The implementation of OASE as an alternative curriculum design to improve learning in higher physics education

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Abstract. Procrastination behaviour, a tendency to superficial learning and the fact that people remember only 10 to 30% of traditionally taught concepts are inherent to learning in any traditional educational context. The Faculty of Science at KU Leuven investigated the potential of changing curriculum design to tackle this and improve learning. After a thorough preparation an alternative curriculum design named OASE was implemented in September 2013 in the first year of the physics and mathematics programmes. The background, implementation and evaluation of OASE will be presented in this contribution.

1 Background

All programmes in higher education aim at enabling students to become independent, critical-thinking professionals. The KU Leuven empowers this with a research-based educational approach in which students are responsible for their own learning process, while the didactical teams provide optimal support. However, lecturers and students indicate some discordance between the approach theory and practice, mainly caused by the standard curriculum design at KU Leuven. For instance, the applied semester system, consisting of 13 weeks of classes followed by two or three contact-free weeks and three examination weeks, typically causes students to procrastinate active studying. Moreover, students tend to lose track of the course content after a few weeks, resulting in passive class attendance and didactical guidance that is not used optimally. Eight years ago, the Faculty of Science at the KU Leuven started investigating the potential of changing curriculum design to tackle this problem and improve learning [1]. After a thorough preparation by integrating existing academic research and own in-field experience in a feasibility study, an ultimate curriculum design within the university's boundary conditions was defined. This alternative approach, *Educational Organisation with Alternative Semester Layout and Assessment,* (with Dutch acronym OASE), was implemented in September 2013 in the first year of the mathematics and physics bachelor programmes [2].

2 Components of OASE

OASE entails different components. First, at a curriculum level, only one course subject is scheduled a day, allowing optimal concentration on this course, thus increasing efficiency [e.g. 3]. Additionally, two weeks of the exam study period at the end of each semester are repurposed for teaching and guided studying. Second, at the course level, contact hours are reduced and students are activated to study in the free time to improve study efficiency [e.g. 4]. In order to stimulate active self-study, classrooms are available allowing students to work or study alone or together, regularly with guidance by a teaching assistant. Third, during contact hours interactive-engagement methods are applied to allow students to actively process new knowledge and skills and thus improve their learning [e.g. 5]. The traditionally applied presentation-assimilation model, where students discover course material for the first time during a lecture, is replaced by a preparation-feedback model. Fourth, continuous assessment evaluates the extent to which students reach curriculum goals, activates students and provides regular feedback.

3 Implementation and evaluation of OASE

OASE was implemented in the first year of the physics and mathematics programmes in September 2013. A well balanced change management integrating a top-down with a bottom-up approach was necessary to proceed towards implementation. Before as well as after implementation, the students' learning process and the didactical teams' experiences have been closely monitored.

In general, students are satisfied about the available guidance in OASE, are well motivated and feel involved in their studies. Additionally, students appreciate the added value of interactive lectures, effective preparation and feedback. However, some students complain about stress throughout the semester. Didactical teams are positive about the fact that students are more active during the semester and are growing in their changed role. However, they indicate that the gap between stronger and weaker students is more obvious, and that summative continuous assessment can cause interference with other courses.

Study results of the students vary significantly between the first four years of implementation. Although study results are on average slightly better in OASE than before implementation, the difference is not statistically significant. Students with a score higher than 55% on a pre-test mathematics do obtain significantly better results during the first examination period (on average 7% more in OASE than before implementation). There are no more drop-out students in OASE, but timing of drop-out is significantly earlier, allowing faster reorientation.

4 Conclusions

This contribution presents an alternative curriculum design (OASE) that was implemented in the first year of the mathematics and physics bachelor programmes in September 2013. OASE entails different components at the curriculum, course and lecture level, including the assessment process. The implementation of OASE was thoroughly prepared, with a well-balanced change management and a close follow-up. First results are positive, with a better synchronisation of teaching and learning and successes but also challenges within a preparation-feedback model. Continuous assessment activates students and provides regular feedback, but can cause stress and imbalance between courses. Good students have significant better results in OASE, weak students reorientate sooner. The Faculty of Science continuously monitors and optimises the physics and mathematics programmes and is currently expanding parts of OASE towards its other programmes.

References

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