

**An assessment of the impact of University Interventions for
improving the Teaching of Science and Mathematics in
Community Day Secondary Schools in Malawi**

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*Presented at the Regional Seminar “The Contribution of Higher Education to
National Education Systems: Current Challenges for Africa”*

22-24 March 2007
Accra, Ghana



THE AFRICAN REGIONAL RESEARCH SEMINAR

**University Interventions in improving the Teaching of Science and Mathematics in
Community Day Secondary Schools in Malawi : Assessment of the Impact**

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Presented at the Second African Regional UNESCO Forum Research Seminar held in
Accra, Ghana, March 22-24, 2007

1. OVERVIEW

Nations all over the world acknowledge the important role played by science and mathematics in development. One sustainable way of promoting science and mathematics is through education.

1.1 Summary of the Issue and Proposed Solution

The teaching of science and mathematics continue to pose challenges. Studies done in different countries have shown that students' performance in these subjects is generally poor, (National Science Foundation , (2002), Malunga (2000), Chamdimba . (2003) . A major factor in all this in Malawi has been identified as a lack or shortage of qualified science and mathematics teachers. Even after the opening of a new college of education in 1994, and the faculty of education of Mzuzu University several years later, the Ministry of Education of Education produced figures that showed a serious shortage of qualified teachers in secondary schools.

In Malawi , the shortage of qualified teachers is a major problem in Community Day Secondary schools, where the majority of science teachers have only a primary school teaching qualification and an academic qualification equivalent to the O-Level.

It is against this background that the Faculty of Education at Mzuzu University undertook an intervention to improve the performance of such teachers. The intervention is a teacher education course called the Secondary School Teacher Improvement Programme (SSTIP). The course provides the teachers with content and training in pedagogy

1.2 Summary of Facts

The challenges faced by the national education system of Malawi cannot be over-emphasized. The symptoms are obvious, with a high drop-out rate of 17% in primary school, low progression rate at secondary education at 18% and even lower progression rate to university with only 0.3% of the learners proceeding to University. This state of affairs has led to shortage of qualified professionals, which also includes teachers. The Ministry of Education in 1997 indicated that only 1% of teachers of the CDSSs were qualified to teach at a secondary school. By 2001, there was only a slight improvement as indicated in table 1.1 below :

Table 1.1

School type	# of teachers teaching	# of qualified teachers	# of unqualified tchrs
Government	633	527	91
Grant-Aided	350	170	180
CDSS	2884	218	2762

Source : MOE, 2001, p15

2 Context and Issue

In Malawi secondary education is offered through conventional secondary schools and Community Day Secondary Schools (CDSSs).

CDSSs are schools dominated by very poor resources and poorly-qualified teachers. Apart from head-teachers and one or two teachers, the teachers who teach science and mathematics, and indeed all other subjects in these schools, are under-qualified. The academic qualification of such

teachers is the School Leaving Certificate (equivalent to the English “O” Level), which is the same qualification their students qualify for. Professionally, they have only a Primary School Teaching Certificate qualification. Such teachers fail to qualify for entrance into the college of education where they could upgrade.

The development of the CDSSs was a result of a policy whose aim was to meet the Education for All (EFA) goals, one of the United Nation’s Millenium Development Goals..When Malawi became a multiparty democracy in 1994, the new government made a declaration for free primary education (FPE). The abolishment of school fees for primary education resulted in an overwhelming increase in enrolment. The enrolment increased by 51% between 1993/94 and 1994/95 academic years (EMIS , 1999). Government could not manage to build conventional type of secondary schools to take care of this sudden increase. The solution was to convert Distance Education Centre into Community Day Secondary Schools. The majority of Secondary School-going students nationwide were admitted into these schools such that between 1993 and 1994 there was an increment of 100,000 students in such schools, and by 1999 CDSS students dominated enrolment , accounting to over half of the total national enrolment (EMIS,1999)

As can be expected the pass rates in these schools is very low. Although the pass rate of the students in CDSSs is extremely low at only an average of 6% at the School Leaving Certificate, the pass rates in Science and Mathematics are even more pathetic. Such low pass rates are attributed, among other things, to the poor qualifications of teachers.

3. Policies and Programmes

3.1 Current Policy Frameworks

Whereas previously secondary education was elitist, government has now developed a policy to expand secondary education opportunity. The development of CDSSs is one way of implementing such a policy.

The Ministry of Education and its partners made an attempt to address the issue of shortage of qualified teachers in CDSSs by mounting a programme to upgrade some CDSS teachers to diploma level via the distance mode in 1999. Although this program registered some success, the majority of the teachers could not qualify for admission into a diploma course despite the fact that they were already teaching at secondary level. Such a programme also proved expensive to run.

Mzuzu University planned an intervention that is attempting to overcome such problems.

THE INTERVENTION

The intervention consist of a programme that has been undertaken to improve the performance of a large number of Science and Mathematics teachers from CDSSs at a very minimum cost, and shortest possible time, and yet expected to produce impact. In this programme, students, who are practising CDSS teachers, are admitted into Mzuzu University during the University’s long vacations of twelve weeks.

The aims of the programme are:

- To improve the academic competencies of Mathematics and Science teachers in CDSS, thereby strengthening their ability to apply knowledge and skills in teaching.

- To enable those who would do well in the programme to be eligible for entry into a diploma programme in a college of education.

The Intervention Process

- i. A needs assessment was carried out to determine the areas in which the teachers need the most help. Teachers identified specific topics in Mathematics, Physical Science and Biology that they found difficult to teach.
The research team concluded that the teaching problems arise not only from poor teaching methodologies, but also from lack of knowledge of subject matter.
- ii. A tailor – made curriculum was developed for the programme. It was developed to meet the following objectives:
 - To include science and mathematics content which is at a level that is slightly higher than the level they themselves teach. This level can be likened to the “A” level of the British Education System. The content also included the problem areas identified.
 - To teach methodology courses whose emphasis is on student-centred approaches without confining the teaching to the laboratory. This means emphasizing activities like Directed Activities Related to Text (DARTS), using the environment and using the concept of TALULAR (teaching and learning using locally available resources) .
 - To emphasize cooperative learning – Cooperative learning has been shown by Novak (1994) to empower learners to lead themselves through course content and materials. This is useful to ensure that the students can continue the quest for knowledge after the short course period.
 - To use continuous assessment to assess the so as to evaluate a large number of capabilities, skills and areas of the content

A summary of the curriculum is shown in the appendix.

- iii. Selection of students: Students are selected based on the criteria that in their secondary school leaving certificate examination , the MSCE, they have passes in Mathematics , and another pass in either biology or physical science. Other requirements are that students should be teaching the subjects they would study, they should be CDSS teachers and be not more than 45 years old. In addition, the Ministry of Education ensures that there is equal representation from the different Education Divisions of the country
- iv. At the end of the twelve-week programme the teacher learners sit examinations that are equivalent to a University bridging course examination, so that those who pass that examination can be considered ready for admission into university.

4. Research Results

Methodology of the Study

The study was carried out to evaluate the impact of the teacher improvement programme , the SSTIP on the performance of the teacher-learners.

Data was collected through observer notes taken in classes, interviews with lecturers and school heads, from test results, and questionnaires. Questionnaires were administered to former teacher learners, and heads of department of the schools where the teacher learners work.

The examination scores of all the 678 from the three cohorts of 2004, 2005 and 2006 were used. These scores were computed to find out the pass rate of the students in the core subjects. Although academic scores are not a clear indication of students future professional development, they are still an indication of achievement. For in-depth study, the performance of the third cohort of the biology group was closely monitored and their continuous assessment grades were computed. This was done in order to assess how their performance was being affected by the learning process. The biology group was used because the researcher had most access to them since she was one of their lecturers. Lecturers from each subject area were interviewed. They provided information on students' levels of capabilities, and how they were coping with the course.

Qualitative data was gathered using survey questionnaires. One questionnaire sought information from thirty randomly selected former students. The items required them to determine the impact of the course on their teaching performance. Another questionnaire was administered to heads of science departments of the randomly selected schools in which the former students were teaching. The items requested information that determines the impact of the course on the teachers' performance in their actual teaching.

The Findings

Currently, the programme has enrolled its forth cohort of 300 and so far, the number of teacher learners that have graduated are shown in table 1.

Table 1: Number of Students Enrolled

Cohort	Total Number Enrolled	P/Sc Option	Biology Option
1 (2004)	182	55	127
2 (2005)	196	91	104
3 (2006)	300	83	217

Capability levels of the teacher-learners on admission to the Teacher Improvement Programme

Lecturers indicated that when they were being admitted into the course, students had the most difficulties in the following areas: (in descending order of the most commonly mentioned)

- Knowledge: At the start of the course the learners' knowledge was narrow. It was evident they had not been able to read beyond the basic recommended school texts.
- Scientific method: Most learners had difficulty grasping the basic concepts which are used in developing science through research. Even when the teacher learners showed that they had understood the meaning of a hypothesis, for instance, they failed to differentiate between different kinds of variables when carrying out a written exercise.

- Teaching Methodology : Nearly all students were unfamiliar with the goals of the syllabuses for both junior and senior school courses. However on introduction to these syllabuses for the first time they showed enthusiastic appreciation of the general objectives and subject goals.
- Language : They made many errors in spelling, grammar and pronunciation. They had some difficulty in understanding spoken and written English .
Deficiency in English was apparent with students having great difficulty in understanding questions and applying knowledge.
- In the practical sessions the students had difficulty in manipulating equipment like microscopes.

Expectations of the teacher-learners from the Teacher Improvement course

In-order to find out what the learners expectations were, the questionnaire included items that required them to indicate their expectations and say whether they felt their expectations had been met. Table 2 gives the responses.

Table 2: Students Expectations from the programme
n = 30

Expectation	% response	Whether Met	%
To qualify for a diploma or degree course	50	Not met	60
		Partially met	40
		Fully met	0
To learn better methods of teaching	20	Not met	0
		Partially met	50
		Fully met	50
To acquire mastery of content	20	Not met	0
		Partially met	0
		Fully met	100
To earn a salary raise	10	Not met	100
		Partially met	0
		Fully met	0
To acquire a higher qualification	10	Not met	0
		Partially met	0
		Fully met	100

To optimize learning, it becomes necessary for educators to understand students needs and expectations for a course of study, and as Matiru et. al. (1993) indicate, a mismatch between the learner and the content or approach to the teaching of a subject will reduce learning outcomes. From the findings of this study it looks like there is a slight mismatch between the students expectations and what the course designers planned. The majority of the students expect to use their admission into the university to get a recognizable qualification such as a diploma or degree

whilst the course was designed mostly to improve the teaching competencies of a big number of teachers.

Impact of the Teacher improvement course on the academic competencies of the teacher learners

The achievement of the teacher learners was measured by different assessment procedures. At the end of the course, an end- of course examination was administered. This, together with the continuous assessment grade, gave the overall grade for the learner. Figures 1, 2, and 3 are computed scores of the learners in the three cohorts in the various core subjects:

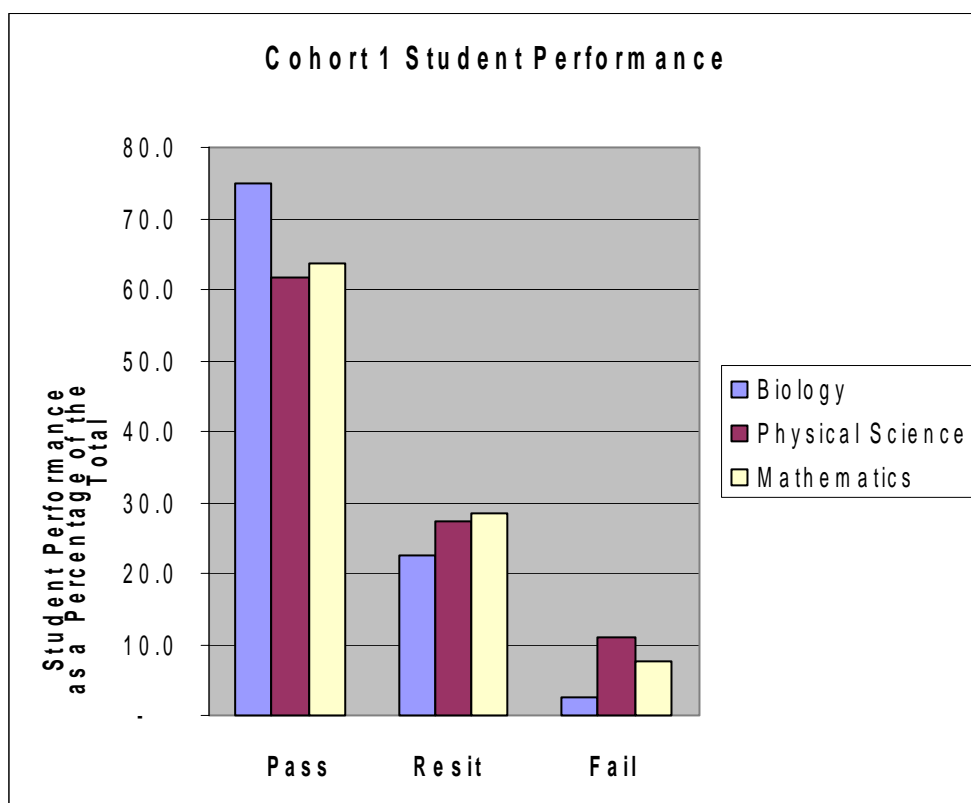


Fig. 1: Performance of students in the First Cohort of 2004

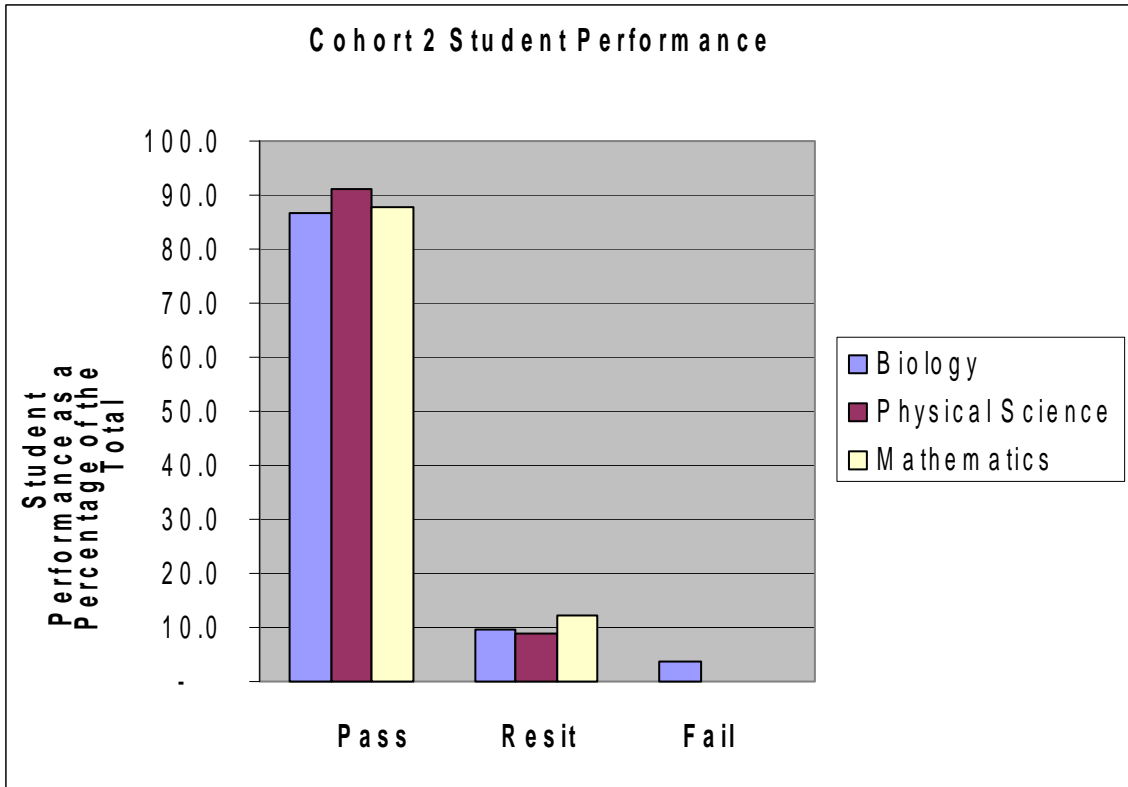


Fig 2: Performance of students in the Second Cohort of 2005

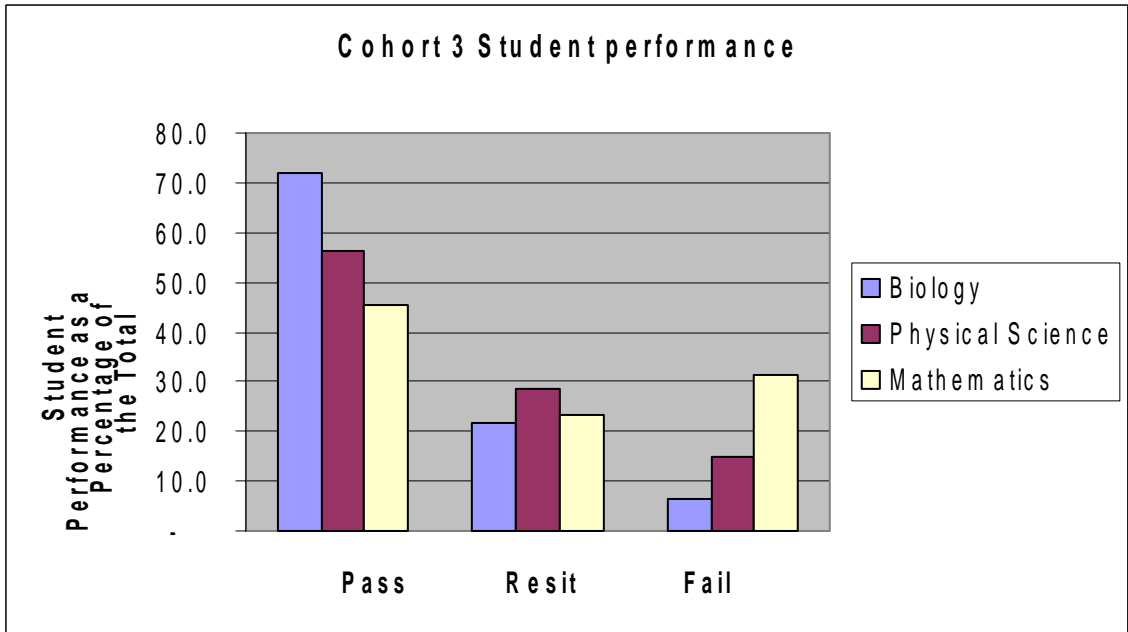


Fig 3: Performance of students in the Third Cohort of 2006

These scores show that the second cohort results were better than cohort one or cohort three results. A number of factors could account for this. Lecturers have indicated that the experience of teaching the first cohort made them realise that the students had weak education backgrounds. The realisation made many rethink their teaching strategies. It is likely that selection affected

cohort three performances. Since each cohort selected those with better grades by the time cohort three was being selected the average entrance grade had declined.

The figure 4 below shows a computation of average performance of teacher learners in various tests over the 12-week period.

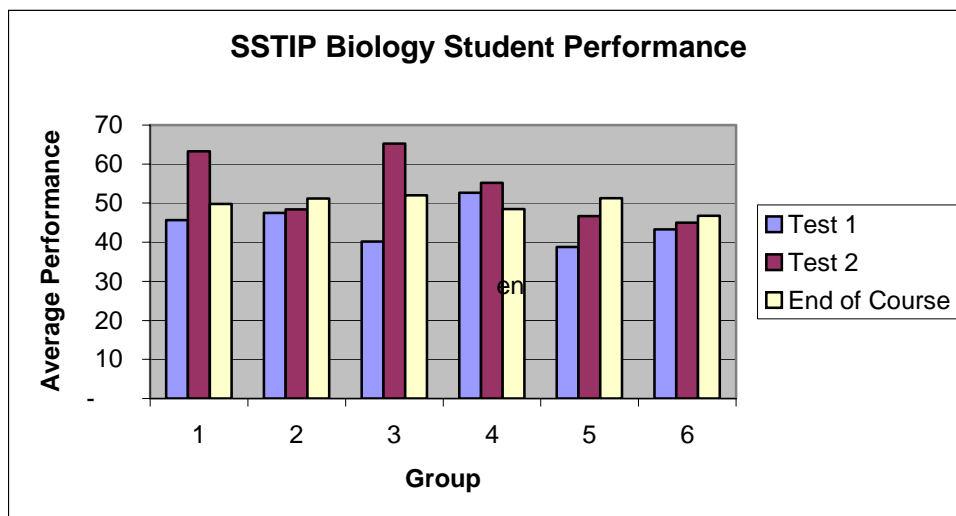


Fig 4 : Continuous performance of Students in Biology tests

The scores show that there is a continuous improvement in the academic performance of the teacher-learners. This indicates that given the right learning environment and resources, most of these teachers are trainable, the majority of them indicated that they had their secondary education in CDSSs also, showing that they had weak educational backgrounds.

Noticeable changes in the pedagogical skills of the teacher learners after the course

When heads of departments were asked to indicate which areas the teaches-learners had improved most in, they gave the responses shown in table 3.

Table 3: Rating of Pedagogical Skills of the teacher-learners

Skill category	% Response
Confidence in teaching	67
More use of pupil-centred teaching methods	33
Ability to effectively deliver content	88

The findings show that there have been noticeable changes in pedagogical skills of the teachers, especially in their use of pupil-centred methodologies and their confidence in handling content and in doing experiments and field work.

Through classroom discussions there was an indication that the teachers were aware of the strengths in using pupil-centred teaching. However they believed that these teaching strategies were only appropriate for primary school. They felt secondary school students appreciate more “serious” teaching methods like lecture and other passive techniques.

- How do the students rate their achievement from the programme ?
When students were asked to indicate how they rated their performance in various skills, they gave responses as indicated in table 4.

Table 4: Students rating of their achievement in various skills/specialist areas

Skills	Rating of their degree of Improvement				
	Excellent	Very Good	Good	Satisfactory	Unsatisfactory
Teaching Methodologies	33	50	17	0	0
Use of instructional media		50	50	0	0
Mastery of content knowledge	67	33	0	0	0
Degree of confidence	67	33	0	0	0
Resourcefulness	17	67	17	0	0
Degree of Professionalism	50	50	0	0	0

The indication by students that they feel confident about mastering content is helpful to them. When all is said and done, teaching is still about imparting knowledge. This, combined with a higher sense of confidence could bring a difference to the schools.

When teacher's content knowledge of the subject is extremely low and their method of teaching very traditionally authoritarian, a short spell of exposure to a higher-level of thinking with hands on experience of progressive teaching methods, does have a dramatic effect. By improving the knowledge and pedagogic skills of a few very weak teachers in many schools, pupils in a wide area benefit from teachers with a broader understanding of their subject and the ability to inspire them.

5. Conclusion and Recommendations

We can see that universities can play a role in helping to raise standards of science and mathematics in schools. This is just one area in which universities can play roles in national education systems.

Teacher-learners capability on entry to the SSTIP indicates that they should not be allowed to take up the teaching of science and Mathematics classes at secondary school level. There should be policy that sets the minimum qualification for secondary teachers to an academic qualification that is an equivalent of the first year of university. Teachers shouldn't be expected to teach material of a level that is exactly their level.

Universities have the expertise that they should use in improving science and mathematics teacher performance even where the teachers cannot be accepted into the conventional classes. In

cases where teacher's content knowledge of the subjects is poor and their method of teaching very traditionally authoritarian, a short spell of exposure to a higher-level of thinking with hands on experience of progressive teaching methods, can have a dramatic effect. By improving the knowledge and pedagogic skills of a few very weak teachers in many schools, pupils in a wide area benefit from teachers with a broader understanding of their subject and the ability to inspire them.

5.1 Policies and Programmes

Governments should also deliberately involve universities in developing developmental policies Funds should be set aside for research into the issues and policies and practices should be based on research findings.

Universities' functions of teaching, research and community service are all relevant in the fulfillment of the Millennium Development Goals. In Africa, where poverty eradication should be a very important goal, interventions like teacher education are key. Universities in Africa tend to be non-flexible but flexibility is important in order to fit in with the situation on the ground. Apart from conventional courses, universities should be able to mount issue-based courses. Entry qualifications to such courses can also be made flexible without compromising quality.

5.2 Plans for Action

The qualification that the teacher-learners obtained in the SSTIP will be made recognizable as a bridging course for entry into the university's distance education diploma course. This will enable the teacher-learners to acquire a higher education qualification whilst at the same time taking care of their classes.

6. Operational Aspects

It should be acknowledged that there are standards that universities must adhere to. There is a limit as to how low entry level to university courses can go. Also, there is a limit as to how much universities can get involved in. Teaching of conventional courses still continues to be the core function of universities and lecturers have to put much more effort on that than all other roles.

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Appendix

Curriculum

Alternative	Subject Combinations	Number of Hours/Week	
		Subject	Total
1 (Biology Option)	<ul style="list-style-type: none"> • Biology • Mathematics • Communication Studies • Education and Teaching • Biology and Mathematics methodology 	6 10 3 4 3	26

<p style="text-align: center;">2 (Physical Science Option)</p>	<ul style="list-style-type: none"> • Physics • Chemistry • Mathematics • Communication Studies • Education and Teaching Studies • Physical Science and Mathematics methodology 	<p style="text-align: center;">5 5 10 3 4 2</p>	<p style="text-align: center;">29</p>
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