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Science Education in a Restructured Sixth Form

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I wish to share with you some reflections on the recently introduced changes to the sixth form curriculum. These reflections are not based on empirical data (it's still early days for the new system) but rather they derive, if you will, from an application of first principles to the recent experiment in pre-university education.

The 2 Advanced level plus 3 Intermediate level subjects plus Systems of Knowledge system has, potentially, two types of impact on the science education picture in Malta: a positive impact, because now all sixth form students will be taking some science (albeit at 'I' level); and a negative impact, because students in the science streams will suffer a loss of one science subject at 'A' level in exchange for one 'I' level science and two 'I' level arts subjects.

I think the teaching of arts subjects, and particularly that of English language, to science students will have a salutary effect on the latter's ability to communicate better and more elegantly than at present, even and especially in matters of a scientific nature.

On the other hand, the reduction in background content, equivalent to 2/3 of that of an advanced matriculation science subject, will have to be addressed by the various faculties (e.g. medicine, engineering, architecture and science) who offer courses to such scientific matriculates. The general entry requirements to university have been modified in order to take account of these curricular changes. However, as far as I know, the various faculties whose study programmes may be affected by this science content reduction have not been formally alerted and requested to harmonize course contents with the requirements of their future students.

How does the syllabus content of an 'I' level science subject compare with that of the corresponding syllabus at 'A' level? I was involved, with others, in the drawing up of the 'I' level syllabus for chemistry and I wish to share some of the problems that we had in that area: I suspect that colleagues in other science subjects had similar experiences.

There was the problem imposed by the time available for teaching the course programme: 2 hours per week for about 60 weeks over a period of 2 years: i.e. a total of 120 hours of course work. Compare this with the time available for teaching 'A' level chemistry, which is 360 hours and that for 'SEC' level chemistry which is about 270 hours. This constraint had a number of repercussions. Firstly, we were obliged to kickstart the course at a point equivalent to that of a completed 'SEC' chemistry programme. Yet, I am informed that students are allowed to follow 'I' chemistry even when they have no 'SEC' chemistry background. Almost certainly, this is going to create a lot of difficulty for these students and, in my view, it would have been wiser to disallow students such a choice.

Secondly, in view of the limited time afforded to teaching the subject, we could not allot time to any laboratory instruction. So while exhorting teachers to use laboratory demonstrations as often as they could, we did not formally request them to organize a practical component for the course. A similar decision was taken by the syllabus setters for physics, biology and environmental science. Incidentally, these panels were not acting in concert and this same conclusion was arrived at in an independent manner.

Thus, a situation developed where all 'I' level science programmes were shorn of their practical component, and this in sharp contrast with corresponding teaching programmes at 'A' and 'SEC' level. To my mind, this situation has automatically impoverished the quality of the learning experience for intermediate level science students. Of course, there was the advantage for the school administrations, that, in this manner, the syllabus was easier and cheaper to teach. Indeed, in retrospect, I wonder what would have happened had we decided to establish a practical component in the course. Was the problem of laboratory provision for all students at sixth form considered when the decision to start 'I' level sciences was taken? Or did this minor detail escape the attention of the planners?

Another problem which has also emerged and which should have been highly predictable at the planning stage, concerns the question of textbook availability.

In chemistry, the course was designed to cover a similar width of subject area as that covered by the advanced level course but each area was to be developed to a lesser extent. In other words, we reduced the course content in depth but not in breadth. I guess this was conditioned by the desire on our part to ensure that no major areas of the 'A' level syllabus remained completely unvisited especially since we perceived most of the 'A' level topics as being of fundamental importance to higher studies at university.

Now, of course, while a few good texts exist for both the 'A' level and the 'SEC' level courses, these being similar to corresponding courses in British schools, no texts are specifically designed for our home-grown 'I' level course. Teachers will, no doubt, manage this problem by employing the current 'A' level texts and advising students to use them judiciously, i.e. to skirt around certain topics, to leave out some chapters completely and so on. Clearly, this is not an ideal situation.

Future syllabus setters might consider to steer clear of the current course content structure and to adopt an approach similar to that followed by North American textbooks designed for the freshman year at US universities. The main advantage in this approach would be that many superb texts exist for such a programme. However, the linkage of such a syllabus with that of 'SEC' chemistry may not be completely congruent.

Similar problems are likely to exist for the other 'I' level sciences although rather than discuss these here I want to end my brief contribution with a few words about the new subject introduced at (and only at) 'I' level, namely environmental science. More to the point, I will focus on the manner in which this new science subject was born to the curriculum.

It is my understanding that environmental science is currently being touted as the likely most popular science choice for the arts stream at the sixth form college. Presumably, students will choose environmental science either because this is perceived as the softest option in science or, more appropriately, because they will wisely decide to stay clear of 'I' chemistry or 'I' biology because of a lack of 'SEC' background in these subjects.

Students should not choose environmental science or any other subject by default. If the cultural base of the nonscientific sixth former is to be enriched with some science, and this is a very good thing, I do not know if environmental science is the best vehicle to use for such enrichment. And having chaired the syllabus panel set up to produce a first syllabus for the subject, please note that I am not making this statement lightly.

Indeed, one could reasonably argue that a study programme consisting of selected topics from the various scientific disciplines and connected by a common theme could well provide a better medium for teaching science to the nonscience major at sixth form. Moreover, other approaches suggest themselves.

But, then, it is not my intention here to evaluate the merits of these different approaches.

Rather, since we are discussing *"planning for the future"*, I feel that it would be better for me to use this very recent experience as an object lesson in *"how not to plan curriculum changes in future"*.

To my mind, such an important decision as to what type of science should be taught to pre-university nonscientists should have been taken after substantial discussion with the various players in the educational field. Not least, one should have involved practitioners and teachers of science. There is no evidence to suggest that the matter was discussed at all outside of a tight circle of persons, who, needless to say, were apparently more concerned with the overall picture than the nitty gritty details of its component bits. After all, the nitty gritty could always be sorted out later, somehow.

Even as we bemoan the manner in which, in the past, physics was imposed on the system as the science subject for the secondary school masses, we, today, see similar impositions being inflicted on the post-secondary science sector with the same abandon and apparent relish as in the past.

I plead with the decision-takers of this land: please inform your minds before you make them up. Look before you leap. The context of any decision should consist of a set of options each of which is accompanied by attendant repercussions and these have to be thought through and agonized over, if need be, before any conclusion is arrived at.

I do not think that all the implications of the recent curricular changes for an ostensibly better sixth form were scrutinized quite in this manner.

At this point one counsels patience and perseverance with the new system. In the spirit of science, we should observe the new model, give it time to produce results and after due process and in the light of the data gathered, modify the model with caution, respect and a great love for the student body of the coming century. It is their necks that risk getting broken if we do not look before we leap.