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Reflection over a Decade of Experiences with Student Projects in the Courses on Information Systems Development

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Study Programs before 2000

- Only two study programs:
  - Applied Informatics (degree Engineer in Informatics)
  - Informatics Education (degree Professor* in Informatics)
- Only one course related to IS
  - Databases
- No electives

* High-school professor (teacher)

Curriculum reconstruction in 2000

- 3 Sub-programs (specializations) of Applied Informatics:
  - Software Engineering
  - Information systems
  - Informatics and Industrial Mathematics
- Information systems specialization consisted of:
  - Information systems
  - Databases II
  - Modeling and simulation with visualization
- Related elective courses
  - Geographic information systems (to be taught by the Department of Geography)

Curriculum reconstruction in 2005

- Introduction of ECTS concepts
  - More study programs and lot's of choice
    - 4 programs x 4-year studies, 2 programs x 3 years
- Information systems upgraded to a program. Courses:
  - Information systems
  - Analysis and logical design of IS
  - Physical design and implementation of IS
  - Databases II
  - E-Business architectures and design
  - Human-computer interaction
  - Software-project management
  - Data mining
  - Team work

Curriculum reconstruction in 2009

- All is the same, except for some restructuring & renaming in order to achieve even more free choice:
  - Applied Informatics → Academic Studies in Informatics
  - All 4 year programs were downgraded to sub-programs of ASI
    - No specialization when entering the studies
    - More choices - later
- The term sub-program was no longer used, instead:
  - They are called Modules
  - If the student enrolls all the listed courses in the module he will get the specialization, otherwise he will not
  - It might be possible for a student to take the courses from two modules and acquire two specializations

Curriculum reconstruction in 2011

- The previous information was on my experience with IS at the Institute of Informatics (II), Faculty of natural sciences and mathematics (FNSM)
- In 2011 we (II@FNSM) merged with the staff from the Institute of Computer Technics and Informatics, Faculty of Electrical Engineering and Information Technologies (ICTI@FEEIT)
- The new Faculty of Computer Science and Engineering (FCSE or FINKI in Macedonian) was created
  - 4 completely new joint study programs
  - 2+2 inherited study programs together with all their sub-programs, modules and specializations

Curriculum reconstruction in 2011...

- An interesting situation occured
  - There is the IS module (from previous slides) inherited from II@FNSM
  - There are IS courses inherited from ICTI@FEEIT (they were not structured as a module or sub-program)
  - There is new IS module in the brand new Computer Science and Engineering program
  - There is new IS module in the brand new Applied E-Technologies program
- All of these modules and programs contain courses that are similar but not the same, or have same name but are not similar
  - All are offered to both new students, and older students

Curriculum reconstruction in 2013

- Since there were many situations as explained before
  - a new revision of the joint programs tried to simplify and reduce redundancies and
  - balance the load and courses within the new programs
- Still redundancies exist with the old programs and sub-programs

History of courses on IS development

- The years mentioned previously were when the reconstruction finished and 1st year students enrolled
- But the IS courses related to development were later:
  - **Information systems** *revision 2000* (started first 2003)
  - **Information systems** *revision 2005* (started first 2007)
  - **Analysis and logical design of information systems** *revision 2005* (started first in 2008)
  - **Physical design and implementation of information systems** *revision 2005* (started first in 2009)
  - *Revision 2009* did not change these courses
  - *Revisions 2011 and 2013* have not yet started
  - Not even mentioning **Databases**

Complicated to follow and execute?

- Not yet
- By law students are allowed to follow the original program for **at least 8 years**
  - The last students admitted with revision 2005 should have finished this year (in progress), or migrate to a program from the latest revision in effect
  - The last students admitted with revision 2009 (before the merger) should be allowed to continue until 2018
  - The last students admitted with revision 2011 should be allowed to continue until 2019
  - Revision 2013 will have the first students now
- This year I had students on Databases, from revisions 2000,05,09,11, all with different requirements to finish

Course: Information systems rev. 2000

- Original description:

  Concepts for information system development; components; types; projecting methodology; managing functions; structured vs. nonstructural analysis; tools for IS structure development: decomposition, DFD, data flow matrix; process structure: process structure diagram, action diagram; data models, data records; alternative tools: prototyping method, CASE tools, evaluating and selecting software alternatives for IS development; programming engineering and re-engineering; concrete IS developing tools; new trends in storing, retrieving, categorization and filtering of information.

- Focus on: Project planning, UML and RUP

Course: Information systems rev. 2000 practical and lab work

- Focus on: Project planning and management, RUP Concepts and UML, using tools:
  - Microsoft Project
  - Rational Rose before 2003, then IBM Rational Modeler
- Students' course work:
  - Only group work
    - Choose and elaborate their own idea for a project
    - Develop project plan of their project work from inception to transition in MS Project
    - Follow a custom short RUP, develop an inception and elaboration level UML model of the project

Course: Information systems rev. 2005

- Original description:

  Theory of systems and concepts; information systems and organizational systems; system components and relations; cost/value and quality of information; competitive advantage of information; decision support; system levels: strategic, tactical and operative; the role of information and information technologies; roles in the usage, development and management of IS; planning and managing changes; IS development process; evaluation of system performance; social and ethical issues related to design and usage of IS; specification, design and re-engineering of IS; application vs system software; software packages; procedural vs non-procedural languages; object-oriented design; characteristics, functions and architecture of databases; networking and telecommunication systems and applications; characteristics of IS professionals; career in IS; information security, information related crimes and ethics.

- Focus on: IS development process and methodologies, IS types and roles in the enterprise, enterprise systems - ERP, CRM, SCM, HRM, quality criteria and evaluation and selection of systems

Course: Information systems rev. 2005 practical and lab work

- Focus on: RUP concepts, RUP Inception phase in detail, Quality criteria and how to choose a software solution
  - IBM Rational Software Architect for modeling
  - Chosen software solution to present a demo or prototype
- Students' course work:
  - Choose and elaborate their own idea for a project
  - Individual seminar works
    - Choice of development process and methodology
    - Feasibility or Business case
  - Group work
    - Vision for the chosen project
    - Following a short RUP, develop an inception level model
    - Find existing software solutions according to Vision and evaluate how the solutions implement each use-case

Course: Analysis and Logical Design of IS (ALDIS) rev. 2005

- Original description:

  IS life-cycle; requirements gathering; logical design, physical design and implementation planning; interpersonal communication skills, interviews and presentations; group-work dynamics; feasibility analysis and risk planning; group-based approach to: project management, joint application development and structural reviews; structural versus object-oriented methodologies; rapid application development; prototyping; IS database design; software package evaluation, acquisition and integration; global and inter-organization problems and system integration; professional code and ethical behavior.

- Focus on: Project planning, RUP overview level and learn UML in full detail

Course: ALDIS rev. 2005 practical and lab work

- Focus on: RUP Inception and Elaboration phases, Project planning, group coordination
  - IBM Rational Software Architect
  - Trac for group coordination and project documentation
  - Microsoft Project
- Students' course work:
  - Continue modeling their own project from previous course IS
  - Only group work
    - Re-iterate over previous work, develop final documents
    - Follow RUP as much as possible, develop an inception level “analysis model” – full use-case model with full scenarios using activity diagrams and sequence diagrams
    - Develop an elaboration level “design model” - full class model, full use-case realizations with sequence diagrams
    - Component model, Deployment model for use-case realizations
    - Tracking of project work in MS Project, final development plan

Course: Physical design and implementation of IS (PhDIIS) rev. 2005

- Original description

  Conceptual, logical and physical data model and modeling tools; structural and object-oriented design; database modeling: relational and object-oriented; design tools; data dictionaries, repositories and warehouses; database implementations GUI and reports; multilayer planning and implementation; data migration; post-implementation review; development frameworks and standards; application design based on structural, object-oriented and event-driven methodologies; testing and quality control; system implementation; system deployment; configuration management; support; multilayer architectures and client-independent design.

- Focus on: RUP construction and transition, application development frameworks, functional testing

Course: PhDIIS rev. 2005 practical and lab work

- Focus on: RUP implementation designs of use-case scenarios, DDD frameworks and CI with automated testing
  - IBM Rational Software Architect
  - Trac and Hudson
  - Other software frameworks
- Students' course work:
  - Continue work on their own project from ALDIS
  - Only group work
    - Follow RUP to develop a final implementation level “IT design model” – final use-case **implementation** scenarios
    - Evaluate software frameworks for domain-driven development and develop a prototype of crucial use-cases
    - Have the software prototype and design model in full sync
    - Develop automated tests for crucial use-case scenarios

Team work rev. 2005

- Original concept (no full description):

  Professors responsible to lead the course define extensive problems/projects, define student groups modules on the problem/project that should be developed using existing knowledge. The projects are then offered to the enrolled students, to choose from.

- The idea was from:
  - Capstone Project course from ACM, IEEE and AIS curriculum guidelines that should integrate knowledge from several topics/courses in a real life-like project
  - *Project work* from several German universities
- Course is being removed in curriculum revision 2013 %-|

Number of students

IS rev. 2000	2003/2004	29
	+	
	2006/2007	83
IS rev. 2005	2007/2008	10
	-	
	2010/2011	9
IS rev. 2009	2011/2012	39
	~	
	2012/2013	38
ALDIS rev. 2005	2007/2008	9
	-	
	2011/2012	4
ALDIS rev. 2009	2012/2013	7
FDIIS rev. 2005	2008/2009	8
	-	
	2012/2013	5

Some example projects

- One very big project (many students have participated in several iterations and courses and depth):
  - Integrated Student Information System
    - Admissions, Enrollments, Exams, Course management, Class schedules, CRM for students, Online consultations
- Many more smaller projects. Some interesting examples, varying in state of development:
  - Kindergarten management
  - Integrated country-wide bus transport system
  - Integrated system for issuing licenses
  - City-wide parking space management
  - Group-wise Biography management
  - IS for a natural-juice production factory

Conclusion and Final Comments

- Advantages of the concept
  - Spiral-like model in learning IS development
    - students who are less interested take usually only IS
    - students who like the specialization take more courses
  - Real-life work, step by step, phase by phase, from idea via model to final product in all details, in coherent way
    - Students get to be real managers, analysts, designers
- Disadvantages
  - Very hard to include newcomer students directly in the later courses, due to specific course-work prerequisites
  - Curriculum reconstructions with lot of choice are counter productive
    - Hard to come up with a coherent group of students

Q&A

- Questions?
- Comments?
- Similar experiences?