Educational Standards in School Informatics in Austria

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Abstract. In the last two years educational standards have been an important issue when discussing the different student achievements in upper secondary education of the EU member countries. Standards are an indicator of quality at school and should be applied to different subject areas in general and to vocational education (and training). Computer science or information technology is one of the most interesting subjects in this context: It is pretty new in all curricula and is strongly linked to practice. The definition of different achievement levels to understand important models and patterns of school informatics is rather easy. There are also good links to certification standards in industry and expert circles. Therefore, the paper outlines a model of four levels for standards of certification in information technology skills. It fits well for 13 year (7th grade) to 18 – 20 year (12-14th grade) old students. Critical success factors are discussed. First experiences with the model have been analysed.

1 Introduction

A government initiative in Austria from 2001 to 2004 has created and initiated a number of projects and perspectives for schools, colleges and universities. Branding "eFit-Austria" (www.efit.at), a support programme with about 30 Million Euro was established, where pupils, students, teachers and educational institutions as a whole can participate. The main activities of this initiative are as follows:

- The campaign to promote "New media in teaching at schools and universities" with platforms and e-learning and internet skills programmes for teachers and a project application procedure for university teachers and institutes;
- A support structure (funding, organisation, evaluation) for e-learning projects of educational institutions (also adult education) and student groups;
- An electronic learning portal www.bildung.at, where community building and content provision is being managed;
- A new approach to reshape the computer science studies at Austrian universities has been established (computer science bachelor, master, and teacher-training programmes at some universities);
- With regard to private-public-partnerships there is intensive cooperation with industry to provide internationally acknowledged IT-certificates like Network Academies, Networking operation systems, ERP-Software and Internet –script languages (JAVA, PHP, ASP,…) for students (from the age of 16);

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- An open source software initiative was launched in December 2002 to promote working with software like LINUX, Staroffice or shareware learning platforms. A certificate for students and teachers will raise acceptance of "free software" and support training structures.
- Some first ideas of developing educational standards of IT subject areas in secondary education (general education and vocational education and training) will be launched.

Recent developments in pedagogy have focused on shifting from instruction to problem solving. The higher independence of the learner from teacher instruction or fixed learning programmes based on behaviouristic ideas has changed to elements of cognitivistic or constructivistic learning models. Not only teacher-student interaction but also working in learning environments or professional support structures (simulation of real working places) increasingly influence the learning culture.

One important issue is to implement quality assurance at schools. This is to ensure that the objectives of subject areas in different years can be fulfilled. One of the most important vehicles to maintain quality is to define educational standards for important subject areas. In Austria educational standards will be introduced for subjects like Maths, English and German in grade 8. As for vocational education and training, in subject areas like information technology it is easy to define valuable and reliable educational standards.

2 What Are Educational Standards?

Educational standards define the demands on teaching and learning. They describe objectives and aims are named for the educational work, expressed as learning outcomes of students. Specific tasks and group of tasks must be fulfilled to master these targets.

Educational standards describe the competences of students necessary to meet the objectives. The competence based models depend on a specific grade and will be written in a way to derive concrete tasks and formulate levels of testing.

Educational standards should be developed in different subjects, also in computer science or information and communication technology. In the field of IT-skills, important work has been done: There are lots of certificates available in the IT-sector to get expertise in different IT-skills and in information technology some basic skills were defined already in 1997 in Finland, Sweden or Ireland.

3 Education and Training in Information Technology

School informatics as a subject area in secondary school syllabi is fairly young and does not have traditional approaches. School books are not really important, a lot of spontaneous work is done and the laboratory character of the students` work is impressive. Syllabi and curricula are very general and aim at implementing concrete skills. The content is "open" to be designed.

All European countries have recently introduced learning standards, national ones or international ones like the ECDL (European computer driving license). So the basic

IT-skill segment is well defined and was approved a number of years ago. The pedagogic component of IT basic skills is not fairly outlined in the ECDL syllabus – like group work, project work or problem solving technics. Combined with a suitable pedagogical approach, the ECDL plus pedagogical items would be a good example of such a quasi standard.

In Austria, further steps have been taken to deal with higher level skills: IT industry certificates were introduced and sometimes even new ones developed. Examples are the CISCO-networking academy, the Microsoft IT-academy, skills to use ERP-software like MySAP (specific customising for county typical accounting) or database qualification in the world of ORACLE. Also a certificate for open source software (LINUX et al) has been developed.

Even if one can see some disadvantage like product near working – and loss of general IT approaches - or the short life cycles of software versions, there is evidence of positive development: near to expert practice, world wide accepted and sometimes linked to e-learning courses with really good material like the CISCO-network academy.

As the well known certificates require high level expertise (like Linux Professional Institute modules 101 or 102), for open source software and LINUX a student skills package to enter this new world was created. The EOSC (European open source certificate) is now offered to young people to prove their often acquired informally qualifications in this field.

4 A Model of IT Standard – Four Levels of Competence

Standards for IT at school informatics are related to similar constructs in language learning (the TOEFL –test in English for example), in training of special technology skills like in welding, manufacturing, or in quality assurance. Providing access to these "external" certifications and integrating the required knowledge and skills into vocational education and training school curricula has a longer tradition in Austria.

The experience in these areas forms an important basis for the discussion on standards. Because of "open" syllabi the main responsibility is delegated to the teachers. Quite different profiles in different schools developed – from low level ranking in student test achievements like PISA (programme of international students assessment) to high level ranking of good or best schools. The gap between the good and the worse performers is to large, decided an expert group of the Austrian minister (Bericht der "Zukunftskommission" des bm:bwk; Vienna, 2003).

Therefore, an "evaluation culture" in the Austrian education system must be established. School programmes and system monitoring form one part this evaluation culture, educational standards in groups of subjects another.

In information (and communication) technology four levels can be defined to standardise skills and knowledge:

- The first level is ECDL (seven modules from general IT-knowledge, operating system, office products to internet access) combined with a pedagogical approach of knowledge in school informatics.
- The second level is a problem solving approach including programming language skills and dealing with moderate algorithm in computer science. There should be a

link to change standard software like office products by using different data models (e.g. to extend the knowledge of office products with macro programming via Visual Basic for Application).
- The third level is a first expert level. External certificates are awarded. It can be done in different subject areas like networks, database-programming, network operation systems or web technologies. A clear occupational sub-area must be linked to this level.
- The fourth level has to do with excellent programming knowledge and software design concepts of computer science disciplines and basic research work together with a grade in higher education.

With this level concept the range from grade 7 or 8 (ECDL) to higher education can be covered. Level two can be met with upper secondary graduation, level three with specific vocational training, practice and certification (career in an ICT- profession field or bachelor degree in applied computer science), level four relates to a university diploma in ICT disciplines.

5 First Experiences with IT Standards Since About 2000

After three years of practice, we have come to the following conclusions:

1. For rather a simple learning process and exam content in terms of basic skills, it may be easier to define standards and norms. Complex know-how in IT and knowledge in upper secondary and higher education are not easy to standardise. We have high numbers who achieve level 1 (100.000 ECDL graduates in 3 years in Austria!). Those, who acquire IT industry certificates, are fewer in numbers. Educational content and skills required in the exams must be part of the school syllabi or it must be easy to integrate it. Exams outside school programmes form a high barrier and are not widely accepted (the CISCO academy syllabus comprises 4 semesters and the semester exams are taken by a broad group of students and teachers. But only 30% of them take the last exam “outside the course” – a summary of the 4 semesters. So the implementation of standards is important and possible, but they must be implemented within the regular programme.
2. For standards there should be a kind of guarantee of acceptance in the professional fields. If they are linked to career pathways, it is easy to argue their importance. The more global (world wide) standards one can introduce, the bigger the link to labour market needs, the easier IT standards will be accepted by a larger amount of students. In vocational education and training it may be easier to get a feeling for these developments. Standards in IT subjects are mostly world wide, connected to specific software or products and have a short lifetime. Not really easy to integrate them in the slow moving education sector!

Educational standards will continue to dominate parts of the discussion of school efficiency and the way to demonstrate the beginning of lifelong learning. IT has experience with certification and could feed its expertise into this discussion.

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