Moving Beyond Traditions: Bachelor Thesis Redesign

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ABSTRACT

Student learning is built on native ability, prior preparation and experiences but also by the compatibility of his or her learning style and the instructor’s teaching style. Past research (Kolb, 1984; Felder & Silverman, 1988; Baillie & Moore, 2004; Biggs & Tang, 2007; Crawley, Malmqvist, Ostlund, & Brodeur, 2007) indicate mismatches between engineering students’ common learning styles and traditional teaching styles. This paper addresses a transition from a teacher centered approach to a collaborative student centered approach. A longitudinal study of bachelor thesis redesign is described by following the progression in three parallel courses over four consecutive years. Moving beyond the traditional practices of individual thesis writing, a strict individual assignment has been transformed where roughly 50% now originates from collective work efforts. Findings show support to a collective approach when working with bachelor thesis writing as work groups become self-governed, attached with a creative disposition, pursuing functioning knowledge, key generic skills of industrial relevance, and collectively supporting deep level learning.

Keywords: Active Learning, Bachelor Thesis, Collaboration, Integrated Product Development, Knowledge, Students

INTRODUCTION

Engineering education has evolved to become a subject that strives to match employability criteria and student attractiveness as key drivers for curricula development. For this to occur, personal and interpersonal skills, together with product, process and systematic skills all play a part in better equipping engineers with practical know-how (i.e., functional knowledge) and efficiency in the capability to engineer (Baillie & Moore, 2004; Crawley et al., 2007).

With the Bologna 3+2 adaptation, the first three years of the education program finishes with a major individual work, known as the bachelor thesis. In Sweden (and particularly at KTH) this process involves 15 ECTS, equivalent to one semester of half time studies. The course ‘Advanced Integrated Product Development’ introduces students to research areas of relevance as they compose their bachelor thesis. Fundamental to the course is that students gain experience in testing theoretical beliefs with empirical data as they conduct case studies, often for the first time. With course outlines that focus on independent team work (i.e. case studies), learning assessments have been shown to change the interactive learning mode (i.e., transition from teacher-centered to more student-centered activities) (Baillie & Moore, 2004; Biggs & Tang, 2007). Building on Kolb’s (1984) need for experiential learning,
education research has shown more efficient learning by actively involving students in the learning process (Baillie & Moore, 2004; Biggs & Tang, 2007).

The individual work procedure follows a bi-polarized tradition. Firstly, for those that wish to settle with their bachelor level degree, it allows for a certificate. Secondly, students learn about the scientific writing process and in some cases experience their first true subject encounters with industry. Thus, writing a thesis for the first time involves numerous questions of “how to?” throughout the various thesis stages. This calls upon variation in student ambition that can be classified in two distinctive learning orientations, namely knowledge-seekers and understanding-seekers (Crawley et al., 2007). Education research normally divides learning orientation in respect to deep level learning formats using Bloom’s taxonomy (Biggs & Tang, 2007). Lectures are characterized by one-way communication that tends to favor knowledge-seekers and thus unintentionally encourages surface knowledge at the expense of deep knowledge. Rather than being facts related, surface approaches to learning can lead to a crippled awareness where students never speculate or search for deeper meaning. In contrast, deep level learning that focuses on functional applicability tries to relate facts to earlier experiences creating a pragmatic understanding between connections and discrepancies. Students with deep learning approaches prefer lecturers that challenge and stimulate problem-based thinking rather than providing pre-digested readings (Entwistle, 2005). This puts pressure on teachers to update and look after teaching procedures and learning elements, directing focus on what is known as the intended learning outcomes (ILOs). ILOs clarify what students should be able to perform when finishing a class or a specific teaching and learning experience (Biggs & Tang, 2007). ILOs are aligned with the aid of distinctive teaching and learning activities (TLAs), and correlating assessment tasks (ATs).

When there is a mismatch between the teaching and learning styles, students can become discouraged, with the consequence that less deep level learning takes place. One way of reinforcing deep level learning is by building on integrated collective efforts by peers, i.e., collaborative learning (Felder & Silverman, 1988; Dillenbourg, 1999) and team-based learning (Michaelen, Knight, & Fink, 2004). Discrepancy between individual learning and collaborative learning is found in the performed activities which trigger specific learning mechanisms. According to Dillenbourg (1999) individual cognition is not suppressed in peer interaction, but rather generates extra activities (e.g., explanation, disagreement) that put forward an extra dimension of cognitive mechanisms (e.g., internalization, reduced cognitive load) (Dillenbourg, 1999). In contrast to collaborative work, the thesis writing process has to date been an area slow to adapt to anything but individual attention. The process and discipline of writing an individual report or thesis is one of the traditional keys to being successful in effectively describing a project and its results.

Following this tradition, bachelor thesis writing is quite an isolated event where interaction with classmates is done only on specific requests (opposition, review, etc.). To bridge process ‘know how’ early, up front learning and the sharing of experiences has been proven vital in past studies (Ballie & Moore, 2004). However, there is no indication that functioning process knowledge is reinforced by promoting collaborative work as part of a student’s first encounter with this type of self-oriented independent work. By emphasizing a shared individual and group course design, this paper proposes an educational approach to effective learning for specific bachelor thesis course design. The purpose of the paper is to share experiences from the redesign of bachelor theses to include course design, intended learning outcomes, grading assessment and lessons learned. A framework-driven agenda is presented as an objective for future work. This work is an attempt to improve student learning within the context of a longitudinal study activity of mechanical engineering students.

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