

## Junior College Utrecht as a laboratory for innovation in school science and mathematics

Proposal for the ISDDE conference 'Linking design research to professional educational design', 29 June – 2 July 2008, Sanne Tromp and Ton van der Valk

Junior College Utrecht (JCU) is a co-operation between Utrecht University, in particular its Faculty of Science, and 26 secondary schools. JCU started in 2004 and its aim is twofold: to offer an enriched and challenging programme in science and mathematics to talented upper secondary school students, and to provide a laboratory for innovation in school science. At JCU, we are currently engaged in the design and implementation of about 12 upper secondary school modules about topics related to science research done in Utrecht University. These modules can be included in the curricula of: 'Advanced Science' and 'Advanced Mathematics'. These are two new subjects that are being introduced in upper secondary school (grades 11/12) in the Netherlands, aiming at teaching recent and challenging science and maths topics in upper secondary.

We will present two related models that JCU is using: the curriculum development model and the implementation model. As an example we will discuss the module 'The moving earth', that combines geology, physics, mathematics and chemistry. This module was taught for the first time at JCU in 2006-2007, and it is now implemented by teachers at a number of our partnerschools.

The *curriculum development model* describes how the modules and the full curriculum are developed by teams of scientists, professional developers and secondary school teachers. On the module level, the module co-ordinator is the developer whose main responsibility is the pedagogical outlining of the module. One or more scientists/lecturers contribute subject matter content (concepts, texts, illustrations, etc.). A small number of secondary school teachers is involved to co-write the modules, adapt them to classroom situations, making sure that modules meet prior knowledge levels, etc., thus preparing themselves for teaching the module. In our observation, the module co-ordinator plays a pivotal role and we will present some guidelines for their work that we expect to be valuable to design researchers and professional developers alike.

On the curriculum level, developments are supervised by the curriculum co-ordinator and the JCU director, linking the developments to national syllabi and to ideas from curriculum research and evaluation results. In this, JCU works closely together with the Freudenthal Institute for Science and Mathematics Education. Main ideas are problem posing, authentic practices and using dynamic modelling for describing complex situations.

The *implementation model* is about the implementation of the new modules by teachers of our partner schools and ultimately of schools nationwide. This model consists of three phases (see table 1). In phase 1, a first version of a module is created that is taught to the students at JCU by scientists and secondary school teachers (JCU version). Evaluation and adaptation to the regular upper secondary level of understanding results in a 'partner school version' in phase 2. This version is tested at a number of our partner schools. We provide the participating teachers with support, e.g. time and membership of a so-called 'Experiment Group' with fellow teachers, contributing to their professional development. We encourage them to adjust our modules to their own needs and situation, such as school timetables. After evaluations and adjustments, a final version is created in phase 3 that will be available

to all Dutch upper secondary schools. The JCU students are engaged in the development process, for example by contributing to evaluations and workshops for teachers. And since the JCU students are also students at our 26 partner schools, we have a natural *entrée* to teachers at those schools. We will report on the progress that we have made through these phases and the lessons that we have learned so far in working together with researchers, schools and teachers.

Table 1: Phases in the development and implementation of modules

Development → Implementation into schools	Phase 1: JCU-version	Phase 2: Partnerschool version	Phase 3: National version
Into JCU (university and JCU teachers)	x	x*	x*
Into partnerschools (by secondary school teachers)		x	x
Available to all secondary schools			x

\* enriched version for JCU students

Reference: Valk, T. van der, Berg, E. van den, & Eijkelhof, H. (2007). Junior College Utrecht: Challenging talented secondary school students to study science. *School Science Review*, 88 (325), 63 – 71.