Sustainable Assessment in Engineering Education – critical features of the examination process

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***Abstract*—Examination in Higher Education involves university culture, formal rules, teachers' knowledge and students' learning efforts. This project researches the interplay between the formal examination system and the development of students' and teachers' work in the actual examination process, relating also to changes induced by the Bologna process. The conceptual frame-work combines strands of social practice theory. Formal aspects of assessments are viewed as classification systems working as boundary objects in relation to educational communities of practice. The examination system shows a detailed assessment structure with specified pedagogical intentions for the examination process both in pace and progress, which most students do not follow. Intended relations between assessments are gradually distorted and shape new conditions for student learning in the actual examination process that hereto is quite unknown.**

***Key words*—Student learning, assessment, communities of practice, classification systems, teaching-learning regimes, examination systems, examination processes, teaching-learning process, Bologna process**

I. Introduction

Learning outcomes, assessments and exams are primary ingredients and working substances in the Bologna process [1]. In the implementation of the decisions regarding qualification frameworks and quality assurance there are several administrative assumptions made, for instance, concerning the comparability of courses having learning outcomes with a wording looking the same. There are good reasons to research the changing patterns of assessment in Higher Education induced by the Bologna process, both in relation to the taken-for-granted effects on the quality of student learning and in relation to the growing demands on teacher competence in the handling of internationally connected examination systems.

The conceptual frame-work for the project is combining different strands of social practice theory. Examination processes are related to the concept of community of practice [2]. The formal aspects of assessments are viewed as classification systems [3]. The description of assessment practices focuses on "momentums of torque" [3] in student learning and in teachers' work in relation to the examination system. The concept of teaching and learning regimes [4] is utilised to explore the social contexts of torques delimited.

This paper is building on the initial and preliminary results from the ongoing project. As a first case we have focused on the first year of the electrical engineering programme at the Faculty of Engineering, Lund University. The preliminary findings are mainly results from the mapping of all the documents related to the examination process. For the interpretation we are also utilising information from a reference group, consisting of students and the chair of the programme board, guiding the project.

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II. A conceptual frame-work for understanding examination processes

Assessment practices are interconnected processes involving several levels, organisations, groups and individuals. An *examination system* is viewed as all the assessments delivered in a course or in a programme together with the formal rules and regulations underpinning assessment. This formal system is channelling the interaction between students and teachers in quite specific ways during their efforts to fulfil their respective responsibilities. Important aspects of assessment practices are dependant both directly and indirectly on the character of the surrounding educational and scientific organisation. By *examination process* we mean all student and teacher activities that are emanating from or directed towards the examination system. The *teaching-learning process* is the totality of educational interaction between students, teachers and other involved participants.

A. Communities of practice and learning

When Lave & Wenger in 1991 published "Situated Learning" [5], starting off the wave of interest for communities of practice, the concept of learning in relation to community in their work was not very elaborated. Later Wenger [2] continued the development of a social theory of learning, trying to balance in between theories of social structure and of situated experience, looking at learning as an integrated aspect of human social participation with its base in *communities of practice* (COP). Wenger [ibid, p 5] delimits four integrated learning processes characterising a COP:

1. *Meaning* - Learning as experiencing a change of meaning.
2. *Practice* – Learning as a development of connected human action.
3. *Community* – Learning as belonging, recognised as increased competence.
4. *Identity* – Learning as a change of personal histories of becoming.

When people interact in a COP the learning supported is an integrated aspect of the kind of participation the community offers. Joining in mutual engagement will contribute to the newcomers' negotiating of new meaning, exploring ways of acting, developing competence and, as time goes by, providing a different path for the development of personal history and identity.

There are two dual modes for expressing a practice – participation and reification. In participation all kinds of human relations are covered, from close friendship and cooperation to competition or neglect. Reification is the production or promotion of specific artefacts that carries meaning in the mutual engagement or works as tools in the joint enterprise of the community. "Things" like forms, tests and portfolios, are working as tools, symbolic resources and sometimes as mental jails.

A crucial point for learning in relation to HE is Wenger's statement: "*In this regard, a community of practice acts as a locally negotiated regime of competence. Within such a regime, knowing is no longer undefined. It can be defined as what would be recognized as competent participation in the practice.*" [Ibid, p 137]. Two things, though, are important to notice. The first being that both COP and learning in this perspective are not supposed to be good or beneficial in relation to any other value than supporting the practice in question. Also a criminal network can form an outstanding COP, building strong identities and supporting the experience of meaning and belonging for participants. The other being the fact that in HE the learning supported through participation in different COP:s, cannot in a simple way be equalled with the learning outcomes intended at, since these are intended to transcend the actual practice.

As COP is an emergent structure. Their boundaries will not be found on the organisational chart. They can only be delimited by looking at the networking of actual practices, where they are the nodes. And since they are the most important social entities carrying human learning, the basic question for the development of any organisation is how to create and sustain fruitful interconnections between different communities of practice. Wenger describes three types of such interconnections: 1) *Boundary objects*, reifications that are shared between different communities of practice, 2) *Brokering*, connections provided by people who can introduce elements of one practice into another, 3) *Boundary encounters or practices*, which are collective ways of organising practices with the joint enterprise of connecting communities of practices. They might develop to a COP of their own. Focusing communities of practice in a complicated organisation could well be described as a way of trying to find the emergent, actual and effective organisational structure behind the official description of the formal structures as well as the learning, intended and unintended, connected to those practices.

B. Classification systems

A classification system is a human artefact, at the same time both material and symbolic in nature. Bowker and Star [3, p 10] delimit a classification system as a set of boxes (metaphorical or literal) into which things can be put, to then do some kind of work – bureaucratic or knowledge production. The classification itself is a spatial, temporal or spatial-temporal segmentation of a part of the world. Most classifications have not only intended but also strange and unforeseen effects on the part of social life that they cover. All classifications also have ethical problems in relation to consequences for the human life they in some way treats in parts and pieces. Still we are deeply dependant on their way of working, as they shape the taken-for-granted infrastructure of our civilised lives - especially, if the systems, through political, economic or technical decisions, are made standard for social practice. Accepted and wide-spread standards soon naturalize and become invisible preconditions for "ordinary" situations. When they are changed or replaced they suddenly reappear on the agenda.

Classifications are systems of reifications that work as objects for cooperation across social worlds and communities of practice. They can also function as boundary objects, which are objects that inhabit several communities of practice and satisfy the differing informational requirements of each of them. The meaning of a classification made in one community of practice might be changed when the classification is brought to the fore in another. In that way the social effects of classification systems can be adapted to circumstances. But that is not always the case. Bowker and Star describes how the utilisation of classifications system has a strong impact and regularly creates different kinds of paradoxes, when the classification exerted for different reasons have inescapable or detrimental consequences for human or social life. They have labelled these effects of classification "torques". It is during the developing process for a new system that the ethical and social consequences of the classification can and must be lifted forward for responsible choices to be made, since a complicated classification system often is very hard to change afterwards.

C. Teaching and learning regimes

Higher education is a many-voiced social practice including a great variety of different pedagogical cultures. *Teaching and Learning Regimes* (TLR) are local sets of practices, values and attitudes concerning teaching, learning and assessment, developed at the level of work-group or course-team in higher education [4]. They include eight moments: recurrent practices, discursive repertoires, distinctive codes of signification, theories of teaching and learning, subjectivities in interaction, power relations, conventions of appropriateness and tacit assumptions. The

developing theory of TLR is a response to practical and theoretical endeavours to promote productive change in higher education. Compared to Wenger's quite harmonious description of the coherence of a COP, the concept of TRL focuses the character of the differences, tensions and problems that normally come to the fore when academics are given the task of realising higher education in higher education. We will use TLR as a tool for analysis of teachers work in designing and carrying through assessments fitting them into the different classification systems that shapes the core of the examination system.

III. Preliminary empirical results

In analysing documents related to the examination process there seems to be one common model for the examination system, underlying the present structure of the programme. The examination system consists of a row of lectures and training sessions followed by a final written test, a model that in later years have been added to, step by step. Three models look like they are derived from this template: 1) the "original" model, often consisting of maths courses, are very close to the original, 2) the "filled" model, where there are a lot of assignments and projects as well as a concluding test, and 3) the "continuous assessment" model, where the final test has been replaced or made voluntary by a row of different assignments.

During the first year in the programme the students are expected to take six mandatory courses. Three maths-courses of the original examination model are surrounded by three courses with a filled character. The formal examination system depicts the group of students as possible participants in six different practices each with a pedagogical logic of its own.

A. The character of the examination system – tight and divided

The examination system during the first year of study is a tight and complicated network of different assessments and assignments. But student and teacher activities in the examination process are also totally divided along the boundaries that the six different courses shape and it is difficult to estimate in what way different assignments and tasks from different courses will interact in the student situation.

B. An incongruent grading of learning outcomes

The scope of the aims/goals often is quite broad and points out knowledge and abilities of importance for a becoming engineer in today's society. For courses of the "filled" model there is an interesting difference in the relation between the scope of the goals and the (several) assignments during the course and the final assessment. It looks like there is a better correspondence between the themes/content of the assignments and the total scope of the goals, than between the final test and the goals. The final test is often trying a more narrow set of abilities, for instance based in mere calculations.

C. The expanded examination system

The syllabi and study-guides pictures courses quite crammed with smaller and bigger assessments and assignments. Almost every week there is more than one piece of work to deliver. Judging from the syllabi, study-guides and the comments from the reference-group at the electrical engineering programme, the officially accepted reason is to help a larger part of the students pass the programme, by distributing their study-efforts more even over time and between the different courses during the semester. The design of the expanded and tightly structured examination system thus pictures a pedagogical intention including a delicate balance between different assignments and assessments to scaffold the learning process in a way that is beneficial to the students.

D. Pace, rhythm and structure of the examination process

To understand the complex pattern of the examination process we have studied the examination system – as a plan. It is a complex structure consisting of a combination of several classification systems (credits, hours, modules, formal assessments), with the aim to support student learning in a productive examination process during their first year. Since three courses are scheduled in parallel for the novice students, there is a delicate balancing of all the different tasks in relation to each other. Thus, to make the picture come true in scaffolding the examination process (and by that also the learning processes) the students have to keep in pace as planned. And many of them do not. The teaching-learning process follows the scheduled plan and concludes at the end of each course. The examination process does not. The two processes are separating from each other, leaving the student in an individualised situation. Each failing student makes one prolonged examination process of their own.

References

[1] Bologna Working Group on Qualifications Frameworks. (2005). *A Framework for Qualifications of the European Higher Education Area.* Copenhagen: Ministry of Science, Technology and Innovation, February 2005

[2] Wenger, E. (1998). *Communities of Practice. Learning, Meaning and Identity*. Cambridge: Cambridge University Press

[3] Bowker, G.C. & Star, S.L. (1999). *Sorting Things Out. Classification and Its Consequences.* London: The MIT Press

[4] Trowler, P. & Cooper, A. (2002). Teaching and Learning Regimes: Implicit theories and recurrent practices in the enhancement of teaching and learning through educational development programmes, *Higher Education Research & Development, Vol. 21, No. 3*.

[5] Lave, J. & Wenger, E. (1991), *Situated learning, Legitimate peripheral participation*. Cambridge: Cambridge University Press