University of Montenegro

Some Experiences in Teaching Software Engineering at the Faculty of Mathematics and Sciences in Podgorica

7th Workshop
"Software Engineering Education and Reverse Engineering"

Topics

- Initial prerequisities
- SE courses and topics
- Experiences
- Acknowledgement

Initial Prerequisites

- **Curriculum: Computer Science**
  - **general background (fundamentals): mathematics**
    - "strong", and "classical" approach
    - calculus, algebra, differential equations, discrete mathematics, mathematical logic, etc.
    - sometimes, intention to fully "compress" a traditional 4+4 course to the given 2+2 one
  - **Computer Science fundamentals**
    - computer architecture, operating systems
    - algorithms, programming techniques and paradigms, data structures, file organization, databases, etc.

Initial Prerequisites

- **Curriculum: Computer Science**
  - **Software Engineering (SE) courses**
    - Introduction to information systems (IS)
      - V semester, 2+0
      - elective for the lecturer
      - mandatory for the students
    - Software Engineering
      - VIII semester, 3+2
  - **SE related courses**
    - Databases, Advanced Databases
      - V & VI semesters
    - Advanced Programming Techniques
      - VII semester, 2+1
    - Programming Languages
      - VIII semester, 3+3

Initial Prerequisites

- **Curriculum: Computer Science**
  - **SE related courses**
    - Databases, Advanced Databases
      - V & VI semesters
      - data models, database design techniques, DBMSs
    - Advanced Programming Techniques
      - VII semester, 2+1
      - XML, web services, SOAP, WSDL, etc.
    - Programming Languages
      - VIII semester, 3+3
      - OO design, UML 2.0 (1.4)

Initial Prerequisites

- **Curriculum: Computer Science**
  - **lack of prior fundamental knowledge about**
    - organization system theory
    - management of organization systems
    - ERP, CRM, HR, financial management, etc.
    - project management
    - business process modeling and WfMS
    - quality assurance in organization systems
    - performance measurement and analysis of organization processes

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SE courses and topics

- **Introduction to information systems**
  - **Goals**
    - recognize IS as a complex system in an application domain
    - recognize an importance of a multidisciplinary approach to the successful development and usage of an IS
    - recognize what is a discipline of the software development and the system development
    - "widening" students' views about the role and the application of CS and SE in the system engineering and software engineering
  - **Methods**
    - ex-cathedra, but
    - motivating the students all the time for a discussion

SE courses and topics

- **Introduction to information systems**
  - **Topics**
    - the role of IS in an organization system and its management
      - social, organizational, psychological and technological aspects
      - user expectations, and expectations from users
    - approaches to IS development
      - methodology - development process model, life cycle, alternatives and approaches, structural and refactoring approaches, software engineering, software vs. IS
      - project management, quality management and standards
      - IS architectures
    - dataflow modeling and dataflow diagrams
    - IS development methodology – a common model
      - a detailed process decomposition (up to 4th hierarchy level)
    - CASE tools and 4GLs in the IS development process

SE courses and topics

- **Software Engineering**
  - **Goals**
    - recognize wide variety of SE topics, and their usage domains
    - practice how to successfully specify and build a working software product in a given application domain
    - become able for further self learning
    - become able for team working
    - motivate to act in a responsible, ethical, professional and independent way in the system engineering and SE jobs
  - **Methods**
    - ex-cathedra, but motivating the students for a discussion
    - students' presentations
    - group exercises
    - practices in a selected application domain

SE courses and topics

- **Software Engineering**
  - **Topics**
    - **mandatory**
      - selected by the lecturer
    - **elective**
      - offered by the lecturer, an extensible list of topics
      - selected, prepared and presented mostly by the students
      - not all offered elective topics were held each year
    - **exercises**
      - practicing SE on a development project in a selected application domain
      - offered by the assistant
      - selected and implemented by the students

SE courses and topics

- **Software Engineering**
  - **Mandatory topics**
    - SE goals, principles, tasks, SE vs. system engineering
    - Management of SE process, Quality management
    - Risk management
    - SE process and process model, different approaches, agile software development and prototyping
    - Software reengineering
    - Requirements engineering
    - Architectural design
    - Configuration management
    - CASE tools in SE
      - presenting main functions of a selected CASE tool
      - practicing the usage of a selected CASE tool in SE projects

SE courses and topics

- **Software Engineering**
  - **Elective topics**
    - Formal methods and formal specifications in SE
    - UML 2.0 vs. UML 1.4 and MDA
    - Rational Unified Process (RUP)
    - Reusability and patterns in SE
    - Validation and verification in SE
    - Software measures and cost estimation in SE
    - Extreme Programming
    - HCI and UI specification in SE
    - CMMI and process improvement
    - Balanced Scorecard (BSC) and performance measurement
    - Information Technology Infrastructure Library (ITIL)

SE courses and topics

- **Software Engineering**
  - **Elective topics**
    - Control Objectives for Information and related Technology (COBIT)
    - Prince 2 and project management
    - People management and P-CMM
    - Workflow Management Systems (WfMS)
    - Data Warehouse Systems and DSSs

SE courses and topics

- **Software Engineering**
  - **Exercises**
    - developing an IS application in a selected domain
      - specification of business processes
      - specification of a software product
      - implementation of a software product
      - development of a project documentation
      - using a selected CASE tool with a code generator embedded
      - using a selected programming environment and DBMS

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Experiences

- **General**
  - there were always well-motivated students
    - ready to learn something new and useful
    - ready to communicate well
  - "non-bologna" students
    - sometimes, a lack of discipline, problems with
      - lessons attendance
      - delays in fulfilling duties and passing final exams
      - a general motivation for studying
    - but, SE does not promote such kind of acting

Experiences

- **Introduction to information systems**
  - final exam
    - very good verbal skills in answering questions
  - the students usually do not perceive a real importance in an industry practice of the topics and problems discussed throughout the course

Experiences

- **Software Engineering**
  - raising of students' motivation
    - well motivation factors: group exercises, elective topics, and practicing on a software development project
  - better lessons attendance
  - better perceiving of a real importance of SE in an industry practice
    - some students were already employed (full time, or short term jobs) in
      - software companies or
      - non software companies
    - differences between the students having or not having and industry experience

Experiences

- **A comparison with the different population**
  - University of Novi Sad, Faculty of Technical Sciences
    - Department of Management and Industrial Engineering
    - Curriculum: Information Systems
    - "small room" for CS, SE courses, and mathematics
      - a lack of knowledge, particularly in programming, formal methods and systems
    - good in organization theory and management
    - students are supposed to learn a lot from CS by themselves
      - they feel much more difficulties in learning topics from CS
      - there are motivation problems and great delays in duties, too
      - some of them are well motivated and become successful in CS and SE disciplines
        - » they are usually excellent in their self-promotion and self-confidence, and consequently
        - » gain a better score on the market

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Acknowledgment

- All the time, I was an invited lecturer at the faculty
  - a lot of traveling, but trying to motivate the students to an intensive communication
  - let me thank to my students for their understanding
- And above all, let me give great thanks to my colleagues **Goran Šuković**, **Verica Sekulić** and **Aleksandar Popović**, who generously supported me in many ways
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End of presentation

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