University *of Ljubljana*
Faculty *of Computer and Information Science*

Andrej (Andy) Brodnik
andrej.brodnik@fri.uni-lj.si

Suggestions and criteria for writing informatics education doctoral thesis

Dec 6th, 2013

Three good men of December

Santa Claus – Xmass Eve

St.Nicholas – this morning

Father Frost –New Year's Eve

Object of research

- **Informatics** and **Educational Science** – **CS** and **ED**

Education of **Informatics**

Informatics for **Education**

- or both – interdisciplinary field
- What department to submit the thesis to?

My path to supervising many doctoral thesis projects in CER revealed much of the richness of the field, but also created major learning challenges for me. One cannot be an expert in all areas. Therefore international networking and joint efforts to improve research quality are essential.

Lauri Malmi, ACM Inroads, Volume 4 Issue 3, September 2013

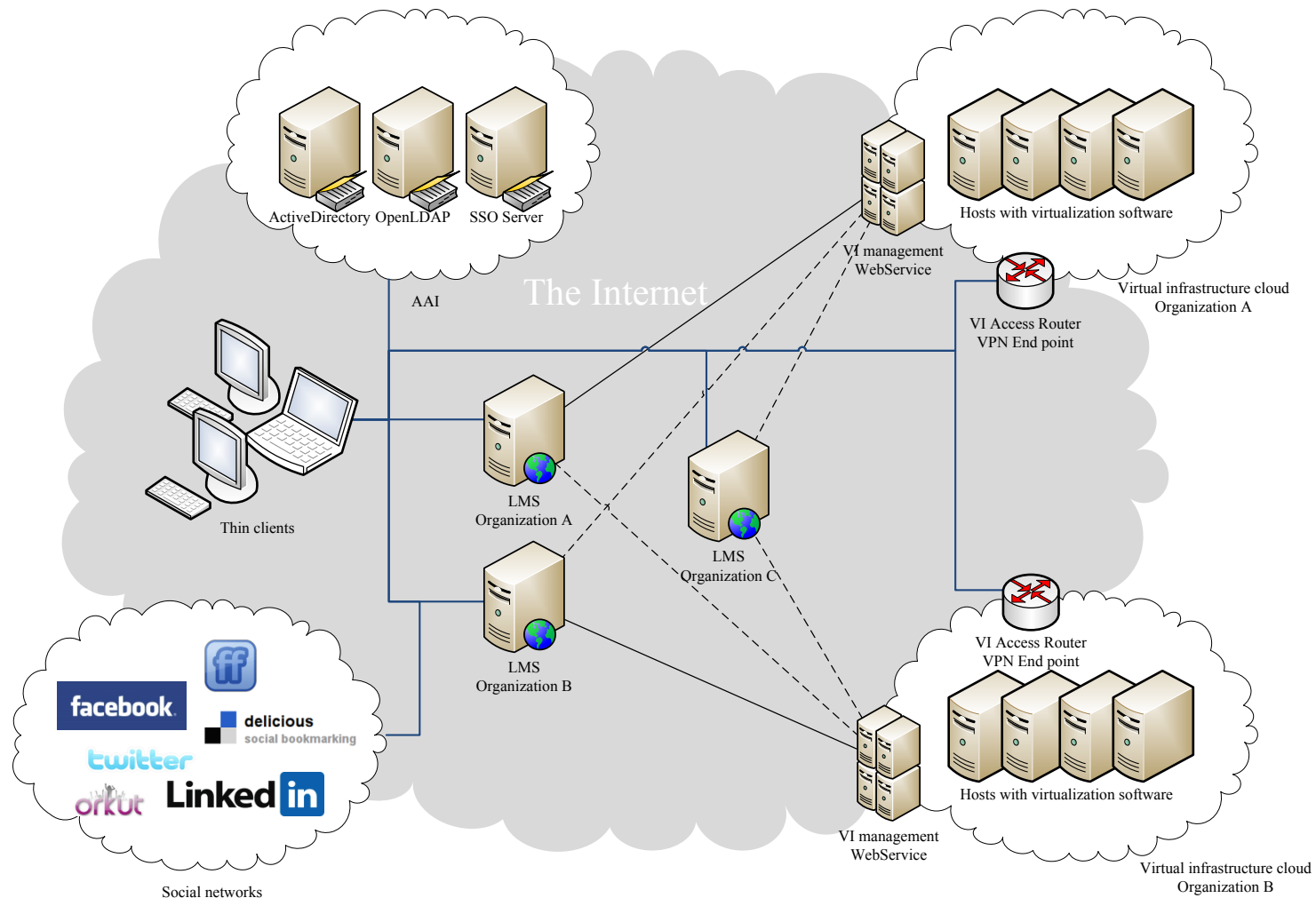# Virtual Computer Laboratory

- web-based e-learning platform based on NCSU VCL
  - reservation based
  - 24/7 availability
  - time and space shift
- practical hands-on experience
  - creativity without fear of breaking things

SAKE: Web Architecture as a Learning Technology for Constructivist e-Learning (http://www.fri.uni-lj.si/en/research/projects/9082/project.html)

J. Rugelj, M. Ciglarič, A. Krevl, M. Pančur, A. Brodnik: Constructivist learning environment in a cloud, LTEC 12
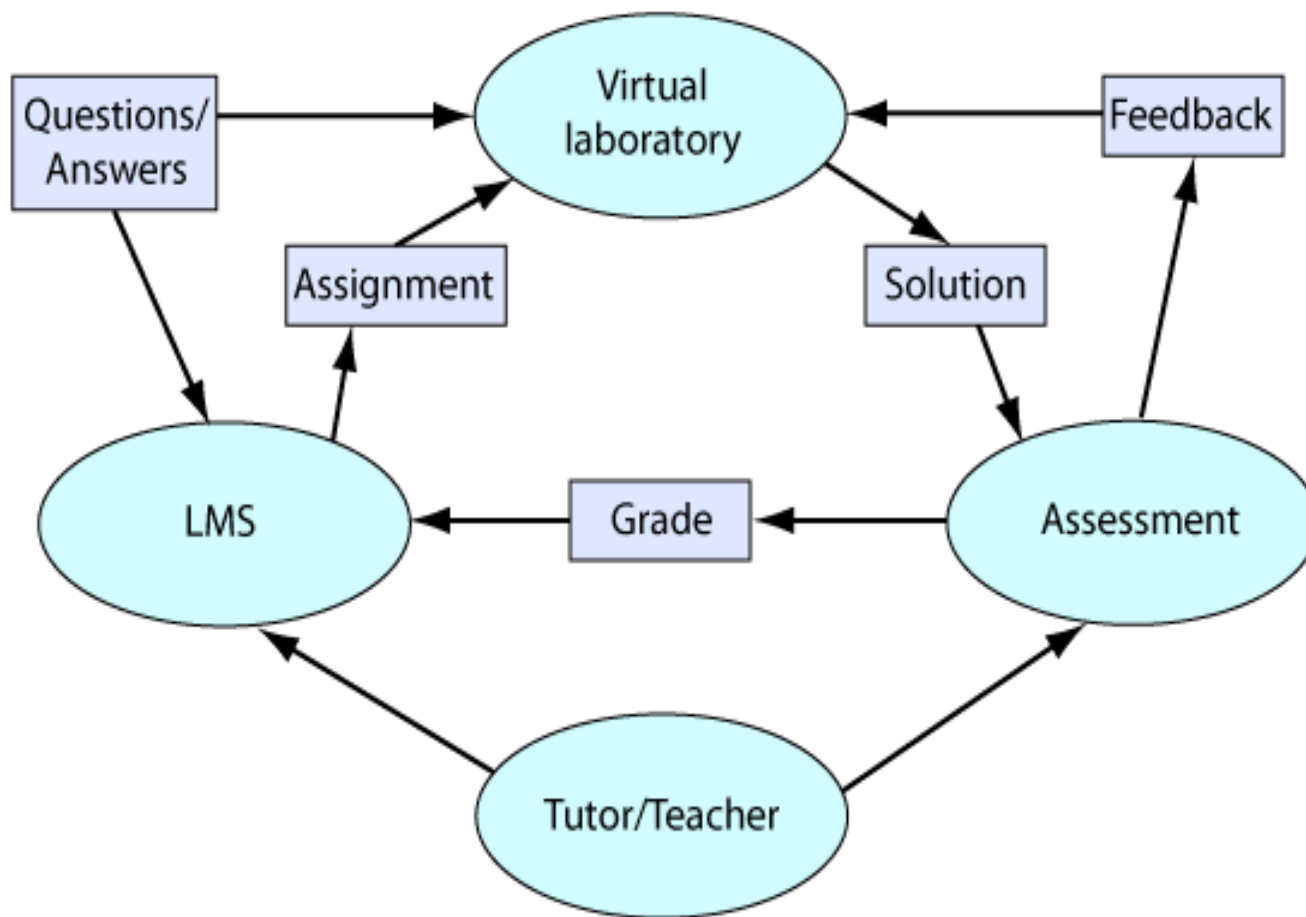
Virtual Computer Laboratory

Virtual Computer Laboratory

Computer Communications

- Assignment in VCL
  - consists of two tasks
- students divided into two groups
  - same first task (topic IP)
  - different second task (topics DNS and WEB)
- 14 days to complete
  - one task should take one hour
  - unlimited number of attempts

What do we teach

Due to development of society and technology it is essential to develop a curriculum for teaching Computing (including Digital Literacy and in particular Computer Science) that will allow children in K12 education to have an access to knowledge that will make them **creators of technology – not just its consumers**.

IFIP TC3, Torun, 2013,

Towards Knowledge Societies for Peace and Sustainable Development, UNESCO – WSIS+10, Paris, 2013

What is Informatics/Computer Science

- **Knowledge areas:** Algorithms and Complexity, Architecture and Organization, Computational Science, Discrete Structures, Graphics and Visual Computing, Human-Computer Interaction, Information Assurance and Security, Information Management, Intelligent Systems, Networking and Communications, Operating Systems, Platform-based Development, Parallel and Distributed Computing, Programming Languages, Software Development Fundamentals, Software Engineering, Systems Fundamentals, Social Issues and Professional Practice

ACM/IEEE-CS Joint Task Force, Computer Science Curricula 2013 ai.stanford.edu/users/sahami/CS2013/, ACM Curricula Recommendations, www.acm.org/education/curricula-recommendations

Education and Informatics

- K-12 education
  - K-3 – primary level/school
  - 4-8 – primary/lower secondary level/ school
  - 9-12 – (upper) secondary level/high school
- College/university level
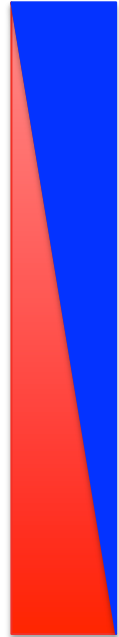
Research

- Etymology [Merriam-Webster]: Middle French *recerche*, from *recercher* to go about seeking, from Old French *recerchier*, from *re-* + *cerchier*, *sercher* to search

- Therefore, look around for sources and existing work.

Dwarfs standing on the shoulders of giants (Nanos gigantum humeris insidentes), Bernard of Chartres, 12th century

If I have seen further it is by standing on the shoulders of giants., Isaac Newton, 17th / 18th century

How to search

- Find the resources:
  - organizations,
  - journals,
  - conferences, ...
- Weekly routine of reading
- My personal experience:
  - browse several tens od abstracts, more thoroughly read several papers, really diligently read one paper
- Make notes:
  - use some kind of tools (e.g. Mendeley)

Organizations

- ACM – Association for Computing Machinery
  - SIGCSE – SIG on Computer Science Education (www.sigcse.org)
  - SIG for Information Technology Education (www.sigite.org)
- IEEE – Institute of Electrical and Electronics Engineers
  - IEEE Computer Society (www.computer.org)
  - IEEE Education Society (www.ewh.ieee.org/soc/es/)
- Australian Educational Researcher (AER)
- International Society for the Scholarship of Teaching and Learning (ISSOTL)

IEEE

- IEEE Computer Society
  - Educational Activities Board (www.computer.org/portal/web/education)
  - Frontiers in Education
  - Learning and Teaching in Computing and Engineering
- IEEE Education Society
  - The IEEE Transactions on Education

ACM SIGITE

- Publications
  - SIGITE Newsletter
- Meetings
  - Annual Conference on Information Technology Education
  - Annual Conference on Research in Information Technology

ACM SIGCSE

- Publications
  - ACM Inroads
  - The SIGCSE Bulletin
- Meetings
  - The SIGCSE Technical Symposium on Computer Science Education
  - Annual Conference on Innovation and Technology in Computer Science Education (ITiCSE)
  - International Computing Education Research Conference (ICER)

Journals

ACM Inroads; ACM Journal on Educational Resources in Computing (JERIC) renamed to The ACM Transactions on Computing Education (TOCE); American Journal of Distance Education (AJDE); Assessment and Evaluation in Higher education; Association for the Advancement of Computing in Education (AACE) Journal of Computers in Mathematics and Science Teaching (JCMST); Australian Journal of Educational Technology (AJET); Behaviour & Information Technology; British Journal of Educational Psychology; British Journal of Educational Technology (BJET); Bulletin of Applied Computing and Information Technology (BACIT); Communications of the ACM (CACM); Computer Science Education; Computers and Education; Computers in Education Journal; Education and Information Technologies; Educational Assessment; Educational Media International (EMI); Educational Psychologist; Educational Research; Educational Technology & Society; Educational Technology Review (ETR); European Journal of Education; Evaluation; First Monday; Higher Education Research & Development (HERD); Human-Computer Interaction; IEEE Computer; IEEE Transactions on Education; IEEE Transactions on Learning Technologies; Information Processing & Management; Informing Science; Innovations in Education and Teaching International (IETI); Instructional Science; Interactive Learning Environments; International Alliance of Teachers and Scholars (IATS) Journal; International Journal of Artificial Intelligence in Education (IJAIED); International Journal of Human-Computer Interaction; International Journal of Human-Computer Studies (formerly the International Journal of Man-Machine Studies) (IJHCS); International Journal of Instructional Media (IJIM); International Journal of Teaching and Case Studies (IJTCS); International Journal of Qualitative Studies in Education (QSE); International Journal on E-Learning (formerly WebNet Journal) (IJEL); Interpersonal Computing and Technology (IPCT); Informatics in Education; Journal for Computing Teachers; Journal of Computer Assisted Learning (JCAL); Journal of Research on Technology in Education (JRTE); Journal of Computing in Higher Education; Journal of Computing in Mathematics and Science Teaching (JCMST); Journal of Computing Sciences in Colleges; Journal of Curriculum Studies; Journal of Documentation; Journal of Education for Library and Information Science (JELIS); Journal of Educational Computing Research; Journal of Educational Multimedia and Hypermedia (JEMH); Journal of Educational Psychology; Journal of Educational Research; Journal of Educational Technology Systems; Journal of Engineering Education (IJEE); Journal of Information Science (JIS); Journal of Information Technology Education (JITE); Journal of Interactive Instruction Development (JIID; Journal of Interactive Learning Research (JILR); Journal of Research and Practice in Information Technology (JRPIT); Journal of Research and Practice in Technology Enhanced Learning; Journal of Research on Technology in Education (JRTE); Journal of Technology and Teacher Education (JTATE); Journal of the American Society for Information Science and Technology (JASIST); The Journal of the Learning Sciences; Knowledge and Information Systems (KAIS); Learning and Instruction (EARLI); Oxford Review Of Education; Review of Educational Research (RER); Research in Higher Education; Review of Research In Education (RRE); Studies in Higher Education; Teaching in Higher Education; UltiBASE; User Modelling and User-Adapted Interaction; WebNet Journal (now International Journal on E-Learning)

Conferences & Workshops

The SIGCSE Technical Symposium on Computer Science Education; Annual Conference on Innovation and Technology in Computer Science Education (ITiCSE); International Computing Education Research Conference (ICER); ACE - Australasian Computing Education Conference (2008), all papers in ACE conferences from 2003 onward are part of the CRPIT series, as volumes 20, 30, 42, 52, 66, and 78.; ACM Special Interest Group in Computer Science Education (SIGCSE) Technical Symposium; Computing and Information Technology Research and Education in New Zealand (CITRENZ); Consortium for Computing Sciences in Colleges (CCSC) Regional Conferences; Frontiers in Education Conference; Innovation and Technology in Computer Science Education (ITiCSE) Conference; International Computing Education Research (ICER) Workshop; Koli Calling - Baltic Sea Conference on Computing Education Research; Lilly Conferences on College and University Teaching; Conference of the National Advisory Committee on Computing Qualifications; Psychology of Programming Interest Group; Workshops on OO Education (OOPSLA and ECOOP)

Sources

- SIGCSE
  - Places to publish: http://www.sigcse.org/resources/publish
- Microsoft Research
  - Computer Education: http://academic.research.microsoft.com/RankList?topDomainID=2&subDomainID=23
 - journals, conferences, keywords, organizations, publications

Some challenges – maybe?

- Informal education: how to approach it?
- Motivation of learners: how to boost it?
- MOOC, Massive open online course
  - how to run it (pedagogy, informatics)?
  - when to use it?
- Big data: use in education?
- Measurement tools: standardize as service?
- Holistic approach in teaching informatics
  - informatics is not only …, how to include other knowledge areas?

Saint Nicholas – why?
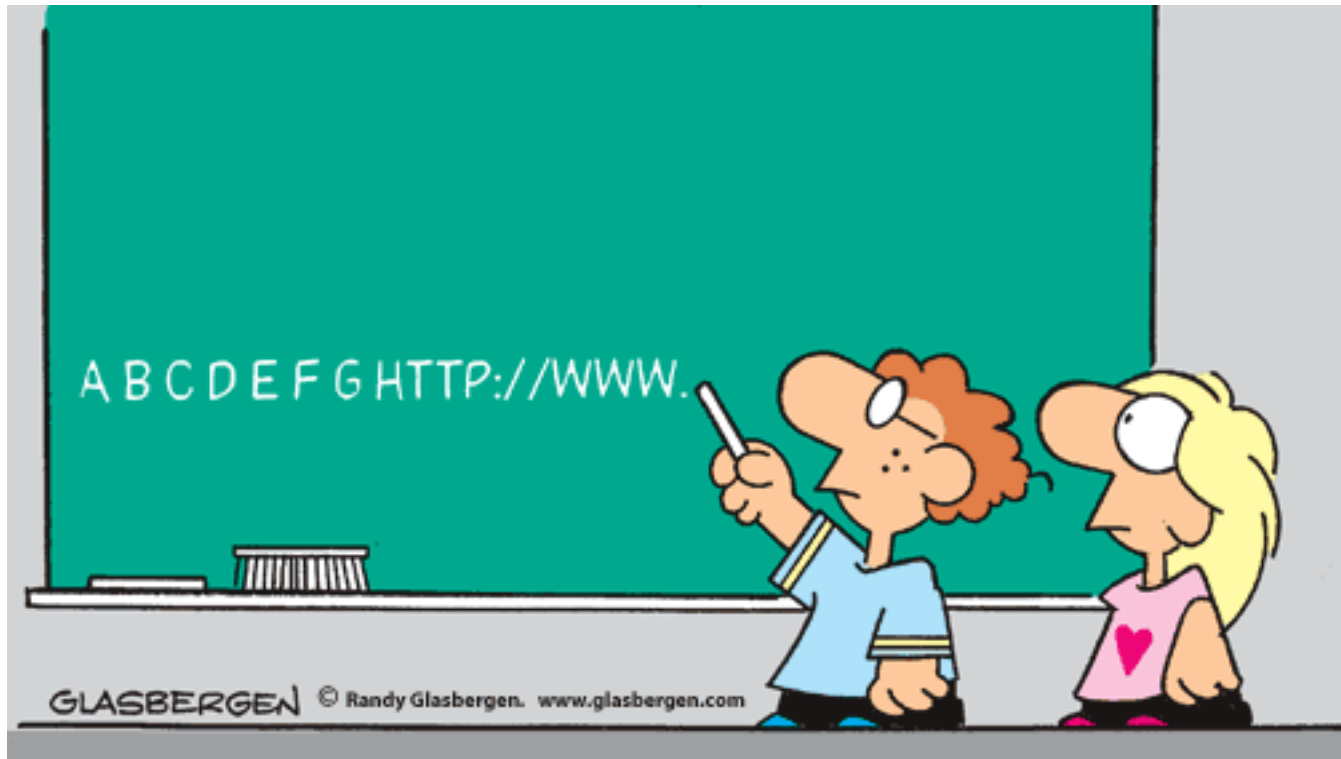
Hvala za pozornost!
Thanx for your attention!