PHYSICS AND MATHEMATICS AS INTERRELATED FIELDS OF THOUGHT DEVELOPMENT

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Students of all ages struggle with Physics not only due to the complexities of the subject, but also due to inadequacies with their skills and knowledge of Mathematics. Mathematics is the "language" of Physics and it is clear that the learning problems of students in Mathematics are transferred to the learning environment in Physics. Lecturers and teachers in Physics consume hours of teaching/learning time to "redo" the Mathematics required to describe physical phenomena. Internationally it is common to find courses such as "Mathematics for Scientists and Engineers" as part of curricula in Physics, since Physics teachers feel that they are in a better position to teach the Mathematics required for their courses. It is proposed that the learning environment in Physics in particular and Science in general, could be much more effectively structured when Physics/Science and Mathematics are considered as interrelated fields of thought development.

Concept formation in the physical sciences depend heavily on two aspects namely a (1) suitable context in which the physical phenomenon takes place and (2) an accessible language in which to comprehend and express these physical phenomenon. One of the criteria for a suitable context would have to be that it is accessible from the real world in which the child/student finds him or herself at that moment as well as that the concepts (e.g. length) within the context, adhere to the psychological (cognitive) structures which the child/student has available at that moment. The context must also be utilised in such a way so that the child/student is exposed to a multitude of interactions in order to prevent him/her from forming so called limiting constructions. The teaching of the physical sciences at school level (secondary or primary) presupposes that some basic building blocks (e.g. position, length, direction, etc.) are in place. By the time the child reaches high school the endeavour is to develop scientific concepts that are already a combination (e.g. velocity, acceleration, etc) of the basic building blocks. The majority of these scientific concepts have their foundation in mathematical sub-structures (magnitude, space, time etc) that the child encounters from his first day of formal schooling (and long before that from birth).

We would like to propose a model that reflects the complexity of this interaction between mathematics and physics with the endeavour to assist in the design of appropriate materials and activities for the development of specific scientific concepts using acceleration as an example.