

Physics: An Endangered Subject?

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Many physics teachers agree that we need to teach physics to more of our students. Although a large number of secondary science students survive their less-than-perfect education in Forms 1-5 with their taste and talent for physics intact, many of those initially interested in physics do not pursue it at the sixth form level. Sixth form science teachers are expressing great concern about the decreasing numbers of students choosing to pursue physics at that level. Despite the deep interest expressed by science students in the lower forms, fewer and fewer of them seem to be willing to venture into the world of upper secondary physics. We are therefore being faced with a crisis in physics education and so far no explanations have been forthcoming for this situation. Why is a discipline that is so intellectually stimulating, so practically oriented, and so interesting not attracting more students?

An answer to this question might be more readily apparent if we first address two other important questions: What exactly is being done in the physics classroom? Is what is being done in the physics classroom meeting students' expectations and gaining their approval?

From my experience as a physics student, I remember my non-physics peers describing physics classes as intriguing and captivating and perceiving it as a field that only few were qualified to enter. Difficult and complex ideas and concepts were taught in the physics classroom and only the brightest students were found there. It was an honour to be in the physics class because teachers and peers held one in high esteem.

But, for me, physics classes were dull and boring. Everyone in the class looked tired and no one seemed particularly excited about the course. Physics classes proceeded mostly via one-way communication from teacher to student. Many definitions and formulas were given, sparse bits of notes were hurriedly dictated, and answers to numerical problems consisted of teacher-centred blackboard solutions and not of any interesting or inspiring exchange of ideas. No real opportunities were presented for students to ask questions, and on the few occasions when this did happen the "how" questions met with brief explanations but the "why" questions were usually not answered. There seemed to be an unspoken understanding that students were expected to learn primarily by reading the text and secondly by doing problems on their own, mimicking the teacher's examples.

Students' opinions were not really valued, especially since there was only one right answer. The physics teacher was the dispenser of all knowledge--the omniscient expert--and students were passive recipients. There was a general lack of community and interchange between teacher and students--no sharing, no helping, and no support. Students were so afraid of expressing themselves in class that even though they were confused at times they sat quietly, robotically following instructions, and only clarified their misconceptions, independently, some time after class.

My personal experiences as well as information I have gathered through close interaction with physics teachers and students suggest that most upper secondary physics students feel that physics classes do not provide them with a warm, welcoming, and accommodating atmosphere. The activities that take place in these classrooms and the methods employed are rarely student-centred or interactive and do not keep students actively engaged in learning physics. Today, many physics classes are conducted exactly as they were ten years ago. Even though pedagogical knowledge about the inquiry and discovery approach to teaching physics abounds, physics teachers are still using the same unmodified modes of transmission. While many arguments and suggestions have been presented to physics teachers about the need to develop and implement new, creative, and innovative ways (using multiple intelligence theory, creative arts, and the general constructivist approach) of teaching subject specializations, it is the physics students who are trying new things.

They appear to be no longer interested in pursuing a subject where the mode of delivery and the methods of instruction are restrictive, regimented, and unappealing. They prefer to venture into other areas of study; areas that employ methods and strategies that allow for multidimensional modes of communication, a true sharing of knowledge, and real opportunities to learn through self-expression as well as inquiry and discovery. Many upper secondary students have expressed strong negative sentiments about the characteristics of the physics class. In some cases they have moved into the other areas of study, sacrificing their thirst for physics by pursuing other areas of science such as chemistry or biology. However, in many cases these students have chosen to settle for an altogether entirely new discipline.

In order to arrest the decline in popularity of physics, our physics teachers need to seriously rethink the way they deliver the curriculum. They need to move away from the belief that physics is only for the elite few who are mathematically inclined, that it is difficult, and that it is not their job to make it easier. By adopting the old “dull and distant” teaching and learning strategies they are only succeeding in making the subject appear to be more difficult to the extent of driving students away from it. Physics classes need to be more inviting for those students who may have a genuine curiosity but who may not choose to become physicists. They need to be more interactive so that students can truly have a voice in the classroom. This will ensure that learning becomes student-guided instead of teacher-dominated. These classrooms, like all others, should be places where students feel free to express themselves in light of their prior experiences, so that learning can occur by fitting new knowledge into pre-existing cognitive structures. Students should also be provided with opportunities to experiment, investigate, challenge, dispute, and discover through extensive peer collaboration and effective teacher facilitation.

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