. In the third we describe the game cited above. Finally, in the fourth section, we explain briefly the essential aspects of the research that we have carried out with the game.

The child has the first formal contact with the map in the third year of primary school, starting the second cycle of this level of education, working in the area of "Knowledge of the Natural, Social and Cultural Environment" different contents related to the local environment. Psychological studies on the subject show that at that age (eight years) the child has begun the stage of concrete mental operations (ranging from seven to twelve years). It has also increased the capacity to understand spatiotemporal relations with some complexity. It is assumed that the child is able to undertake the interpretation and understanding of simple maps and spatial orientation concepts related to plans and maps. However, it is quite common that students have serious difficulties when starting to use these tools, resulting in poor learning. It is therefore necessary to carry out an approximation to this issue, prior to the work with maps.

Cartographic conventionalisms that have more difficulty to students are, undoubtedly, the relief represented by contour lines, representation on the maps of everything as seen from above, the interpretation of the shading and the concept of scale. In other occasions we have addressed this issue and have offered various didactic materials that we have designed, aimed to facilitate the understanding of the relief represented by contour lines and to palliate the blur generates in the smallest students "view from up" in the maps. In this paper we address the subject of the scale and offer teachers interested in this issue, a particularly useful teaching resource to facilitate their work and the work of his students in the teaching-learning process of this concept.

Classic studies on the subject (Piaget, 1973; Chateau, 1973; Vygotsky, 1979) indicate that very few children are able to understand the concept of scale under the age of eleven, and often do not master it before fourteen. However, it is considered that it is possible small children understand the principles of relationship involved in

the concept scale if they are introduced into this issue properly. Our research experience has shown that using specific educational games is a particularly ideal way for it. In these games the students play to be builders of different elements (houses, boats, trees, etc.). It is important to do it by vertical elevation, which should be compared with its graphical representation horizontally, in order to understand that the transposition of planes does not prevent the representation to be true to the reality represented. In fact, this representation will initially be the same size as the reality represented, and afterwards will be of different scales.

We consider it is very important to perform these kind of activities before students begin working with maps and plans, allowing them to visualize the relationship between reality and its scale representation in a simple way. Through these activities children can capture by their senses the mechanism through which a real three-dimensional object is represented in a flat shape and with different sizes. They perceive it in a vivential way, and this allows them to have their cognitive structures to understand, in due time, the abstract concept of scale. This will be done in the first years of primary education, to immediately initiate students in working with plans and maps. Fundamental studies such as Bailey (1981), Bale (1996), Holloway (1998) and Gardner (2003), among others, recommend that children must see maps from an early age, although this first contact will be made by working with plans and large-scale maps. It is also recommended to link these plans and maps with simple aerial photographs of the area or with pictures taken from buildings or high relief points. This allows the child to easily associate the vision of reality with its representation.

The game that we explain in this paper is designed from the perspective of active methodology, in which the student can not be considered as a mere recipient of developed content, but, on the contrary, he/she has to participate actively in the learning process, both through individual actions or through participation in group activities and implementation of joint projects. Active learning promotes in student the interest in understanding the world and the things, helps them to transfer the content of academic knowledge to real life and encourages the development of intrinsic motivation. This increases the personal desire to learn, the enjoyment of autonomous learning and interest in learning to learn. All these aspects are of crucial importance, especially when working with very young students, just starting out in the acquisition of habits and attitudes, since these attitudes will shape their ability and motivation to learn throughout their lives.

Active learning, based on meaningful learning, attaches importance to practical activities and learning through discovery. Both should be basic strategies in the teaching and learning of all curricular disciplines and at all levels of education, and, as noted by Garner (2002), are key to develop children's multiple intelligences.

On the issue that concerns us, the aim is the students be able to understand the basic concept of scale experientially through the game we present. It is designed to perform a battery of practical activities, rigorously designed from an educational point of view. Its implementation provides students the understanding of the concept of scale from the previous ideas that are related to it, which are specified in the preconception they have about the different sizes (large, medium, small) and that beings and objects have in real life. The game is composed of activities in which each student reaches learning by discovery in a gradual and personalized way, according to his/her ability to understand concepts. They learn through personal experience and they integrate what they learn in their own knowledge structure, using mental representation levels they have.

Active teaching grants a capital value to ludic methodology, especially when working with children, and we are becoming teachers and researchers who are convinced of the important role can play the game as a motivator of learning and of its usefulness for make more simple academic disciplines by connecting them with the interests and motivations of the students. Play, in its various expressions, is an innate craving in humans. That is, the play is intrinsically motivated. As noted Saegesser (1991, 38), "purely recreational activities are determined by internal variables reflecting general trends in the individual." The main variable is the tendency to search for novelty or neophilia. This trend is especially important in phylogenetically highly developed animals and opposes to neophobia, which is the characteristic of animals with a very poor behavioral repertoire. Consequently, higher animals have an innate tendency to explore the physical and social environment. This is especially pronounced in humans, who are not dedicated only to explore the physical and social environment, but also the symbolic environment".

As a result of the expertise that the individual acquires of the environment (physical, social and symbolic) as his life progresses, the interest he has for the play change as well as his conception of play. During childhood and adolescence play is the activity that interests and amuses the individual, while it constitutes a fundamental element for the development of their potentialities and for the configuration of his adult personality. "A child who do not know play, will be an adult who do not know think" (Chateau, 1973, 4). Through play the child acquires knowledge, develops skills, acquires skills, releases tension, develops creativity and spontaneity. The ludic activity plays a key role in cognitive and emotional development of the individual, and it is essential for socialization, both individual and collective".

Therefore we believe that "the great educational and motivator potential that play has, should not be ignored nor wasted by teachers, but, on the contrary, they should consider play as a key teaching resource, which if is used properly, and in combination with other activities, will allow students to learn through highly motivating situations. Through games, specifically designed according to the characteristics of the topic to be studied, it is possible to introduce positive stimuli in the class, attracting the interest of

students for those curricular contents, which necessarily have to address and, especially when contents are bored or especially difficult to assimilate "(Marrón Gaité, 1995, 81), as the concept of scale. From this perspective, we have designed the material presented, which facilitates learning the concept of scale through play.

The game that we report has been created thinking in cognitive ability of children in the first year of primary school from three key assumptions:

- 1) The need that exists to make easier to assimilate for a child between six and seven years old, the conventional and abstract concept of scale, which is included in a complex instrument: the map.
- 2) The active methodology is crucial to enhance the teaching-learning process of any academic discipline and to achieve meaningful learning.
- 3) Active teaching is a crucial resource methodology in ludic, especially when working with children, because the world of children is closely linked to play, and through it is easier to arouse their interest in the issues they should study in their curriculum and it is easier to motivate them positively to learning.

This is a didactic material for children between six and seven years old. Using this material in the classroom, the students can improve their logical reasoning and their abstraction capabilities, which facilitate the understanding of the concept of scale, through the link to the concept of size and by using shapes and basic colours. Using this material children can achieve the full conceptual and formal concatenation between the way these children have to work at the beginning of primary education and how they do it at the end of the next level. This results in a perfect adaptation of children to new ways of assimilating the content they must know to get started in understanding the concept of scale. Hence, the material should start to be used at six years, although until eight or nine the child does not hear the term scale, which was phased in, initially, only subliminally.

The learning objectives that students should acquire are:

- Be able to perform different constructions with vertical elevation and identify them with its graphical representation horizontally at different sizes.
- Relate the concept of scale with the concept of size, because the knowledge that children have about the concept of size helps them to understand the concept of scale. The aim is to support new content related to the scale on the cognitive structures linked to it, in order to advance in their understanding.
- Understand that scale reproduction of beings, objects, abstract forms or real territories by various methods corresponding to the representation of these realities with sizes increased or decreased proportionately, without affecting the accuracy of the information.
- Getting to graph various spatial realities at different sizes.

- Develop the ability to understand the abstractions related to this topic through sensory experience.

To achieve these objectives, the activities will be conducted through play, with the slogan "playing with the scale", so that the children perceive them as rewarding tasks, highly motivating. Activities can be done individually or in teams, so that collaboration among members of the group promotes cooperative and solidarity learning. With this idea we design the research we have conducted for the validation of this game. This research showed that:

- 1) The students in the experimental group understand better and faster than students in the control group the principles of relationship that are included in the concept of scale.
- 2) These students learned with a much higher level of motivation than the control group, because doing so through playful activities was highly rewarding.
- 3) The teachers who participated in the research found that this material is a valuable tool to optimize teaching of this topic.