Developing 21st Century Skills in Engineering Studies with E-Learning
Agenda

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Introduction

> Increased need for highly skilled software engineers, having a blend of both technical and professional skills
> Technical vs. professional skills = 21st century skills
> Limited time devoted to professional skills in engineering curricula
> Differentiators between applicants for a job position
Approach & Contribution

> Analysis of possibilities for integrating 21st century skills into an engineering curriculum
  > Extensive literature survey
  > Few examples how these skills can be systematically developed across any curriculum
> Presentation of different existing e-learning based approaches
> Evaluation in two study programs at our University
  > Bachelor Computer Science and Digital Communications
  > Master study program Software Design and Engineering
> Set of recommendations using blended learning concepts for introducing professional skills into curricula of engineering studies
Relevance

> Employees of the 21\textsuperscript{st} century are required to apply their knowledge and skills in unknown and evolving circumstances

> In engineering: Many interdisciplinary projects in rapidly changing and globally distributed environments

> Students have to learn to
  > think in more integrated ways
  > considering interconnections and
  > relations between the perspectives of different disciplines

> Problem
  > Low acceptance of courses related to 21\textsuperscript{st} century skills in engineering studies
Teaching 21st century skills

**Isolated**
Courses are held independently from other courses

**Integrated**
Integration into technical course

**Module**
Combination with technical course – 1 grade

**Interdisciplinary**
Complex projects among several disciplines
Example Course Design – Module

Create
Synthesize
Analyze
Apply
Understand
Remember

Solving Real Software Integration Problems
In-class Lectures with Coaching
Distance Learning Tasks
Learning Diaries
Anchored Instructions
Gamification
Short Videos
Wiki Repository
Example Course Design - Integrated

- Software programming and testing
- Mobile learning devices
- Mobile e-learning
- Virtual collaboration
Recommendations & Findings I

>Administration Effort

- **Module**
- **Integrated**
- **Interdisciplinary**
- **Isolated**
Recommendations & Findings II

> Include 21st century skills in the curriculum starting with the first semester

> Interconnection of 21st century skill courses with technical courses in increase students’ acceptance

  > Start with Module courses in earlier semesters

  > Integrated and Isolated courses can be gradually introduced

  > In advanced semesters, Interdisciplinary courses can be introduced

> E-learning concepts can help to lower administration efforts

  > Support communication and coordination between and lecturers.

  > Serve as knowledge repository, making best-practices examples and lessons learnt structured and available for everyone
Conclusion

> Integrating 21st century skills in engineering curricula is a challenging task

> Discussion of four categories for integrating 21st century skills in engineering studies.

> Recommendations and examples for the integration

> In our future work

  > Further application and investigation of e-learning concepts for integrated teaching of technical and professional skills
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