A Study of Case concerning the Models of Vision

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Abstract

This work reports on a study that was designed to investigate teaching interventions, starting from high school students' misconceptions about vision and light propagation concepts. A standard test was applied to detect these misconceptions and its results obtained were discriminated in categories as a threshold for the organization of teaching. These categories were formulated analogously to the models created in the History (eye, light bath, intermediate and scientific ones). The intervention was elaborated assuming the strategy of conflict or instability of cognitive nature, carried out through debates of open problematic situations. The results acquired after post-testing evaluation reveal that this methodology is quite advantageous owing the confirmation of successful retention learning, through the annihilation of misconceptions and the belief in the scientific model.

1. Introduction

The influence of the students' of Medium Teaching spontaneous conceptions, as an obstacle in the construction of the correct entail between light and vision, it is analyzed here. A standard test of pencil and paper, elaborated by Harres [1] to detect the students' pre-conceptions concerning introductory topics of Optical Geometric, it was used and the obtained results were discriminated in categories with the objective of providing an adapted procedure of teaching that embraced situations of cognitive conflict.

The thematic regarding the conceptualization of the phenomenon of propagation of the light should be approached using resources as the experimentation and the argument. The found difficulties are due to the student's sensorial perception that defines its spontaneous conceptions and distant the same of the scientific model historically built and socially accept.

The construction of the knowledge is reached starting from observations of the daily and of experiences to motivate or of interactions. The evolution of the spontaneous conceptions happens as such interactions and experiences facilitate new reflection disseminating a driven conceptual change.

To operate this intended change, the generation of the cognitive conflict it was implemented through the debate of open problematic situations, initially in small groups and, after this, with the whole group. Such procedure is justified for the natural impact suffered by the student when verifying that its intuitions are not in consonance with the positioning of its pairs [2]. a habit doesn't exist, on the part of the students, of formulating reflections related to the natural phenomenon to its turn and, consequently, he/she/it is not motivated to learn Physics and to overcome the existent trivial difficulties in the solution of problems.

2. Procedures

The interventions applied in class room had the double intent of to comment and to discuss ideas directly related to the resolution of problems and of stimulating the student to a larger inquiry concerning the problems to him proposed. Show to its student intuitive ideas and to establish a I confront of these with the result of a problem and of an experience he/she considers its relevance in the verification for the same that some of its ideas are inefficient to interpret certain situations. The result, as it emphasizes Solis Villa [3] it can be the dissatisfaction and trust lack in its intuitive conceptual outline that this way it will give, facilitating the conceptual change and the change of attitudes in the face of the solution of problems.

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Initially, the student answers the test writing with subjects of multiple choice. To proceed he takes place the pertinent experience to the situation problem and a wide discussion is promoted (the student then can be verified its predictions they agree or not with the result of the experience and to expose its ideas). The final stage involves the quantitative resolution of the problem with the appropriate formalism.
This procedure was followed in class room constituting a study exploratory preliminary, being applied later on to a larger sample of students. Based on the frequency of answers in according with a certain vision model, the surprise can be foreseen when, after happening the debate in small groups and the exhibition to several problematic situations they discovered the flaws of its pre-conceptions.
The quantitative resolution of the problem supplies additional elements, in the cases in that is applicable.
The knowledge lifted in the pre-test allowed that quickly could know which was the logical-causal structure contained in each answer of the students' group. Not only to improve our sensibility as we chose the appropriate intervention procedure to the form of thinking of the adolescent. For we plan our action in class room, we used strategies in which the students could not only improved its ideas, but also interaction to improve them or to alter them, in function of the divergence of opinions.
We cracked of the hypothesis that the mechanism of passage of an initial mental outline for an elaborated thought structure of the rational point of view, gives him for the construction of a contradiction of the same with other reflections originating from of the real experience.
The next step went present to the students' group the answers obtained without the its authors' mention, feeding a discussion in panel attempts the consent lack and of coherence among the formulated hypotheses.
The students' spontaneous grouping is not a limit for the appearance of conflicts, once for sampling reasonably big, the heterogeneity is latent.
The teacher's intervention was limited the concerning the formulated subjects, always seeking in any moment to fan its personal hypotheses, abandoning like this the superior hierarchical posture associated to teacher's paper. The most important in its intervention went explicit contradictory reflections to the hypothesis defended by the group, delegating to this its explanation.
This whole process reached the restructure objective the students' spontaneous conceptions and to raise the curiosity for a better explanation, more coherent.
The search for the cognitive re-equilibrium motivated an analysis of the historical evolution of the involved concepts and its analogy, at least partly, with the students' pre-conceptions, pointing out its flaws and driving for the social scientific model and culturally I accept.
To verify the adaptation of the intervention drifted to generate the cognitive conflict and the re-planning of future interventions. The theory psycogenectic of Piaget supplies us guidelines to establish apprenticeships that each subject should pass in the elaboration of its knowledge on a certain concept, besides allowing to know which the differences and succession mechanisms among these stages, what went decisive for to unbalance occurrence, very matter and addressed. Such unbalance is based in the existent contradiction in the elaboration of the structured explanations causal better gradate.
The unbalance created the need of the formulation of another hypotheses capable to explain the concepts, including the contradictions, that become nonexistent for its adoption. In the choice of the situation-problem we had the care of selecting those that only facilitated an unquestionable solution being been worth of the scientific model. Besides, such situations converge for a larger inclusion of the luminous phenomenon.
To define clear and in fact a concept doesn't guarantee its learning in an appropriate way, except if this definition be engendered in a dissatisfaction context with the pre-existent structure.
The re-equilibrium situation is looked for modifying the structures previously mentioned and re-elaboration the same in an own rhythm until the acquisition of the new concept.

References

[1] Harres, J. B. S., " A Test to Detect Alternative Conceptions on Introductory Topics of Optical Geometric ", Cad. Cat. Ens. Fís. 10, 220 (1993).
[2] Peduzzi, L. O. Q., " Solution of Problems and Intuitive " Concepts, Cad. Cat. Ens. Fís. 4, 17 (1987).
[3] Solis Villa, R., Intuitive " Ideas y Aprendizage of las Sciences ", Enseñanza of las Science, 2, 83 (1994).