Junior College Utrecht: a Laboratory for Innovation of Science Education

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Introduction

In 2004, Utrecht University started a project for motivated and gifted secondary students with a science and technology orientation. For this, the University cooperates with secondary schools from the Utrecht region (JCU partner schools) to offer a joint programme. The project has a dual purpose:

- to offer a challenging science education to talented students (grade 11 and 12) from partner schools
- to create a laboratory for innovation to the science sections of the JCU partner schools

This poster describes how JCU tries to be a working place for curriculum innovation.

Junior College Utrecht

JCU is a partnership of Utrecht University with 26 partner schools. In fact, this is a specific elaboration of one of the school innovation strategies that Watter and Dietzmann (2003) have listed namely "cluster groups – cooperation between schools in a region to provide a central facility and specialist". Its administrative board consists of representatives from the University and from partner schools.

Utrecht University aims at enhancing the attractiveness and public image of science and technology and at giving its students a motivating educational environment. In the last decade, the University has developed a policy of paying attention to talented students. It has started University College Utrecht (UCU), a for the Netherlands unique, broad, residential undergraduate program for talented students who live and study together and take a broad range of courses in a very interactive and active learning environment. Junior College Utrecht is a logical extension of this policy towards the secondary school level. JCU is located at the UCU campus.

The first JCU cohort was admitted in 2004 and completed its examinations in 2006 (the 2006-cohort). It counted 23 students from 12 partner schools. The 2007-cohort and the recently started 2008-cohort count about 50 students from 26 schools. So each school sends on average two students a year to JCU.

JCU employs teachers from partner schools to teach the secondary school science and mathematics. The teachers selected all have a solid subject background (an MSc), a continuing interest in research and education in their discipline, and a high level of dedication. Most of the JCU teachers had been actively involved in many of the reforms that took place during their careers and all were eager to try something new, like developing and teaching the JCU curriculum.

University lecturers involved are not employed by JCU, but are members of the Faculties of Science, Geology or Medicine. They are asked to spend a small part of their time on teaching JCU students.

JCU curriculum development is supported by project funding from National Science Curriculum Innovation Committees as the JCU is considered a laboratory for national curriculum development. Secondary teachers get extra time to develop innovative lesson

materials and to participate in developing university level modules that are initiated by university lecturers.

The JCU curriculum

The JCU curriculum includes all topics from the national biology, physics, chemistry and mathematics syllabuses as well as topics beyond the regular syllabuses. It has 4 characteristics that make it different from science curricula in regular secondary schools (Fig. 1).

Accelerated	**Comprehensive**	**Curricular coherence**	**Enriched**
- exam topics taught in 60% of regular time - students find out details themselves	More profound understanding by - lab work in University labs - excursions e.g. to CERN	Coherence between the science subjects by - doing investigations - modelling - project work, e.g. GPS	Academic topics by - guest lectures - modules e.g. * modern physics * nanoscience * molecular biology
Topics from syllabuses		***Topics beyond syllabuses***	

Figure 1: JCU curriculum characteristics

Students do interdisciplinary investigations. They get room for asking their own questions and finding answers, for developing their inquiring mind. Two investigation assignments are conducted in university laboratories, guided by researchers from Utrecht University:

- the pre-thesis at the end of grade 11 (60 hours)
- the JCU thesis half way grade 12 (120 hours)

Much effort is spent finding out how to introduce an intellectual enrichment in a broad sense (wisdom, intelligence, creativity – synthesized, Sternberg 2003). In the 11th grade classes teaching topics beyond the syllabuses can have the form of a seminar or a lecture (e.g. about relativity), or an excursion to a university lab. In the 12th grade classes, university specialists teach university modules that elaborate issues at the front of research. In the 2006/07 course, interdisciplinary modules containing syllabus as well as academic topics will be tried out in the 11th grade.

Titles of some interdisciplinary modules (11th grade)	**Titles of the university modules (12th grade)**
Molecular biology (biology and chemistry)	Modelling
Equilibria (chemistry and mathematics)	Astrophysics
Human perception (physics and biology)	HIV/AIDS
GPS (physics and mathematics)	Nanoscience

Figure 2: Some topics in the enriched part of the curriculum

A laboratory for innovation

The aim of JCU, to be a laboratory for science curriculum innovation, fits into the context of the science and mathematics reforms that are taking place in Dutch secondary education. A main objective of the reform is to update the curriculum content with recent trends in

scientific research and to narrow the gap between secondary and university education. Among others, a new integrated science subject is to be introduced into senior secondary education: 'Advanced Science, Mathematics and Technology'. In JCU, new curriculum materials that fit into the reform plans are developed and tried out. Because of its close interaction with the University and its characteristic of interdisciplinarity, JCU can be a prominent working place to develop and try out reform education in spite of the fact that its student population is unique rather than representative for the pre-university stream in Dutch secondary schools. Partner school teachers will be involved in adapting teaching material to the local situation. This will contribute to professional development in the schools (Borko 2004). Results will be disseminated to partner schools and to other secondary schools. By disseminating, JCU wants to generate a new élan in the science and mathematics departments in secondary schools. For this, a dissemination model (see Fig. 4) has been developed consisting of three phases.
In the first phase, new lesson series are developed by university and secondary teachers, are taught in JCU and experiences are evaluated. The 'university modules' are examples of these.
In the second phase, the lesson series are revised, adapted to the regular 12th grade students and made available to partner-school teachers. They test (parts of) the material in their classes and evaluation studies are carried out.
In the third phase, a last revision is carried out and the lesson materials are made available to all secondary schools.

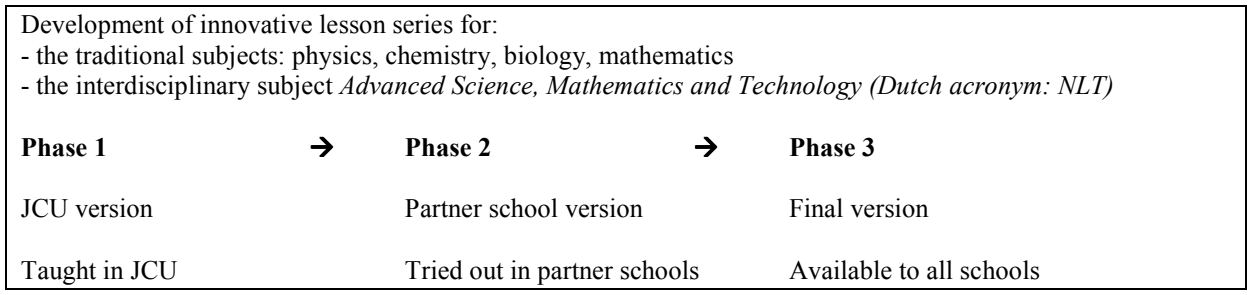

Figure 3. The JCU dissemination model

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