Shared QA for Producing Free Educational Materials at the FTA

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1 Introduction

The emergence of Free Technologies such as Free Software and Open Standards has led to an increasing demand for skilled specialists, while few academic programmes exists to prepare people. The Free Technology Academy (FTA) was set up to address this need. In this article we will in particular show the need for shared development and shared quality assurance. The authors sustain that lessons can be learnt from such shared efforts, which are particularly relevant for the advance of Open Educational Resources in general, their move from in-house produced and run educational objects towards peer produced materials and online learning networks. The FTA shows how this can be done in the field of Computer Science and invites interested participants to join the debate and participate in its multiple open futures.

2 The Free Technology Academy

2.1 Need for Education on Free Technology

Software has become a strategic societal resource in the last few decades. The emergence of Free Technologies, such as Free Software and Open Standards, are drastically changing the economics of software development and usage, but most educational programmes in Computer Science and other related fields do not reflect this reality.

In contrast to proprietary software, Free Software (FS) [1] – also referred to as 'Libre Software' or 'Open Source Software' [2] – can be used, copied, studied, modified and redistributed freely. Thus, FS supports the freedom to learn and the freedom to teach. In addition, Open Standards (OS) are fundamental for interoperability: they enable the unencumbered flow of knowledge and information and make competition possible, since users do not depend on formats and specifications that are controlled by one stakeholder.

Many national and regional governments have set the use of these technologies as a strategic goal. The value of FT is recognised by the European Commission in its Digital Agenda for Europe, as part of its EU2020 strategy [3], and

they have been one of the cornerstones of FP6 and FP7 for Software and Services. Their strategic importance has also been confirmed by the Open Source Observatory of IDABC and the Worldbank infoDev report. IT Research firm Gartner predicts that by 2012 more than 90 percent of enterprises will use open source in direct or embedded forms [4].

One of the main factors that holds back the massive adoption of Free Software, as pointed out by a group of specialists led by Manuel Castells [5], is the lack of knowledge and expertise among IT professionals, educators and decision makers. This is shown by the JISC funded OSS-Watch observatory, which detects a shortage in Open Source skills [6]. Capiluppi and Baravalle [7] confirm this by showing vacancies in the UK and above average job opportunities for FS specialists Visiting `http://monster.com` on 03/2009, nearly 600 positions were open (only in UK) in the areas of LAMP development, Web development, Linux system administration, and technical support. Nearly 200 of those openings were in the London area. In 08/2009 1020 such positions were found, 438 of which in the London area. Entry level rates start at 18,000 pounds per year, and experienced developers can earn over £35,000 per year. Several studies, like the EC-funded FLOSS-Impact study [8], clearly recommend Member States to integrate Free Software into the educational system.

2.2 Purpose and History

It was this need for education on Free Technology that triggered the set up of the FTA in 2008. With a grant from the EC's Lifelong Learning Programme a consortium consisting of the Free Knowledge Institute (FKI), the Universitat Oberta de Catalunya (UOC), the Open University Netherlands (OUNL) and the University of Agder (UiA) in Norway set of to lay the foundations for an online master-level programme on Free Technologies. At a high level, the FTA strives to:

- contribute to a society that permits all users to study, participate and build upon existing knowledge without restrictions;
- contribute to the building of a critical mass in the use of Free Software and Open Standards.

At a more concrete level, the FTA aims to:

- upgrade knowledge on Free Software and Open Standards of ICT professionals, learners, teachers and decision makers;
- build a sustainable Free Technology Academy;
- build a network of partners to share the costs and benefits of education on free technologies.

In order to reach these goals a strategy to develop and publish all educational materials as Open Educational Resources was developed. The rationale and business model behind this is based on a 'Fully Free Knowledge model' [9]

In 2010 the Academy has run its first course modules in its Virtual Campus and attracted 161 enrolled learners, three times as many as initial expectations.

At the same time more than 100.000 complete downloads of the published course books were made in the first 9 months of publication.

While the project ran as an EC project until the end of 2010, the founding partners decided to continue the Academy as a joint venture between the FKI, UOC and OUNL and with the help of an incipient learning community and partner network [10]. In order to be successful, the project is conceived as a knowledge commons in which both the community and partner network play a critical role.

2.3 Provenance of the OER Materials

The course materials used at the FTA consist of course books (syllabus) that are published openly under free licenses in various formats. Additionally course activities, study guides and other materials are made available. Those course activities that can be of value for future cohorts are developed by the learners on the Campus Wiki, thus enabling a mode of peer production.

Since 2003 the UOC has been running its master programme in Free Software in Spanish and Catalan. The programme was leading in making available all its course books under free licenses. For authoring the books the UOC contracted leading specialists in Spain and Latin America. Jesus Gonzalez Barahona and other colleagues from the Universidad Rey Juan Carlos participated to author several parts, such as for the Introduction to Free Software book. In 2007 some of those books were translated into English by the FP6 funded SELF Project and when the FTA project took off, these were updated and other books were translated as well.

One of the courses, Deployment of Free Software, has been translated from the UOC's Spanish book and has been complemented by the Free Knowledge Institute with a set of case studies that are seeded in the Campus Wiki. Learners are invited to contribute new case studies to the wiki as part of their course activities.

In 2011 the OUNL has made available its Software Architecture course book for use in the FTA. The first edition of this book was written by Sylvia Stuurman and Ella Roubtsova in 2007 as an OUNL course book based on lectures given by Lex Bijlsma in the Software Technology master programme of Utrecht University. These lectures in turn owed much to an earlier version by Gert Florijn. A second edition, with contributions from Bastiaan Heeren, was published in 2009. The FTA version was updated and rewritten by Sylvia Stuurman in 2011.

2.4 Certification and Recognition

A learner who successfully completes a course, that is to say is awarded a passing mark for his or her contributions, receives an FTA certificate. These certificates are issued by the FTA itself, and not by any of the participating universities; hence they have no a priori formal status and, in order to obtain credit in the context of a university master, a recognition process is necessary. The three universities that are consortium members in the FTA have each established such a

recognition process for their own separate master programmes. Other universities may or may not follow suit according to their own rules for recognition of external courses.

Recognition of FTA certificates is easiest where the course module involved has little or no overlap with obligatory courses in the university master programme. Since most of the courses in the initial FTA offering were based on original courses from UOC that had no counterpart at OUNL, recognition at OUNL simply takes the form of adding these to the list of options allowed for inclusion in the electives part of the Computer Science master. To be able to do so, the official examinations committee had to inspect the courses for academic level and scientific orientation. The outcome at present is that CS master students at OUNL may include up to four FTA courses in the electives space. There are some exceptions, mostly having to do with courses deemed more proper for the bachelor level. A similar arrangement holds at UiA, but there the restrictions are more severe due to the different focus of its master programme.

Procedurally, recognition of FTA certificates has a different basis where FTA courses have the same subject as obligatory courses in the regular master programme. At the UOC recognition is straightforward in the sense that most FTA course modules originate from the UOC's master programme in Free Software. The UOC recognises each of the FTA modules. The same holds at OUNL for the (for now single) course that originated there. In such cases the student that desires recognition for the FTA certificate will have to obtain a waiver for the corresponding obligatory course, which may require some form of payment.

The FTA certificates are not issued on paper, but take the form of a pdf file sent by e-mail to the learner. Authenticity is guaranteed because each certificate carries a unique identification number that can be checked at the FTA. An online automated check is foreseen in the future.

The fact that the certificates are not issued by an individual university but by the FTA consortium, which is not even a legal entity, causes some problems with recognition by universities not involved in the project. This is one reason why the consortium is planning the development of an accredited international master programme offered jointly by several universities, possibly accompanied by a joint degree.

3 Quality Assurance

The FTA has set up procedures necessary to ensure that the qualifications and learning outcomes offered by the FTA are recognised by all participating universities while ensuring coherence with the Bologna process. This will enable potential learners to get a certification for the completed FTA modules and get a waiver in case of continuing a complete cycle of study at one of the universities. For a (potential) learner that is located inside or outside the European Union, the quality process will give the learners confidence he/she will get course materials that confirm to high quality standards and the same is true for the learning processes once the learner has enrolled in a course. The FTA has defined a set of

predetermined systematic actions applicable within the framework of quality assurance with the purpose of ensuring that the participants get a standard quality product or service. It consists of separate yet connected activities: quality control and quality assessment. The quality aspects are derived from international academic standards. For classifying the knowledge areas within the FTA, the ACM Computing Classification System (CCS) is employed. ACM is the world's largest educational and scientific computing society, and aims to deliver resources that advance computing as a science and a profession. The ACM Computing Classification System, has served for 30 years as the primary and most generally used system for the classification and indexing of the published literature of computing. In order to present a standardised description of competences, the European e-Competence Framework was selected. This is a European wide reference framework of information and communication technologies competences that can be used and understood by ICT professionals and human resources managers from ICT user and supply companies, small and medium sized enterprises, the public sector, as well as educational and social partners across the European Union.

Quality assurance is directed at the two main processes within Tree Technology Academy: course creation and course delivery. The course creation process concentrates on the production and delivery of course books that are made available for free download from the FTA website. In the course delivery process learners can get additional support while studying the course books by enrolling in a course run. In an electronic learning environment they can deepen their insight in the content of the course book by making assignments, getting support by academic tutors and discussing the various topics of the course with fellow learners.

3.1 Implementation of the PDCA Cycle

The Quality Assurance processes of the FTA follow a Plan-Do-Check-Act cycle aiming at continuous improvement of the products en processes. PLAN: establish the objectives and processes necessary to deliver results in accordance with the expected output. DO: Implement the new processes. CHECK: Measure the new processes and compare the results against the expected results to ascertain any differences. ACT: Analyse the differences to determine their cause.

The board of the FTA controls the complete PDCA cycle, iteratively starting with the planning phase, monitoring the processes, arranging improvements and start a new planning phase. As part of the DO phase course developers make new courses or improve existing courses whereas tutors support enrolled students. Learners and tutors present their opinions with respect to the conditions and outcomes of the delivery of the course as part of the CHECK phase. The Scientific Council is especially active in the ACT phase and analyses the difference between anticipated outcomes of the FTA courses and the actual outcomes.

The course materials of the FTA originated during the starting period of the FTA from the Universidad Oberta de Catalunya, one of the founding members of the FTA, using existing course books which were used already extensively within the curricula of the UOC. The courses were adopted for the FTA and

some new courses were made from scratch. This process of making new courses and improving existing courses will be integrated in a more open process in the future using principles of peer production. The quality guarantees for building upon materials and processes that are used and practised for years in the constituting Universities, will now be secured in an open platform where comments and contributions from experts, people that download the course books and students that followed the courses can be used to improve the quality of the FTA offerings. Periodically new versions of the course books will be the result of these processes and will be presented as revised course books and improved delivery processes and assignments.

3.2 The Scientific Council and Other Quality Related Committees

The Scientific Council is an advisory commission to the Board of the FTA. The council will meet once a year to look back at results with respect to the goals of the Free Technology Academy and will give advice on future activities and projects that could support the goals. The Scientific Council has both members with an academic background and members with a professional background with respect to Free Software. The members were recruited worldwide, not just from participating countries and can be dependent from partner universities. At the moment the members are: Susan D'Antoni, Nagarjuna G. Jesús M. González Barahona, Rob Koper, Ronaldo Lemos, Anne Østergaard and Elizabeth Stark.

Advice given in 2010 by Scientific Council members includes;

- Improve the information made available on the FTA site about the courses, in particular with respect to the course prerequisites and assumed knowledge or experience, but also about form and value of the certificates and what to expect from the tutor.
- It is urgent to establish a mechanism for keeping course content up to date and adapting it to various national contexts.
- The use of the virtual campus is too limited: many learners mostly view content and do not interact much.
- The most important subject still missing is the social, as opposed to technical, aspects of FS development.
- The FTA does not seem to use blogging in an essential way. Students could get a blogging assignment on pressing issues, e.g. software patent law. Works out well, because people from the outside pick up on it, but it is also a writing exercise and a research exercise for the students. Of course one should put a CC-BY-SA licence on the blog.
- The products handed in as assignments are not yet made public. Students might be reluctant to have their name attached to not-so-good code, but that's the spirit of the free software community.

The FTA has also defined a process to guarantee the quality of the exams and will install a committee for complaints. The quality of the exams is guaranteed by the formal procedure appointing the examiner (the tutor who is responsible for

the examinations for a specific module) and the evaluation report the examiner produces after each run of a specific FTA module. Handling complaints is a two-step process. A learner can have questions or can have complaints about a course, the services of the FTA or the way he/she has been treated. Entering a support question is the first step a user should take if he/she has a question or a complaint. A staff member of the FTA Academic Management team will respond to this question or complaint. If this learner isn't satisfied with the response of this staff member, the learner can make a formal complaint to the Complaints Committee of the FTA.

3.3 Course Evaluations

The evaluations from learners and tutors are the corner stones for guaranteeing the quality of the FTA delivery. Every learner that has enrolled in a course receives a questionnaire after finishing a run and can give his opinion with respect to the following aspects: the course content, the assessment, the Electronic Learning Environment, the learning support, the general appreciation and administration related aspects like: marketing, the registration process and the printing on demand of course book offerings. The tutors fill in a questionnaire presenting opinions from their perspective of the study processes: the possibilities to give proper learning support and being able to assess the learning progress of the learners, the usability of the electronic learning environment and the general appreciation of the extend to which they are able to support the learning process of the learners.

In addition data is gathered about the activities in the Moodle Electronic Learning Environment. The following main categories are distinguished: course activities, assignments, user activities and viewing, adding, deleting or updating information in the Learning Environment. It appears viewing is by far the most predominant activity indicating learners use the Learning Environment in the first place to collect information. To activate the study process discussions will be stimulated as a result of the analysis of these logs.

The course evaluations resulted in a large number of suggestions for improvements. Suggestions where related to the course books (making some of the books more up-to-date, giving clearer information about required implicit or explicit prerequisites, improving the technical production of courses, stimulating peer production of new and revised courses, checking external links, introducing a printing on demand service), to course delivery (being more explicit about what learners can expect from tutors, for example about response times, offering tools like chat) and to the administrative processes (avoiding re-registration and improving the delivery of certificates).

4 The Learners' Network

The Free Technology Academy facilitates the learners with a Virtual Learning Environment (VLE), called the Virtual Campus. The Virtual Campus is fully

based on Free Software in order to guarantee its sustainability and the transfer of technology and expertise to all present and future partners. The basis for the FTA Campus is the Campus Project, a framework developed by a consortium of Catalan universities in cooperation with the MIT and which is published under the GNU Public License (GPL) [11]. The Virtual Campus runs on top of the Moodle LMS and integrates various other Free Software applications such as Wordpress, MediaWiki, OpenFire and Elgg. The virtual campus is freely accessible for everybody who wants to participate in and exchange knowledge about Free Technology. The campus includes a community portal where people can participate in existing discussion groups, set up new groups, contribute to the development of learning materials, the campus, its tools and methodologies and more in general contribute to the building of a specialist community around the topics of Free Technologies. Registration to the campus is free and provides access

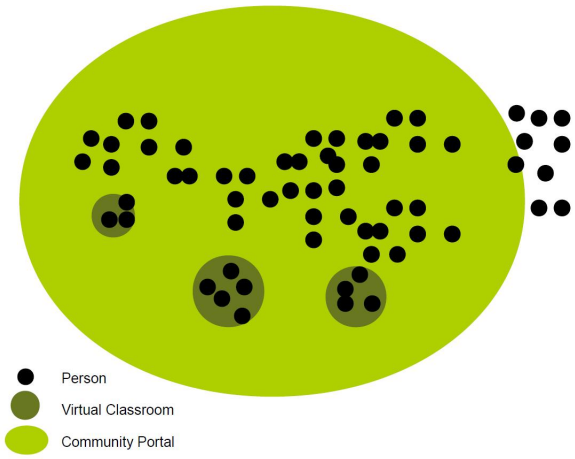

Fig. 1. The Virtual Campus of the FTA

to the biggest part of the facilities. Apart from the more informal participation, there is also a formal track of course modules that can be followed at the FTA Campus. Participants can, in exchange for a tuition fee per course module, enrol in individual course modules and get access to the formal learning part. The core of the formal part takes place in the so called virtual classrooms as indicated in figure 1. A university tutor supports the learners in those classrooms typically during a period of 13 weeks for a 5 ECTS course module. The methodology is activity based: participants perform certain assignments and in the dedicated virtual classroom forums the learners could discuss the theories and concepts of for instance GNU/Linux, the concepts of Free Software and Open Standards, Economic Aspects of Free Software and Business Models or Legal aspects of the

Information Society, depending on which course they are enrolled. While the formal learning process takes part inside the virtual classroom (only accessible to enrolled learners), participants are encouraged to contribute their activities and assignments to the open community, such as the Campus Wiki, Annotation Tool or particular spaces in the Community Portal. One can speak of a Learning

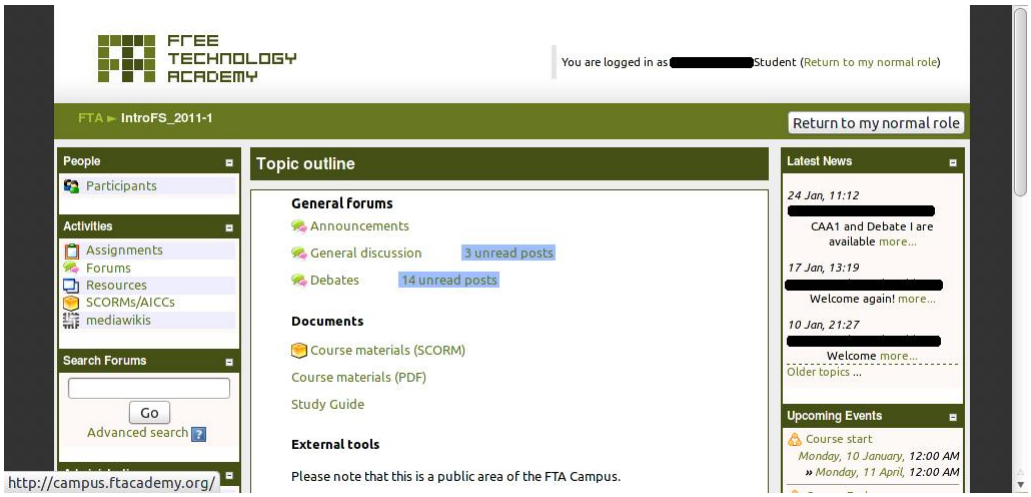

Fig. 2. Screenshot of the virtual classroom

Network, when the learners and other participants of the virtual campus are exchanging, sharing knowledge and even build new knowledge (peer production) in this case about Free Software and Open Source Software and the use of Open Educational Resources. To accomplish this we discuss in the next paragraphs the role of the community platform (here meant as a platform with tools), the annotation tool and explain what we mean by Peer Production in the context of the FTA.

4.1 The Community Portal

At the community portal different tools are available. At the community portal (see figure 3) one can fill in a profile and portfolio, join a group, or start a new group and make or invite friends; a system comparable to LinkedIn. Also wikis are available to use as a tool to share and construct new knowledge together. Also it is easy to share bookmarks and to stimulate interaction a social awareness tool has been included. When somebody of the other learning network members are online it will be indicated and it becomes easier to contact an other member.

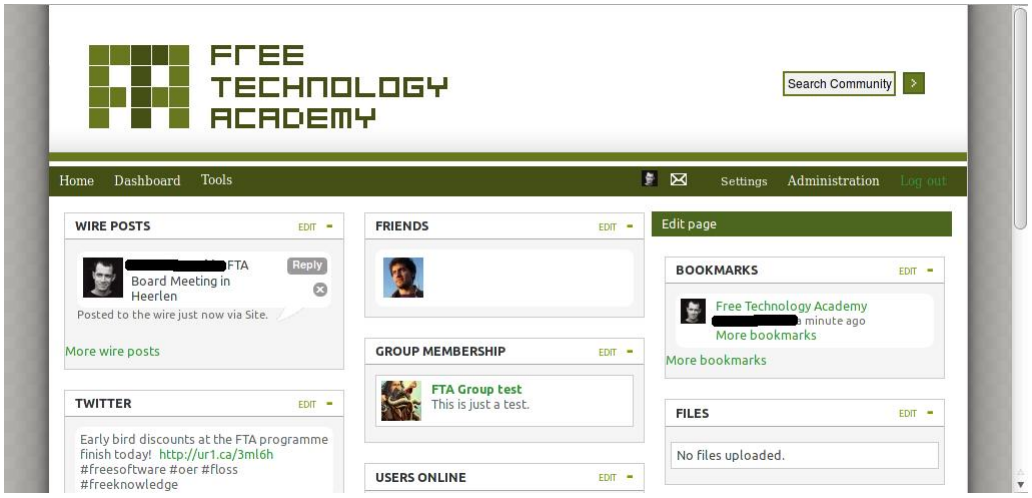

Fig. 3. Screenshot of the Community Portal

4.2 The Annotation Tool

While many educational materials need frequent updates, this is especially the case for the field of ICT and even more so for Free Software and Open Source software. As is important new developments come out at the speed of so called "nightly builts", course materials should be updated regularly. Obviously the concepts are not changing at that speed, so there is a clear need for separating the concepts and applications in different bodies. In any case it can be argued that an open development process can help improve and keep up to date either body of materials.

As a first step towards a more open process, the FTA is experimenting with a web-based document annotation tool [12] which allows users to comment on specific sections of a document. This will allow to centralise feedback form learns, tutors and external users in a single application, making it much easier for the FTA to review these comments for the next update of the resource. The course authors decide on adoption of suggested improvements, which are thereafter subject to the QA mechanisms described in the previous section.

4.3 Peer Production of Course Materials

The FTA is growing fast (161 enrolled participants in 2010) and the workload of the tutors accordingly high. At the same time it is difficult to extend the study programme and produce and maintain the necessary course materials in an economically sustainable way. This is especially challenging for individual partners. Hanneke Potters, Adriana Berlanga and Lex Bijlsma suggested in their article at the CSERC'11 conference [13] that Peer Production and Peer Support could

be a part of the solution of these questions. This idea takes things further than the procedures described above: we are now talking about producing materials from scratch, not about gathering comments about previously published texts.

Peer Production as an Economic Model For the development of educational materials, Benkler [14] discusses three different economic models, the intra-firm model, the market-based model and peer production. It seems that, given the context, the peer production model should be superior to the other two models. The reasons for that are (1) the lack of transaction costs as no contracts need to be managed and there is no hierarchy, (2) the non-monetary motives people have to participate and (3) the availability of the results of the collaborative effort to all participants under equal conditions.

The FTA already started with the introduction of the peer production model by the project of designing a new curriculum for a master on Free Technology [15]. The other courses are still produced by the FTA-curriculum development team. Via an annotation tool (see paragraph 4.2), participants of the courses can give feedback on the material of the course.

In general the principle of peer production in the FTA works as follows: The FTA invites relevant experts and institutions in a particular field to participate in the development of a new course, including the authoring of course materials. The structure of the course is then discussed with the interested parties and the workload of developing the materials is distributed. The resulting Open Educational Resource (OER) produced this way is enriched by the discussion that led to its conception, and each participant invests only a fraction of the total resources. Once the material has been published, it becomes subject to the QA procedures discussed in preceding sections.

Peer Production and Peer Support Here we will discuss the question 'How can we foster peer learning and peer support in the virtual campus?' in order to improve the peer production process. What follows are possibilities to be applied within the FTA or other online learning environments.

It is important from a design perspective to distinguish between the Virtual Learning Environment (VLE) and the people (users) using the VLE. When a VLE is made available, that does not mean that the users are also willing to use it. In the case of the Free Technology Academy the virtual campus (VLE) has been built for sharing knowledge and supporting the learning processes of the participants of the courses. Several factors determine whether a community becomes a lively and dynamic place. The Learning network theory sheds light on these factors. In this article we only pointed out two different models, the Ad Hoc Transient Communities model (AHTC-model) and the Trust and Trustworthiness-model.

To minimise the time-effort of tutors [16] developed the Ad Hoc Transient Communities model.

This model automatically invokes peer learners to give support when a student has a content-related question. The setting is a learning environment where

students are following diverse courses about a subject. The principle of the model is as follows: A student of the VLE proposes a question. A wiki is then set up and it is automatically seeded with three small documents. Also, the wiki is populated with users who have been selected and invited to help.

To identify the peers the selection is based on a weighted sum of four criteria that are derived from the users' background and performance. The four criteria are: Tutor competency, content competency, tutor availability and tutor eligibility. The tutor competency could be derived at a rating system on previous answers given by that specific tutor; the content competency could be derived from a portfolio or successful completed courses; tutor availability could derive form an online diary. Potential tutors who are on holiday or busy with something else could thus be excluded by the system.

Finally, a tutor's eligibility is assessed. It is based on similarity in competence level of the users. To users with similar competence levels, it is easier to explain something [17].

Finally, when the problem is solved and the solution has been incorporated into the published materials, the wiki disappears. However those participants have become acquainted with each other in an Ad Hoc Transient Community, they may want to stay in touch [18]. Maybe, later they will seek each other for other problems, without the use of the AHTC, but through contacting each other directly. This way, their social embedding has been strengthened.

Another design principle that fosters social interaction is the Trust and Trustworthiness-model of Ellen Rusman et al. [19].

To fill in a profile is very important to get acquainted with other members of the learning network. Rusman did research about fostering trust in virtual project teams and found peers in the beginning look for personal characteristics that they have in common, and that later certain skills as for instance competence become important for the trust of a peer.

When we want to foster peer production among the members we should have in mind that only to provide tools is not enough to make this happen. Also it is important that the participants are encouraged to get acquainted to each other. There are more factors known which are important to the dynamics of a learning network (communities), such as the strength and weakness of the ties between participants, motivation factors, heterogeneity of the participants etc. Also lessons could be drawn form the Open Source Software developer communities. The FTA is investigating different models, so that the peer production will be encouraged and becomes normal and intuitive for the participants. When we succeed it will also contribute to the sustainability of the Academy in the future.

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