On methods to motivate students to self-organized learning and to enable them to acquire "future skills".

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ABSTRACT

The growing discrepancy between the rapidly changing requirements for competencies in engineering and the rigid structures at universities is causing ever-increasing frustration, longer study times, high dropout rates and, last but not least, dwindling enrollment figures. The challenges of overcoming these discrepancies seem insurmountable. In this lecture, we would like to explain measures, methods and concepts that are taking the first essential steps towards solving this problem.

1 Introduction

The ability to obtain knowledge or, more generally, information from external sources and to use it effectively and efficiently for one's own work has developed rapidly in recent years. In particular, the use of AI-based tools is revolutionizing modern professional and everyday life. These developments, which will have lasting effects, bring with them completely new demands for urgently required competencies. On this basis, so-called "future skills" have been defined, for example in [1]. In contrast to this, the content and learning objectives of the courses in current engineering degree programs rarely integrate even the use of computers. Furthermore, the learning objectives often include relatively low taxonomy levels, cf. [2, 3], and do not go beyond pure application and, even worse, remain at the level of rote learning. More specifically, the future skills mentioned above are usually not addressed at all. This growing discrepancy between urgently required competencies and those that can actually only be achieved in the course of study generally leads to great demotivation among students. This in turn leads to inadequate examination results, longer study times and ultimately, in the long term, dwindling enrollment figures. The challenges for overcoming these discrepancies are numerous and seemingly insurmountable. On the one hand, they stem from the learners, who are becoming increasingly heterogeneous. On the other hand, the teachers and university structures are so inflexible that, for example, already in [4] the conclusion is drawn that engineering education is resistant to demands for change. In this presentation, we would like to explain elementary concepts and good practice examples that particularly promote the design of motivational teaching — the elementary basis for acquiring "future skills" and, among other things, reducing the average duration of studies.

2 Motivational teaching

Many lecturers assume that students are highly motivated, or should be, since the purpose of their studies is to prepare for their future careers. However, this is where a fundamental problem of current university teaching comes into play: due to a lack of reference to reality and a lack of competence orientation, students cannot recognize at all what the subject matter has to do with their desired profession. Without sufficient motivation, students are often not interested in the subject matter. This is where the role of teachers in modern education according to learning theories based on constructivism becomes apparent: It is our responsibility to motivate students through appropriate concepts and to design a setting that is conductive to learning. This fundamentally includes a high degree of empathy and sufficient positive individual evaluation of learning activities. In this contribution, we present essential building blocks of motivational teaching.

3 Constructive Alignment

One of the biggest problems in the design and implementation of conventional courses, especially in engineering degree programs, is that mainly and sometimes exclusively the topics to be covered, i.e., the curriculum, is defined. However, the learning objectives cannot be derived from the subject matter alone, cf. the examples provided in [5]. The clear definition of learning objectives, including the associated teaching and learning activities, is of fundamental importance because the achievement of these learning objectives is observable for both learners and teachers. In short, learning objectives state what students should be capable of at the end of a course. Constructive Alignment according to [6] in addition states that, in a nutshell, learning objectives, teaching and learning activities, and the type of examination must be optimally aligned with each other. If this is clearly recognizable to students, it also significantly increases their motivation.

4 Good Practice Examples

On June 10 and 11, 2020, the workshop "New Ways in Teaching: From teaching to learning events" organized by the expert committee "Modern Teaching and Didactics in Mathematics and Mechanics" of the German Society for Applied Mathematics and Mechanics, GAMM for short, took place. The workshop was led by several lecturers who already use modern methods of didactics in higher education and have extensive experience with them. One of the aims of the exchange with the participants was to explain

DOI: 10.17185/duepublico/82628

which specific measures have which effects. In a subsequent evaluation and analysis of the discussion contributions, it became clear that the various best-practice examples have one positive effect above all: a significant increase in student motivation. The underlying concepts are briefly introduced below and explained in detail in our presentation, along with the specific good practice examples.

Activation of students

In many cases, courses are still similar to medieval lectures in which the lecturer delivers a 90-minute monologue. In terms of motivation, this is the worst possible form of teaching. And we shouldn't just blame everything on the YouTube or TikTok generation, but rather ask ourselves how long we can concentrate on a lecture that is not didactically optimal at professional conferences. Activating students, e.g. by involving them through audience response systems or other direct forms of participation, significantly contributes to boosting their motivation. Above all, student activation methods also offer significantly better learning progress monitoring for both students and teachers.

Alternative examination formats

The prospect of having to reproduce the knowledge acquired on a specific day, and in most cases within a very short period of time, causes frustration, demotivation and, not least, stress and panic for many students. Alternative and, in particular, formative examination formats offer the advantage of not having to base the assessment on a single "measurement". Students benefit from continuous activity and early and ongoing feedback, which ultimately also helps to increase motivation. In addition, formative examination formats considerably facilitate the possibility of achieving higher levels of competence.

Gamification

Lecturers usually base their choice of lecture format on what they themselves experienced as students and found to be good. However, there are two fundamental problems with this: 1. university lecturers are usually not representative of the average student, 2. the more time passes, the less representative are one's own preferences compared to those of the current younger generation.. Gamification transfers elements of (computer) games into teaching and ensures, among other things, that the younger generation of students are more motivated to engage in learning activities at all. In addition, gamification is perfectly suited to formative examination formats and also provides the opportunity to experience learning with multiple senses.

Practical examples

The question from learners as to why they should do what they are told to do is an absolutely understandable and legitimate one. Statements along the lines of "because it says so in the curriculum" are the worst possible responses. Even the prospect that certain aspects will be needed later in the course of study is far too abstract to serve as motivation for most students. However, to show students that they can now develop solutions to problems that may have even prompted them to study in the first place, leads to a significant increase in motivation.

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DOI: 10.17185/duepublico/82628
URN: urn:nbn:de:hbz:465-20241118-105939-7

1st IFToMM Young Faculty Group Symposium on Emerging Fields in Mechanism and Machine Science 2024: 19.11. - 21.11.2024, Online Symposium