# Leisure as a tool for learning sciences

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**Abstract**

Several investigations has shown that the active participation of the individual concept`s formation is relevant in ones learning process; the different points of view based on constructivism which make them explicit. It this document it is shown how, from three activities, that motivates the interest of the pupils, it becomes noticeable improvements in their physics´ learned concepts. In this particular case concepts related to Inertia, Atmospheric Pressure and Flow. So, it is presented in the document the recreational continuity in the learning process of science. The results are from the experienced process made with First years Students from the department of the School of: Physics, Biology and the Art´s School, during the second Period (semester) of the year 2010 and First Period, (semester) of the year 2011, in the University Distichal Francisco José de Caldas. Bogota, Colombia.

**Keywords:** Physics education, teacher training, teaching methods, experimental demonstration.

**Resumen**

Diversas investigaciones han venido mostrando que la participación activa del sujeto en la formación de conceptos es relevante en el aprendizaje; los enfoques basados en el constructivismo lo explicitan. En el presente documento se muestra, como a partir de tres actividades, que motivan el interés de los estudiantes, se evidencian avances significativos en el aprendizaje de conceptos físicos, en este caso relacionados con inercia, presión atmosférica y continuidad. De esta manera se muestra el papel de la lúdica en los procesos de aprendizaje de las ciencias. Los resultados surgen a partir de la experiencia realizada con estudiantes de primer semestre de las carreras Licenciatura en Física y Biología, durante el segundo semestre del año 2010 y primer semestre del 2011, en la Universidad Distrital Francisco José de Caldas. Bogotá, Colombia.

**Palabras claves:** Física educativa, enseñanza y aprendizaje, métodos de enseñanza, demostraciones experimentales.

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## I. INTRODUCTION

A problematic recognized in the teaching of sciences of education is the search of methodological strategies that overcome the traditional vision of the science and favor motivating, active, inquiring and reflective learning. In this sense, it is tackled here, a strategy centered on the use of playful activities, based on the problematic-communicative-experimental approach. Activity in which there appears a physical situation that motivates and generates imbalance, by means of the initial question of the type: What happens if…? This allows explaining the work's hypotheses that the student has before realizing the experimental situation, according with [1]. The activity involves mental, emotional and manual interactivities [2], it is centered on processes and phenomena and not on approaches as it usually focuses the physics education. Some authors pointed out that this method another type of similar activities, they correspond to the discrepant experiments, which it consists of an assembly that, on having driven it, shows an impact phenomenon counter intuitively for the student [3].

There appear some of the results reached in an activity realized with sixty students of the first semester from the bachelors in Physics and Biology. It is claimed, to demonstrate the implications and didactic possibilities of these activities in learning of the sciences, as well as its epistemological interpretations.

The situations tackled in the activity are centered on the construction of the explanations about a certain phenomenon and on the contrast of these explanations both with the observed phenomenon and with the explanations given by the science. The following stages are realized:

- Explicit previous ideas: The situation to treat appears. Here the student writes his ideas, perceptions and possible explanations to the question.

- Experimental achievement of the situation: From simple experiments, the presented situation is executed. Here, the student observes and takes part in the achievement of the experiment.
- Contrasting the observed phenomenon: Conceptual models are written to the phenomenon observed contrasting with the ideas and initial perceptions.
- Socialization and agreement of common points: It is exhibited, is debated, is joined to others and an explanation is prepared. Questions, guesswork appear, discrepancies and points are identified together.
- Questions construction: All knowledge arises like answer to a question and needs a conceptual change [4].

The situations tackled during the achievement of the activity are the following ones:

**A. Situation 1:** On a table a glass is placed on a pasteboard piece and it is placed above an empty soda can and as final part of the arrangement gets ready of a ball. Achieving balance conditions in the system. The following question appears: What will happen with the ball, if one gives a horizontal strong blow to the pasteboard?

**B. Situation 2:** It uses an empty soda can and little water is added to it (in a sixth part to its entire volume), it approaches the fire supporting it while the liquid there suppressed reaches the boiling point. Immediately afterwards it moves back from the fire, with a rapid movement it is turned (in such a way that the hole of the soda can stays down) and it submerges in a receptacle with water. What do you consider that it will happen to the can?

**C. Situation 3:** There is used a glass-blower, which has a hose in whose end fixes a funnel. If a ball is located on the funnel on having connected the glass-blower (it is possible to have balls of different sizes and weight): What will happen to the ball in the following situations: When the ball is placed on the funnel? When being in the previous situation the funnel is invested?

The aspects on which there were done emphasis on the development of the activity are presented: a) importance of the observation, like aspect that forms the built character of the phenomenon; b) importance of the hypothesis in the explanation of previous ideas and in the construction of explanations of the phenomenon; c) the possibility of contrasting of ideas, in two moments of the activity: "before", and "after"; d) importance of the group work, like aspect that allows comparing the right explanations among partners and with the accepted ones by the science; e) construction of questions, like aspect that makes the concepts construction possible.

## II. RESULTS

**A.** Results to Situation 1:

Initial moment: What will happen with the ball if one gives a horizontal strong blow to the pasteboard? The majority Answer was: the Ball falls down out of the glass.

Moment two: As soon as the situation was done, the great majority of answers were: "The Ball falls down inside “if the blow is powerful enough and the friction is little”, “on having exercised a horizontal force to the pasteboard, it would go out of its original rest and would lose the balance inertial conditions, but, on having the can a system of different reference, the can would remain in rest and hence when the pasteboard is moved the can would fall down inside the receptacle”.

Results when putting together: The majority answer is: "the ball falls down inside the can”. The conditions that, according to the students, must happen in order to obtain possible successfully arrangement are mostly: "That the surface of the pasteboard is smooth, from the speed of the blow and, the force that is applied to the pasteboard, The force that is printed on the pasteboard must be very fast, in case that the blow is dry, does not have too much force, there must be a greater force than the one that exists between the pasteboard and the can at the moment of balance, The force with which the pasteboard was struck has to be quite strong so that the force of static friction is the possible minor thing”

**B.** Results to Situation 2:

Initial moment; what do you believe that will happen to the can? The most frequent answer was: "The can is compressed”.

Moment two: As soon as the situation was realized, the great majority of answers were “The sudden change of temperature, provoked that the can was compressed“. “The pressure exercised by the liquid compresses the fluid inside”, “The can contracts, because the can warms up, just as the water that is inside”, “The can is compressed because of the pressure that will interact on the can”, “It wrinkles due to the pressure and at the rate of temperature”.

Results on putting together: The majority answer is: "the can is compressed”. The common points of view are: "A shock happens for the pressures difference, since the atmospheric pressure is much bigger than the one that was inside the can”, “The air, that is warm turns into steam, and occupies more space, when putting it on cold water, the steam returned to its liquid state occupying minor space and consequently the external pressure compressed the can”, when changing the form of the state of the water contained in the can, it is compressed or exploits depending its temperature”, In the can it operates a pressure, which does that the particles are compressed, doing that the pressure disappears quickly from water effects”.

**C.** Results to Situation 3:

Initial moment: What will happen to the ball when it is placed on the funnel? The majority answers were: "The ball will be supported floating, if it turns round it will fall down”. “The ball might levitate for the pressure of the air or if the ball has weight too much it does not levitate, if it turns round it will fall down, it owes to the weight and to the gravity”, “The glass-blower has air expulsion system, then when it is put in vertical position up the ball will float while it is supported and when it is put in vertical down, the ball will go away towards the soil, since the expulsion of the air helps the gravitational acceleration”.

Moment two: As soon as the situation was realized, the majority answers were: "There happened something completely opposite to the one that was expected, the ball supported inside the funnel after ignition the glass-blower and when it was inverted, it was still equal".

Results from putting together: The majority answer once made the first and the second stage of the situation is: "the ball does not fall down". The points together are: "The ball does not fall down for an air mattress", "The ball is surrounded by an air current that makes a pressure towards the ball and does not allow it to move", "when placing the ball in the top part of the mouthpiece of the glass-blower, the ball tends to turn. When we take the mouthpiece in direction down, the ball does not fall down keeps on turning. Why does this happen?".

## III. RESULTS ANALYSIS

It is possible to conclude, that the explanations given by the students in two moments: earlier and after the experimental situation are of descriptive, qualitative and causal character. The beginners construct descriptive models of the problem and they are concrete and specific, while the experts create conceptual models and are more abstract, in accordance with [5].

What it shows, on the one hand, that the notion of science that prevails is of traditional character, and on the other hand, that the notion of observation, hypothesis and contrasting of ideas plays a secondary role in learning, prevailing the memorizing concepts without daily referent neither experimental.

It was observed, that there is considerable the number of students who use terminologies to give explanations without knowing the concepts. The same form difficulties were demonstrated on having written the previous ideas, the student is not used to questioning, to constructing explanations, is more acquainted in spite of repeating.

The following methodological and epistemological aspects are highlighted in the achievement of the activities:

**a)** Role of the observation: The importance of the observation becomes notable in the achievement of three activities, understanding the observation as "observation loaded with theory". It was tackled by the students, the fact that, "observing" is not enough to interpret and to explain a phenomenon, since it is observed from the theory, and has an often tendency to understand the observation as a simple act of looking. Nevertheless, it is necessary to explain that any observation is influenced by the previous knowledge.

**b)** Importance of the hypotheses: The hypothesis allows explaining the previous knowledge. Learning depends on the previous knowledge [6]. The built knowledge integrates to the already well-known thing (conceptual schemes) into a double sense: the new knowledge is determined by the already existing knowledge and simultaneously it restructures this previous knowledge.

**c)** Possibility of contrasting of ideas: It is demonstrated that the explanations constructed at individual and group level are descriptive.

**d)** Increase of the work in group: The realized activity promoted the work in group, at the moment of the putting points of view together, there was favored the argumentation of the hypotheses and the observation of the phenomenon. What favors the understanding, the generation of questions.

**e)** Questions construction: In the inquiring phase, the students formulated more and more concrete problems and realized experimental designs for contrasting, which proved to be motivating, that contributes to the procedural change; this often prefigures the outstanding features that stand out in the phenomenon [7], and the observation like a process that includes the experimentation from a particular context, articulated with the theories making the possible construction of problematic and of explanatory models.

## IV. CONCLUSIONS

The showed results reflect the multiple ways of conceiving the phenomenon, the relations between the different conceptual elements that support the phenomenon, the difference between the explanation done from the sciences and the one done by the student, the joint between the observation and the representation.

The achievement of these activities allowed increasing the motivation of the students in front of the study of science phenomena. This aspect that was demonstrated in the increasing interest of the groups, for defining what was the reason of the happened in the experience, since in most cases, particularly in the situation 3 the observed experimentally, was not agreeing with the predicted thing initially for them.

The students showed a high satisfaction level with the activities. Between the causes of answering are: the dynamic and entertaining character that can be given to the fact of learning, greater integration, promotes a more entertaining and different way of studying, encourages to study more and gives possibility of confirming the learned, changes the monotony of the classes. Most of the participants asked that more activities of this kind will be done.

The use of activities based from this perspective can help to a better comprehension of the nature of the science and with it an education and learning of the science to contribute positively to the citizen participation.

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