

Working Group “Informatics in Secondary Education”

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ABSTRACT

We propose a working group that will collect, evaluate, integrate and present research findings about Informatics in secondary schools. As a result we expect a comparison of the effects of different organizational conditions, teaching approaches, curricula, teaching methods of Informatics courses in secondary schools in different countries. As a theoretical framework for the synopsis we propose the *Berlin Model* of Heimann, Otto and Schulz.

Categories and Subject Descriptors

K.3.2 [Computers and Information Science Education]: Computer science education, Curriculum, Information systems education

General Terms

Human Factors

Keywords

Active Learning, Secondary Education, Preconditions of Learning, Decision Areas, Consequences of Learning Measures

1. INTRODUCTION

Browsing through relevant international literature about Informatics or Computer Science in education, it is conspicuous that there is a large amount of publications about specific aspects of teaching, e.g. topics, teachings methods or application of certain programming languages, but only a few papers that present research findings about the overall effects of courses in Informatics that take place in secondary schools [7]. From time to time a new curriculum approach is presented (e.g. [2], [9]), but very seldom it is followed by a study about the effects of this approach.

In consequence, the discussion about the improvement of teaching Informatics in secondary schools is driven more by pure opinions, hope or suspicion, than by evidence. This might be one of the reasons why it gets very emotional sometimes.

2. RELATED WORK

There were several publications describing national initiatives, e.g. by A. Tucker, who presented and explained the situation in the US and the ACM K12 [8] or by the Computer Science Teachers Association [7].

The UNESCO offered 1994 its curriculum for Informatics in secondary schools [9], that was updated in 2000. In 2001 the Joint IEEE/ACM Curriculum Task Force presented its “Computing Curriculum 2001” [2]. Concerning standardization the subject of Informatics runs far behind the traditional subjects like Mathemat-

ics. Some proposals for educational standards in Informatics came e.g. from Austria [3].

In 2005 Dagiene and Mittermeir organized a new series of specific conferences that was called “Informatics in Secondary Schools – Evolution and Perspectives (ISSEP)”. Until today the ISSEP took place 2005 in Klagenfurt (Austria), 2006 in Vilnius (Lithuania), 2008 in Torun (Poland) and 2010 in Zurich (Switzerland). Although there are some contributions from other countries (like Israel), the main emphasis of these conferences lies in central and eastern Europe. The ISSEP 2011 will take place in Bratislava (Slovakia).

3. THEORETICAL FRAMEWORK

In order to structure the work of the group, we propose to use the so-called *Berlin model* (by Heimann, Otto and Schulz) as a theoretical framework, which we use also in our teacher education courses [1]. This well-structured and proven model distinguishes between *preconditions* of learning (age and social level of students, gender aspects, prerequisite knowledge, school system, ethnic and traditional aspects, technical and financial resources), *intentions* (learning objectives, competencies, standards), *learning content* (curricula, syllabi), *teaching methods, media* (programming languages, software), *consequences* (changes that are caused by the subject, learning outcomes of the students).

4. GOALS

There is a variety of very different approaches towards teaching informatics in secondary schools. They differ heavily concerning e.g. learning goals or topics, programming paradigms and languages (respectively application software), organizational aspects (e.g. within a mandatory vs. an eligible subject) or teaching methods. We want to collect research findings from as many different countries as possible about the effects and outcomes of these approaches in different countries. The focus of the research will be on general education of students from 11 to 19 years.

We propose to compare these findings concerning the variables that arise from the *Berlin model* (see section 3).

5. RELEVANCE

The outcomes of the working group might be used e.g. by national stakeholders arguing in favor of (or against) a subject of Informatics, curriculum designers deciding which of the investigated approaches a coming national initiative should follow, researchers developing a framework for further studies about informatics in secondary schools or teacher educators as a ‘look over the fence’ in teacher education.

6. WORKING PLAN

The work of the group is planned to start immediately after the working group membership application period closes, using a collaborative group in the *Mahara* portfolio system (www.mahara.org) on our server offering views, common access to files, forums etc. The final work on the draft will be done using *DropBox* (www.dropbox.com).

We aim to develop a draft document before the conference that already contains the most important findings of the working group. The working sessions during the ITiCSE will be used to discuss the draft in presence sessions, finish the work on the document, collect additional literature, best practice examples etc. and to include some input that might come from the presentations at the conference.

7. EXPERTISE

Peter Hubwieser has been teaching Mathematics, Physics and Informatics at secondary schools for 15 years. Since 2002 he is an associate professor at the Technische Universität München, teaching and researching Informatics and didactics of Informatics. He has designed the new mandatory subject of Informatics that was introduced 2004 in the German state of Bavaria (see [4]). In 2007 he elaborated the core curriculum in Informatics within a nationwide initiative for standardization of teacher education.

Torsten Brinda worked as a scientist in the "Didactics of Informatics" groups at the Universities of Dortmund and Siegen. In 2005 he became an associate professor for "Didactics of Informatics" at the University of Erlangen-Nuremberg. Since 2007 he has been member of working groups of the International Federation for Information Processing (IFIP) on secondary and higher Informatics education and in 2010 he became the chairman of the IFIP working group 3.2 "Informatics and ICT in higher education".

Johannes Magenheimer was a teacher of Informatics and Mathematics in Secondary Schools since 1976. Since 1998 he is a Professor for Didactics of Informatics at the Institute of Computer Science at the University of Paderborn. Within IFIP he is member of Working Groups 3.1 and 3.3.

Since 1979 *Sigrid Schubert* has taught informatics in secondary, vocational and higher education. She has been professor of "Didactics of Informatics and E-Learning" (Universities Siegen and Dortmund) since 1998. She is the German National Representative in the International Federation for Information Processing (IFIP) TC 3 "Education" and Fellow of the "German Society for Informatics (GI)". As vice-chair she is organizing the cooperation in IFIP WG 3.1 "Informatics and ICT in Secondary Education". Together with Johannes Magenheimer and Niclas Schaper she conducted competence model research for the domains of informatics systems and modeling at secondary level (project MoKoM), founded by the German Research Foundation (DFG), see [5], [6].

8. WHO MIGHT CONTRIBUTE

We expect people from many countries to contribute to the WG ISE, particularly secondary school teachers, teacher educators, educational researchers that are active in the field of Informatics in secondary schools and/or teacher education, professors that are interested in and well informed about informatics in secondary education.

9. REFERENCES

- [1] Brinda, T., Hubwieser, P.: How to teach didactics of informatics to informatics student teachers. In: IFIP (ed.) *New developments in ICT and Informatics education*. To appear (2010)
- [2] Cross, J.; Denning, P.: *Computing Curriculum 2001*. The Joint Curriculum Task Force IEEE-CS/ACM Report, (2001). http://www.acm.org/education/curric_vols/cc2001.pdf.
- [3] Dorninger, C. : Educational Standards in School Informatics in Austria. In *From Computer Literacy to Informatics Fundamentals*, Goos, G., Hartmanis, J., Van Leeuwen, J., Eds. Mittermeir, R., Springer, Berlin, Germany (2005), pp. 65-70.
- [4] Hubwieser, P.: Functions, Objects and States: Teaching Informatics in Secondary Schools: Invited talk. In: Mittermeir, R. (ed.) *Informatics Education - The Bridge between Using and Understanding Computers*, 4226. Springer (2006)
- [5] Magenheimer, J.; Nelles, W.; Rhode, T.; Schaper, N.; Schubert, S.; Stechert, P. : Competencies for Informatics Systems and Modeling. Results of Qualitative Content Analysis of Expert Interviews. In *Proceedings of the 1st Global Engineering Education Conference - Educon 2010*, Digital Library IEEEexplore, IEEE Computer Society, (2010), ieeexplore.ieee.org/search/freesrchabstract.jsp?tp=&arnumber=5492535.
- [6] Schubert, S.; Stechert, P.: Competence Model Research on Informatics System Application. In *Proceedings of the IFIP Conference "New developments in ICT and Education"*, June 28-30, Amiens, France (2010.), www.die.informatik.uni-siegen.de/e-publikationen/Publikationen/2010/2010-Amiens-Schubert.pdf.
- [7] Stephenson, C., Gal-Ezer, J., Haberman, B., and Verno, A., *The new educational imperative: Improving high school computer science education*, Final report of the CSTA Curriculum Improvement Task Force February 2005, Computer Science Teachers Association, Association for Computing Machinery (2006).
- [8] Tucker, A.: K-12 Computer Science: Aspirations, Realities, and Challenges. In: Hromkovic, J., Královic, R., Vahrenhold, J. (eds.) *Teaching fundamental concepts of informatics*. 4th International Conference on Informatics in Secondary Schools - Evolution and Perspectives, ISSEP 2010, Zurich, Switzerland, January 13-15, 2010 ; proceedings, pp. 22–34. Springer, Berlin (2010)
- [9] van Weert, T.J.: Informatics for secondary education - the UNESCO/IFIP curriculum as a resource for developed and developing countries. In: *Proceedings of the IFIP TC3 WG3.1, 3.4 & 2.5 Working Conference on Capacity Building for IT in Education in Developing Countries*, pp. 275-288. Chapman & Hall, Ltd., London, UK, UK (1998)
- [10] Schulte, C., Magenheimer, J.: Novices' expectations and prior knowledge of software development: results of a study with high school students. In: ACM (ed.) *Proceedings of the first international workshop on Computing education research*, pp. 143-153. ACM, New York, NY, USA (2005)