Research Based Learning (RBL) in undergraduate education

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Problem statement

The present theme builds on (1) a growing critique, related to the design and implementation of undergraduate studies, and (2) an analysis of the shortcomings of recent educational innovations in – higher education.

First, a critical analysis of higher education in e.g., the USA points at a failure of undergraduate higher education to develop scientific literacy in undergraduate students because of a lack of active involvement in the process of knowledge creation and development (Boyer Commission, 1998). This critical analysis reveals that undergraduate studies reflect mainly an introduction to the grounding knowledge domain, and students are isolated from research activities. Roach & Dempster (2001) define this as "adoptive learning", in contrast to "adaptive learning" that foster a deeper understanding of the knowledge and knowledge development techniques. This critique reappears in Australia; see e.g., Zubrick, Reid & Rossiter (2001) who call for an advanced integration of teaching and learning. The same is true in Chinese universities, where extra-curricular attempts are being set up to involve undergraduates in research activities (see Beijing Normal University).

Secondly, recent innovations in higher education have especially focused on new teaching methodologies; e.g., anchored instruction (Young, 1993), collaborative learning (Vygotsky, 1962), problem based learning (Moust & Schmidt, 1998), active learning (Grabinger, 1996), self-directed learning (Paris, Byrnes & Paris, 2001),… These innovations were heavily inspired by constructivist theories, such as Distributed Cognition, Distributed cognition (Hutchins & Klausen, 1996), Reflective learning (Brown, 1987), …. There is empirical evidence about the impact of these innovations, but the main focus has been on the social-cognitive results. These innovations have hardly taken into consideration the research dimension in the academic knowledge base.
The two observations have influenced universities to reorient undergraduate education towards better attempts to integrate teaching and research; called Research Based Learning (RBL).

A typical example of RBL is found at Warwick University (Roach, Blackmore, & Dempster, 2001). RBL is characterized by adding extra activities above the introduction to the basic scientific knowledge domain. These activities comprise developing students' awareness of methods of enquiry, and engaging students in real research activities. The teaching strategies reflect research-process based learning methods. Huggins, Jenkins & Scurry (2007) define this as "learning through research" instead of "learning about research". Wenzel (2003) stresses that is to be done throughout the undergraduate experience and not solely at the end of the curriculum. Students are engaged in activities that reflect the empirical research cycle; e.g., problem definition, literature search, defining research questions, hypotheses, identifying research variable, (re)using research instruments, data collection, data cleaning, data analysis, discussion of results, critique of research approaches, coming to conclusions, … . Boyer (1990) presents in this context the concept of undergraduate "scholarship". From a theoretical point of view, RBL is congruent with more radical constructivist learning theories, such as cognitive apprenticeship (Wilson & Cole, 1991), experiential learning (Kolb, 1984), situated cognition/learning (Brown & Duguid, 1993), inquiry-based learning (Collins & Stevens, 1983), …

Examples of RBL can already be found in a variety of knowledge domains; such as law (Burridge, 2001), marine sciences (Gilbert, 2005), chemical sciences (Wenzel, 2003), social sciences (Joyce, 2003), … These experiences are helpful to develop RBL-models about the roles, nature and characteristics of variables, processes and actors involved in the teaching learning process: changes

in the curriculum content and build-up, nature of evaluation, types of interaction between student/staff, critical balance between the prior knowledge and the research activities, necessary support tools (ICT, library,, …), etc. The potential impact of RBL is described in a broad way (Dupuis, 2007; Hathaway, Gregerman & Davis, 2003; Roach & Dempster, 2001; Seymour, et al., 2004): changes in conceptions of science and research (scientific literacy), attitudes towards science and research, approaches to learning (shift towards from surface to deep learning, in-depth acquisition of research skills, better learning performance. Roach & Dempster (2001) points at changing conceptions and beliefs of staff about science and teaching. But there is - in the available literature - a clear lack of empirical research that evaluates the claims of RBL. Most available studies centre on perceptions/expectations; only a limited amount of studies present clear empirical evidence in relation to e.g., critical thinking skills, employability, N retention of students, and N start-up of postgraduate studies (see e.g., Smith & Rust, 2007 for an overview). Or studies centre on extra-curricular research initiatives; e.g., research summer schools (see e.g. Seymour, et al., 2004). The present project is set up in view of this lack of empirical research. Feasibility: Since RBL affects the content and set-up of a formal curriculum, negotiations have been carried out that guarantee the willingness of the university authorities to re-design courses at undergraduate level and to link an evaluation research cycle to this redesign.

In the context of this conference presentation a number of practical examples of RBBL in undergraduate education, set up at Ghent University will be discussed. ICT tools are used in this context to solve a number of logistic, and efficiency problem. In a related workshop, participants will be invited to develop their own design, based on a format for RBL.

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