Cart before the horse? Curriculum and the quantity/quality trade-off: The case of secondary school science in PNG

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Educational quality requires not only adequate physical and human resources (Varghese, 1993), but a functional congruence between these and curriculum. Curricular innovations can be expected to succeed only in an environment of teacher subject competence and appropriate methodology training, and an adequacy of physical facilities and equipment. In practice, curricular reforms in developing countries have often neglected these prerequisites (see Lewin, 1985, 1990, 1993). The implementation of curricular reforms, or the expansion of curricular scope as a corollary of system expansion, have therefore frequently reversed the cart and the horse in terms of the impetus of intended educational changes, with negative effects on the quality of instruction.

The early history of secondary school science education in Papua New Guinea exemplifies this observation. Science instruction at the post-primary level commenced in 1960, the expatriate teachers initially choosing between the Sarawak and New South Wales Alternative Science curricula. Student numbers in the early days of high schooling were relatively low, and by the mid-1960s the academically poorest 40% of students were dismissed at the end of Grade 8. By 1968, curriculum flexibility had been introduced through the incorporation of locally-adaptable biology, geology and technology projects to supplement a common basic science core (see Maddock, 1968, 1983).

The PNG post-primary sector entered a phase of impressive expansion in the late 1960s that was intended to meet anticipated manpower requirements following independence. Consistent with the drive for human resource self-sufficiency, what was the Goroka Teachers' College began training secondary teaching personnel in 1967 initially mostly up-graded primary teachers. The transfer of the college to the University of Papua New Guinea in 1972 saw the rapid establishment of Grade 10 leavers completing a matriculation year followed by a two-year Diploma programme as the secondary teacher qualification norm until the end of the 1980s, although the proportion of Grade 12 leaver entrants to the college did increase throughout the latter decade.

The comparatively poor subject grasp of early Goroka graduates forced the abandonment of locally adaptable curricula by 1971, when a standard curriculum was introduced. By 1975, the problem of Grade 10 graduate overproduction by the still expanding high school system was beginning to force a reappraisal of the relevance of the curriculum, particularly with respect to the growing number of school leavers who would find neither formal salaried employment nor a place in an institution of higher education. This situation was compounded over the next decade by the abandonment of the mass dismissal after Grade 8, brought about by public pressures on provincial education divisions following the introduction of the provincial government system in 1977. The 'Science for All' movement initiated by the UNESCO Minedap V Conference provided a rationale for the further deacademization of science curricula, particularly at Grades 9 and 10 (see Deutrom & Wilson, 1986, and Palmer, 1984, 1987 for very different views of this process). The result was the 'soft', qualitative, supposedly 'relevant' 1983 curriculum, essentially still in force today.

This is not to say that academic standards in PNG secondary science classrooms are poor, the converse was indicated by the comparatively favourable rating of the PNG Grade 10 sample in the 1984 IEA study (see Postlethwaite & Wiley, 1992). Much UN money was spent on laboratory facilities and the design of a laboratory-oriented modular science programme in the early days, and science teachers were trained accordingly. Standards could be regarded as having recovered since 1971, with teacher quality catching up with the demands of the curriculum again - albeit a less rigorous curriculum, weakened by the stresses

of overheated system expansion, with negative flow through effects on tertiary educational intake and output (Wilson, 1989). At the same time, the quality of the secondary teaching force has been steadily improving since 1990, when matriculation became the entry qualification to the new three-year Diploma at Goroka Teachers' College; now a Campus, Goroka is embarking on a four-year Bachelor of Education degree programme in 1995. The stage is slowly but surely being set for a qualitative improvement in academic standards in PNG.

But the growing disparity between expectations and outcomes of education initiated a drive towards educational structural reform (Avalos, 1992), the momentum of which had become irresistible by the time of the 1992 national elections. Under the reforms, now in their early stages of implementation, Grades 7 and 8 are to be transferred to the primary school sector, universal access to which is envisaged in about ten years' time, while access to Grade 12 is to be achieved by extending at least some of the traditionally Grade 7-10 provincial high schools to that grade level.

The change of status of Grades 7 and 8 from 'lower secondary' to 'upper primary' has profound and mostly disturbing implications for science education. Primary schools have no laboratory facilities. Primary school teachers are mostly lower secondary school leavers with a two-year teaching certificate from a teachers' college, the subject content component of which is generally low, particularly in science (about ten hours), reflecting the very little time allocated to science in Grades 1 to 6. The colleges are presently introducing a three-year diploma of their own, but the third year does not appear to be equipping teachers for the new 'upper primary' levels with respect to content mastery, which is not surprising when one considers the fact that many of the lecturers at primary teachers' colleges have little above Grade 10 in the way of science content themselves. All this was openly conceded and discussed at a Conference of Science Teacher Educators at Goroka Campus on 25-26 July, 1994. Even if the existing syllabuses are transferred intact, it is difficult to see how the nature and quality of what is now lower secondary science can be safeguarded.

As for the Provincial High School 'top-up', the old Goroka two-year diploma that most practising teachers possess reflects the qualitative, 'soft' science that they were being trained to teach at the time. Perhaps it is not surprising, then, that a two-strand science (Environmental Science and Technology) is currently being mooted for Grades 11 and 12, given that these people cannot be expected to teach the 'hard' quantitative science that characterises the existing Grade 12 science syllabuses.

History would appear to be repeating itself, with attempts to turn curriculum into the horse, when in reality its function should be that of the cart. Research has already cast serious doubts on primary teachers' ability to cope with Grade 7-8 mathematics (Zepp, Matang & Sapau, 1994) and on trainee secondary teachers' ability to cope with qualitative physics (Olney & Vlaardingerbroek, 1994). Serious commitment is needed towards qualitative improvements in teacher quality and physical resources for the current reforms in PNG to achieve their objectives without compromising educational standards.

References

Avalos, B. (1992) The need for educational reform and the role of teacher training: the case of Papua New Guinea. *International Journal of Educational Development* 12(4): 309-318.

Deutrom, B. & Wilson, M. (1986) 'Science for all' in Papua New Guinea. *Science Education* 70(4): 389-399.

Lewin, K. (1985) Quality in question: A new agenda for curriculum reform in developing countries. *Comparative Education* 21(2): 117-133.

Lewin, K.(1990) International perspectives on the development of science education: Food for thought. *Studies in Science Education* 18: 1-23.

Lewin, K. (1993) Planning policy on science education in developing countries. *International Journal of Science Education* 15 (1): 1-15.

Maddock, M.N. (1968) The beginning of a new era of secondary science education. *Papua New Guinea Journal of Teacher Education* 5 (4): 4-11.

Maddock, M.N. (1983) Two decades of school science education in Papua New Guinea. *Science Education* 67 (5): 561-573.

Olney, J. & Vlaardingerbroek, B. (1994) School physics education in Papua New Guinea: Problems and prospects. *Papua New Guinea Journal of Teacher Education* 1: 41-45.

Palmer, W. (1984) Chemistry in the provincial high school curriculum in Papua New Guinea: A personal view. *Science in New Guinea* 11 (3): 173-178.

Palmer, W. (1987) Environmental, ethical and safety issues in the chemistry/science curriculum in high schools. *Science in New Guinea* 13 (2): 82-91.

Postlethwaite, T.N. & Wiley, D.E. (1992) *The IEA Study of Science II: Science Achievement in 23 Countries.* Pergamon Press.

Varghese, P. (1993) Science education in the Pacific: Are we progressing? *Pacific Curriculum Network* 2 (2): 17-19.

Wilson, M. (1989) SISS science curriculum in Papua New Guinea. *Papua New Guinea Journal of Teacher Education* 25 (1): 81-9.

Zepp, R., Matang, R. & Sapau, M. (1994) Mathematics content knowledge of community school 'top-up' teachers. *Papua New Guinea Journal of Teacher Education* 1: 25-28.

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