UPGRADE is the European Journal for the Informatics Professional, published bimonthly at <http://www.upgrade-cepis.org/>

Publisher
UPGRADE is published on behalf of CEPIS (Council of European Professional Informatics Societies, <http://www.cepis.org/>) by Novática <http://www.ati.es/novatica/>, journal of the Spanish CEPIS society ATI (*Asociación de Técnicos de Informática,* <http://www.ati.es/>)

UPGRADE monographs are also published in Spanish (full version printed; summary, abstracts and some articles online) by Novática

UPGRADE was created in October 2000 by CEPIS and was first published by Novática and INFORMATIK/INFORMATIQUE, bimonthly journal of SVI/FSI (Swiss Federation of Professional Informatics Societies, <http://www.svifsi.ch/>)

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Cover page designed by Concha Arias-Pérez and Diego Blasco-Vázquez
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Layout Design: François Louis Nicolet
Composition: Jorge Llácer-Gil de Ramales

Editorial correspondence: Llorenç Pagés-Casas <pages@ati.es>
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UPGRADE Newslist available at
<http://www.upgrade-cepis.org/pages/editinfo.html#newslist>

ISSN 1684-5285

Monograph of next issue (August 2008)

"EUCIP: A Model for Definition and Measurement of ICT Skills"

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CEPIS UPGRADE
The European Journal for the Informatics Professional
http://www.upgrade-cepis.org

Vol. IX, issue No. 3, June 2008

Monograph: Technology-Enhanced Learning
(published jointly with Novática*)
Guest Editors: *Carlos Delgado-Kloos and Fridolin Wild*

UPENET (UPGRADE European NETwork)

CEPIS NEWS

* This monograph will be also published in Spanish (full version printed; summary, abstracts, and some articles online) by **Novática**, journal of the Spanish CEPIS society ATI (*Asociación de Técnicos de Informática*) at <http://www.ati.es/novatica/>.

Free / Libre Open Source Software (FLOSS) Communities as an Example of Successful Open Participatory Learning Ecosystems

Andreas Meiszner, Rüdiger Glott, and Sulayman K. Sowe

This paper examines participatory knowledge creation and transfer in the Open Educational Resource (OER) movement from the viewpoint of the Free / Libre Open Source Software (FLOSS) community. In more recent years FLOSS communities gained attention for their community production and support models and regarding their way of knowledge creation and learning. From the "FLOSS perspective" it becomes obvious that the OER movement falls short in some points. Most strikingly, the traditional way of resource creation using the traditional role distribution models that clearly distinguishes between educators as creators and learners as consumer is still predominant. As a result even the most prominent examples within the OER movement are rather static repositories than open participatory learning ecosystems (OPLE). This paper illustrates how FLOSS communities function as open participatory learning ecosystems, focusing on the aspects content, support and underlying tools. We will also try to show differences between the FLOSS case, current OER initiatives and education at large.

Keywords: Communication Tools, Communities of Practise, Free / Libre Open Source Software (FLOSS) Communities, Informal Learning, Open Participatory Learning Ecosystem, Social Learning, Peer Support, Technology-Enhanced Learning, Virtual Learning Environments.

1 Introduction

FLOSS communities increasingly influence teaching and learning, and content quality and delivery at a rate unprecedented in the history of both software development and education. As revealed by the FLOSSPOLS skills survey [1], improving skills and sharing knowledge are by far the most important motivators for people to engage in FLOSS. FLOSS communities can thus be seen as a good example for Open Participatory Learning Ecosystems (OPLE) in which individuals interact and collaborate with their peers to solve problems or to exchange ideas [2]. Collaborative learning and the peer review process emphasize the importance of shared dialogue which results in the creation of public knowledge resources for the benefit of interested individuals. Generally, FLOSS communities consist of individuals, who contribute to, write, and build a particular application by means of the FLOSS development or *bazaar model* [3]. However, the volunteering and unselfish nature in many communities enables members to get involved in activities further than the realms of software development. FLOSS communities possess many characteristics that educational settings seek to apply such as:

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Figure 1: Example of FLOSS Community Places (Ubuntu Project).

1) Open and inclusive ethos: everyone can participate, no charges, no deadlines, life long membership.

2) Up to date and dynamic content; everyone can add, edit and update the content.

3) Materials are usually the product of many authors with many contributions from people other than authors.

4) Frequent releases and updates where product features and community structures are the result of a continuous re-negotiation/reflection process within a continuous development cycle.

5) Prior learning outcomes and processes are systematically available through mailing lists, forums, commented code and further instructional materials (re-use).

6) A large support network; provided voluntarily by the community member in a collaborative manner nearly 24 hours a day, 7 days a week.

7) Free Riders (lurker) welcome paradox (the more the better).

8) New Information and Communications Technologies (ICT) solutions are adapted early by the community for the sake of their usefulness, but not for the sake of using technology.

The FLOSS model shows how users can become active "resource" creators, how learning processes can be made visible and can benefit other learners, how to successfully establish and maintain user support systems, and ultimately how all of this can be re-used and freely maintained [4] [5].

Learning in the FLOSS community therefore highly corresponds to the definition of OER, which is "*the open provision of educational resources, enabled by information and communication technologies, for consultation, use and adaptation by a community of users for non-commercial purposes*." [6].

The way FLOSS communities function, and in particular the underlying commons' approach, should thus be of interest for educational settings to advance towards OPLE [2] and towards an educational commons [7].

The current OER movement is tackling maybe one of the most crucial aspects for education: the free and open access to educational resources being released under a commons license and thus the possibility to re-use those resources and to adapt them [8].

We will however show that up until today, the OER movement, analogue to the e-Learning movement, is still following largely traditional educational paradigms using experts' production and development models, often using technology for the sake of technology and seeing the learner as a passive consumer, or at least leaving him with this role.

Within the following three sections we will try to illustrate how FLOSS communities function as OPLE, focusing on the aspects of content, support and underlying tools. We will also try to show differences between the FLOSS case and current OER initiatives and education at large.

2 Learning Resources in FLOSS vs. Traditional Educational Settings

FLOSS communities provides users with various types of learning resources, not only the "common" ones that also can be found in traditional educational settings, like manuals, tutorials, or wikis; but also resources that might not be recognized at first as learning resources or content. Those types of content sources, like mailing lists, forums, blogs or Concurrent Versioning Systems (CVS), help to make learning processes visible and to avoid answering the same questions over and over again. As shown in Figure 1, one common aspect of all of the different types of content is that

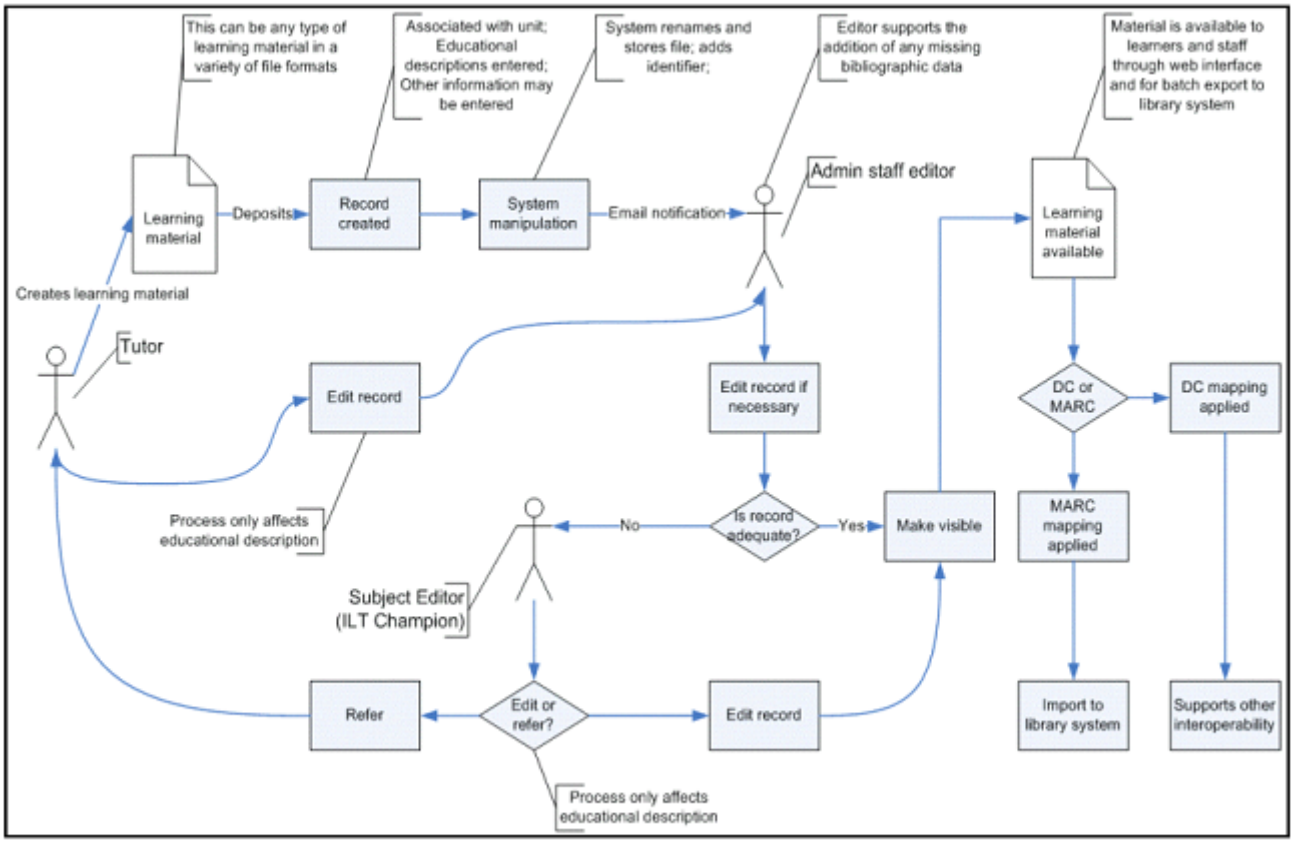

Figure 2: Learning Resources in Traditional Education (Expert Production Model).

they are jointly generated by users and developers and after their generation continuously updated and improved [4].

In sharp contrast, content in traditional educational settings is usually the product of few authors with few contributions from people other than authors. This content is infrequent released and feedback to it is only seldom considered, resulting in a low degree of updates with no continuous development cycle [9] [10]. Content usually does not include the prior learning outcomes and processes of learners, which are consequently not systematically available and searchable for future learners as one can see in FLOSS (e.g. at mailing lists, forums or within the commented code).

The way content is produced and the underlying complexity of its production is still very different to what one can see in FLOSS, or the Web at large[1] [4][5]. Figure 2 provides an example of the content production approach in traditional educational settings. As one can see, this approach follows the traditional expert model with complex and well defined development structures. Students' learning processes and outcomes are not considered at this model as a learning resource for future students and students' involvement might be limited to providing some feedback on the final product.

The FLOSS model on the other hand combines expert production with users input, plus featuring additional user generated contents in various forms, formats and that was built for various purposes at various times [11] [12]. The production of the software within FLOSS, or at least the core code of it, might be comparable with the expert production model as shown at Figure 2, but FLOSS community members on the other hand, as illustrated in Figure 3, are equally valuable contributors that create content "on the fly" due to their interactions and activities, but also in a more organized way by compiling manuals, instructions and live demos, or by establishing own sub-projects to extend the core functionalities of a respective software [4] [5].

Early FLOSS-like educational pilots have indicated how-

[1] FLOSS is not solely about the production of software. As Glott et al. [4] have shown, to integrate and/or play a role in the FLOSS community is not *per se* and not only dependent on good programming skills. Though FLOSS community members consider coding skills as the ones that can be learnt best within the FLOSS community, participating in FLOSS can also require expertise in patents law and license issues or management skills and capacities to mobilise community members in order to exercise pressure on political and economic decision-makers. Since the *lingua franca* of the community is English and since many software projects ask for translations of the code and programme documentation into other languages (so-called "localisation"), language skills are also required in the FLOSS community. All these skills can however be learnt within the community, through interaction with other community members and project participation.

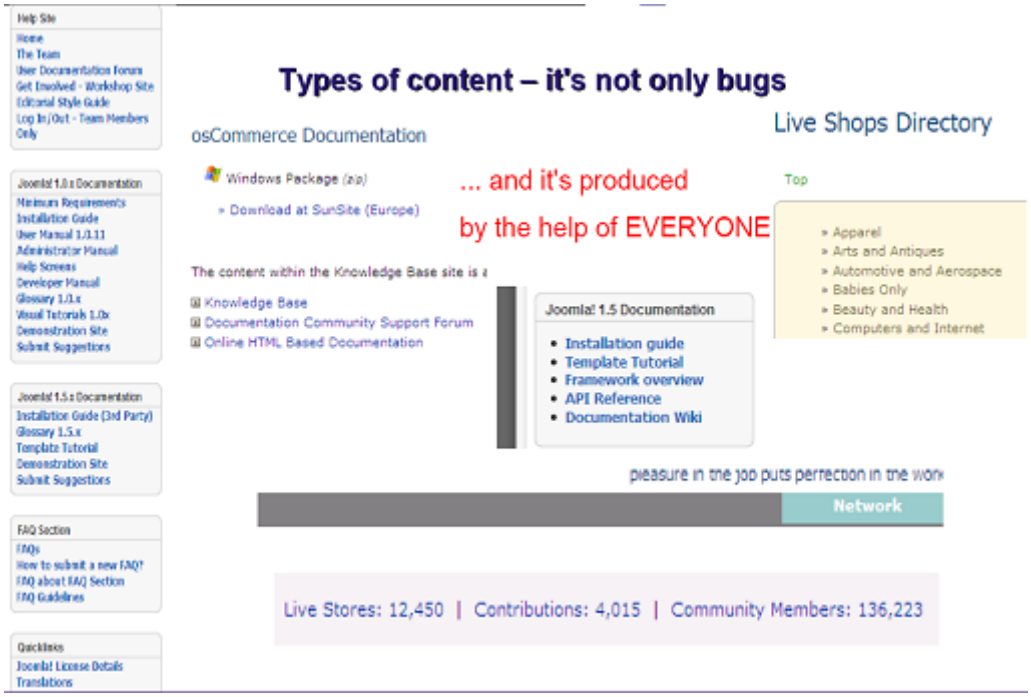

Figure 3: Learning Resources in FLOSS at the Joomla & osCommerce Projects.

ever that FLOSS principles related to the creation of content and learning resources at large can be successfully applied within educational settings; allowing to provide students with similar learning resources than in FLOSS; with students adapting roles of content creators [5]. A FLOSS-like educational approach has also been suggested by the Edukalibre project; stating that FLOSS-like principles might add a value for the creation and maintenance of educational materials, with those educational materials being located mainly on the Web and are produced by groups of educators coming from different institutions and being geographically dispersed. Those materials would also be used, commented and modified by students; with educators and students using tools that enable them to collaborate in the way FLOSS developers do, making their produced materials publicly available to enable further collaboration on them with third parties [10].

3 Community-Based Support in Floss and Possible Educational Counterparts

The FLOSS community support system is today largely recognized for its user to user support approach, also known as *peer support*. E.g. DELL already started to market their products with Linux preinstalled as a result of their customers' expressing that those community support systems would meet their support needs[2].

The Floss support system is a good example of how Web based technologies initiate and fuel learning processes. Lakhani and von Hippel [13] analysed the support system of the Apache community and found out that their field support systems functions effectively and that 98% of the support services return direct learning benefits for the support provider. They are confirming that "giving as a natural thing" as described by Demaziere [14], or "gaining reputation" and "personal enjoyment" are important motivational factors, but so are the learning benefits. Thus the situation between the information provider and receiver could be described as a win/win situation.

The fact that a great part of motivation to provide volunteering support resides in learning benefits for the support provider leads also to the conclusion that there need to be problems in order to keep the support system alive [3]. Support in FLOSS is characterized by "*information seekers posting their questions on a public website. Potential information providers log onto this website, read the questions and post answers if and as they choose to do so.*" [13]. The FLOSS support model relies on experts and advanced members that provide user to user support, plus demanding support seekers to first check that their problem or question has not been answered beforehand, or in the case it was answered to try learning from those answers. However, even if not finding the answer and raising a question there is a great likelihood that it has been answered "somewhere else at the Web" and that other users would either point the information seeker to those sources, or would bring those sources in.[3]

It might be assumed that newbies represent the largest group of support seekers. In the case of the Apache support system however the most active support providers, but also the most active support seekers, were experienced community members with recognizable skills [13]. Approximately

[2] See also: ZDNet, "Dude you are getting Linux", 29.03.2007, <http://blogs.zdnet.com/Burnette/?p=284>.

50% of the answers on the observed Apache support system were provided by the 100 most prolific providers (2% of all providers) and 50% of the questions were provided by the 2,152 most prolific posters of questions (24% of all information seekers). This supports the above described functioning of the FLOSS support system with a large degree of newbies' support being provided in the form of learning from what others did, with questions being raised mainly once the individual is stuck.

As by today there seem to be few cases within the educational landscape that try to provide similar extra-institutional community based support systems, of which many appear to arise together with the current OER movement [15]. One major initiative here is the Utah State University's Open Learning Support (OLS)[4]. OLS is a free and open resource for faculty, students, and self-learners around the world that currently provides discussion services for over 2,200 modules in the Connexions collection at Rice University and for MIT's OpenCourseWare initiative[5] Despites the scope of this project and the strong institutions behind it has, however, only attracted, as by November 2007, 2077 registered users that generated 565 posts between 2005 and 2007.

Besides those initiatives from educational institutions the web provides myriads of informal support communities such as PhysicsForums[6]. PhysicsForums features an extra educational section, where 50% of the total postings can be found within the more advanced forum sections, with 40% of the posts being in the educational section. This distribution between activities at advanced level and beginner level shows some analogy to the before mentioned Apache case, though a more detailed analyses would be required to compare the type of activities within those two cases and to evaluate if beginners do learn from advanced members in the same way than can be seen within FLOSS.

Contrasting the OLS case with the PhysicsForum case and putting those two into perspective with FLOSS cases; it appears that community based support systems can work out in educational settings as long as the community is heterogeneous enough consisting of experts, more advanced members and newbies and provides different types of

[3] This activity is also known as information brokering where humans take on the role that technology has failed to take on. Furthermore, FLOSS community members may be involved in practical information seeking (seeking answers to specific questions in the form of postings). In some communities, members undertake a more general activity characterized by frequent visits to monitor the information neighborhood and what goes on in other communities with similar or different projects. Erdelez [16] likens this activity to information encountering: a memorable experience of an unexpected discovery of useful or interesting information. Because of this serendipity, FLOSS communities are also agents of socialization and information providers, thus making FLOSS communities fertile and important learning environments.

[4] <http://ols.usu/edu/courses>.

[5] <http://ocw.mit.edu/OcwWeb/web/home/home/index.htm>.

[6] See <http://www.physicsforums.com/>. PhysicsForums is an informal collaboration space where people can chat about maths, physics and science. The forum went online in 2003 and had 77,203 members that started 154,509 threads and received 1,341,084 answers by November 2007.

Displays and manifestations of knowledge	Technological tools	Initiated processes of learning and knowledge-building
Code	• CVS repository	• Full cycle of re-experiencing: • Concrete experience • Reflective observation • Abstract conceptualization • Active experimentation
Transactive Group Memory	• Website content and hyperlinks (e.g. FAQs, content)	• Productive inquiry • Reflective observation
Instructive Content	• Online tutorials and screenshots • Bug reporting system, CVS change log and diff application	• Active experimentation • Reflective observation • Participative practice
Instructive Discourse	• IRC (Internet relay chat)	• Reflective observation • Collective reflection
Reflective Discourse	• Asynchronous communication (e.g. mailing lists, newsgroups)	• Collective reflection • Collective conceptualization • Virtual experimentation*
Note: * Here virtual experimentation is used as synonym for experimentation with things the programmers have in mind, but that do not exist as yet.		

Table 1: Learning Processes Initiated and Displayed Through Technological Tools (Hemetsberger 2006).

motivations for the different groups to participate and contribute.

Concluding it might be stated that the commons component is obviously a pre-requisite for community based support systems, but as important seems to be the right consistence of community members that include experts, advanced members and newbies providing the right mix of motivations to participate at such a community and to provide support.

4 The Role of Technology in FLOSS and Educational Settings

FLOSS projects are almost exclusively administered online. One of the most important prerequisites for coordination and cooperation on the Internet is provided by the functionality of various communication and groupware tools. They provide a meeting place for online interaction without regard to time or physical location [12]. Many of these tools were built by FLOSS communities themselves; creating products like wikis (Wikimedia), blogs (Wordpress), or social networking solutions (Elgg).

FLOSS projects are either hosted at their own platforms and systems, host their project at a repository like sourceforge.net[7], or they choose a mixture of both. As detailed by Giuri [17] FLOSS communities seem to rely on two important infrastructures: modular design and the use of the Internet. The Internet (email, newsgroups, forums, etc.) reduces transaction and communication costs among developers and therefore provides a fundamental infrastructure for distributed development across space and over time.

The underlying technological infrastructure that can be found in FLOSS communities is both simple and mature. Code is usually stored in CVS, documents and manuals in knowledge bases or wikis, and additional information are published through the project's website, newsletters, or blogs [18]. Communications occurs mainly asynchronous through mailing lists or forums and are therefore preserved and available for the entire community. The availability and integral application of this diverse range of tools is one of the most important preconditions for collaboration and to enable mass participation in collective activities as they can be found at FLOSS communities [12].

In order to be able to digest the huge amount of knowledge and information and to build up a group memory, knowledge technologies and task-related features are implemented that decrease complexity through e.g. a modular structure of tasks. "*To foster comprehension developers also add comments to their source code (reflection-on-action) which enables a re-thinking and re-experiencing process among the other community members.*" [18].

Mailing lists and forums are important for discourse and open reflection and as an archive for transactive memory of the learning community. These asynchronous communication technologies are not only valuable for knowledge creation purposes, but also in order to make community members think before they act and respond [12].

Meanwhile mailing lists are targeting the developer community; forums seem to target the community at large (e.g. the user) [19].

Table 2 provides a general overview of the different types of tools that are used within FLOSS communities and the way they impact learning [12]. Wikis, documentation and knowledge management systems are also important for co-authoring and collaborative content management [20] and would (depending on their usage) belong to the transactive group memory or instructive content.

Looking at counterparts in educational settings one can find the more or less same type of tools, with LMS like Blackboard, Moodle or WebCt providing most of them "on-board". However, as was shown at the OLS case it is not only a question of providing those tools, but as detailed at this section the reason they are provided for. The OLS case has shown that providing forum spaces for OER is not sufficient to be of use for learners and to be used. What would be additionally required is to create needs for using those tools and to provide participants with the option to engage at personal meaningful tasks and activities [21] [22]. "*By allowing users to be designers, sociotechnical environments offer the possibility to achieve the best fit between systems and their ever-changing context of use, problems, domains, users, and communities of users. They empower users, as owners of a problem, to engage actively and collaboratively in the continual development of systems capable of sustaining personally meaningful activities and coping with their emergent needs.*" [23].

A related question would also be what the equivalent motivational aspects are for the seniors / advanced learners to engage at those spaces and to provide (voluntarily) support. Motivation, as shown in FLOSS, results not only out of the FLOSS culture of meritocracy, but also due to a win/win situation that need to be created.

The case of PhysicsForum e.g. shows that analogue to FLOSS a simple forum solution can be sufficient to serve as a working support environment, thus the primary problem seems not to lie within the tools, but within the purpose and way they are used for.

5 Resume

The examination of FLOSS communities as an example of open participatory learning ecosystems revealed that many open educational resources that have been developed and that are used today still rather resemble traditional learning environments than tapping the full potential. Content is static and provided by a specified group of professionals that is also solely responsible for the provision of support, and knowledge is created and distributed in a relatively rigid system of curriculae and timelines, and new technologies are adopted relatively slowly. The learning environment and principles of FLOSS instead emphasize peer-to-peer production and dissemination of knowledge with changing roles of knowledge providers and learners, within disperse environments.

It could also be shown that principles of learning in the FLOSS community can be implemented in educational set-

[7] See also: <http://www.sourceforge.net>.

tings. These attempts, at current, seem to focus on blurring the boundaries between teachers and learners, collaborative creation of learning resources, and teaching and learning on vast geographical scope with participants dispersed across regions and countries. These attempts appear however limited with regard to the emphasis on practical usability of what has been learnt. While in the FLOSS community the outcome of the informal learning and production process (software code, a political action, technical documentation) is valued by its immediate visibility and usability, FLOSS-like learning in educational settings is still often required to compare to what is learnt in traditional curriculae and to traditional formal certificates and degrees.

Three trends appear to reinforce a general trend towards FLOSS-like approaches in education: Successful business cases, like exemplified by DELL, the OER movement, and Web 2.0-related inventions like interactive forums and wikis demonstrate more and more how powerful these approaches are with regard to speed, scope of content, and quality.

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