The importance of mathematics studies in engineering education in the assessment of employers

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Factors affecting the engineering in Latvia

- Competition for the best workers is increasing, but candidates are becoming more mobile and ready to move to other country.
- Existing professionals are close to retirement age, and companies have problems with succession building.
- Interest in engineering has declined (only 10.3% of all students are studying engineering).
- The shortage of qualified engineering specialists in Latvia is one of the main reasons why Latvia, compared to other countries, obtains the worst indicators of global competitiveness.
Necessity to increase math knowledge and skills

- The demand for highly qualified engineers determines the need to improve mathematics studies.

- Employers believe that university graduates should focus on a broad spectrum of new technologies. A good specialist is the one who is able not only to adapt to changes and to improve (or even change) its qualifications, but can be the originators of innovations.

- Graduates must be prepared to work in a modern organization, which is characterized by a continuous process of innovation, customer centricity, the resignation of the old, working in teams, etc.

- Universal and sustainable skills, which will be useful for various areas of professional activity in the long-term period, are important both for production and the university education.
The development of study programs

- The usefulness of the subjects included in the study programs and their required amount is assessed by the contribution of the subject to the programs for the achievement of the common study objectives.

- In Latvia the development of study programs is usually implemented in close cooperation between higher education institutions and employers.

- Several sectoral councils have been set up in Latvia, as well as institutions of the Convention of Advisers, which participate in the development of profession standards and the development of higher education programs.

- Each higher education institution regularly evaluates the quality of study programs, their driving forces and obstacles, as well as their relevance to the needs of the Latvian economy and labour market.
The aim of the study

A survey of engineers from various disciplines was conducted to reveal the views of employers on various aspects of mathematics education and the need for mathematical knowledge and skills to perform professional duties.
Questionnaire for employers

Different types of questions were used:

- a number of statements are given for respondents to mark one or more topics
- most of the answers to the questions were to be given by expressing approval or rejection in the four-step Likert scale: I fully agree, agree, disagree, or completely disagree
- some statements had to be evaluated it in the scale from 1 to 10, where 1 – is not required and 10 – very high
- open questions

The survey includes 68 cases
Indicators by which employers evaluate study programs

- The employment of graduates in general and the jobs they do
- The level of preparedness of the graduates in profession
- The development of so-called soft skills or transversal competences
- Etc. ..
The employment of graduates in the construction industry

- A quarter of the graduates work in construction, that is, on the construction place in various managerial positions
- The other quarter is employed in the administrative work of construction companies
- 20% of the graduates work in construction supervision and control structures
- 15.4% - in design work
- The remaining 15% of graduates are employed in construction-related consultancy, research, and information gathering and processing
Graduates' level of preparedness in the employer assessment

- Very high: 8%
- High: 7%
- Average: 31%
- Low: 54%

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Necessity of mathematical knowledge in the employer assessment
Graduates' level of preparedness in the employer assessment

- When hiring a new employee, you prefer graduates with high mathematical skills
- A person, who understands mathematics, will easily master most jobs that require thinking
- I appreciate people who understand mathematics well

0% 20% 40% 60% 80% 100%

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- I don’t know
The development activities of the math study process to ensure the development of relevant competences

- Shift of emphasis, content distribution by levels, inclusion of ICT programs
- Organization of the study process:
  - inclusion of ICT in the teaching process
  - interdisciplinary approach
  - self-directed learning
  - diversification of teaching methods
  - development of e-materials
  - etc.
Aspects of usage of math software in engineering

- Software packages are now widely used in industry. The extensive use of information and communications technology in the workplace has changed not only the way that work is done, but also the work itself.

- The availability of increased computational power means that analyses that were previously unavailable because they would have taken too much time are now carried out routinely.

- On the one hand, the pervasive presence of computers to carry out calculations has reduced the need for mathematics in the workplace.

- On the other hand, more sophisticated analyses are available at the click of a mouse, the workforce needs to be more mathematically competent in order to understand and interpret the information produced by these analyses.
E-learning and math software

- Both universities in the study are using an e-learning system based on the MOODLE e-learning system in which:
  - each student is provided with information on the progress of his or her subject, lecture materials, curriculum, teacher ratings, course information, etc., as well as user-created and public courses are available
  - each user receives e-learning reports and tips and video tutorials on how to use the e-learning environment more efficiently

- At both universities, the study of mathematics also includes familiarization with a variety of mathematical software, from which Matlab is most profoundly taught, which is also highly regarded by employers
Conclusions (I)

- Nowadays an important tendency in the development or improvement study programs is the intensification of dialogue between higher education institutions and employers, analysing the level of preparedness of graduates in the assessment of employers.

- Based on employer survey results, the aims of teaching mathematics require students to be prepared to put into practice the learned subjects, as well as to master the theoretical principles that will be needed in future work to understand and use professional literature, make decisions, etc.

- The need for a number of topics that are currently covered in engineering degree programs is rather underestimated by employers.
Conclusions (II)

In designing mathematics study content and forms, understanding of the importance of the subjects being studied and prerequisites should be taken into account, providing the necessary information on content issues in the math course, taking into account the difficulty of mathematics topics and continuity of learning.

The practical training organization should take into account the students' level of preparation, their intellectual abilities and their cognitive advantages.

The proportion of contact hours and independent work should be respected in relation to the degree of difficulty and importance of the subject in other mathematical subjects.
Conclusions (III)

The following conclusions are based on the research methodology:

- The empirical part of the research uses a self-assessment method, therefore the results are based on the respondents' opinion.
- This was a case study, and it only reflects the views of the students and lecturers who participated in it.
- The study will be used to identify problems / directions for in-depth research.
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Thank you for your attention!

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