Institutional and pedagogical criteria for productive open source learning environments

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Abstract: In this article we present some institutional and pedagogical criteria for making an informed decision in relation to identifying and choosing a productive open source learning environment. We argue that three concepts (implementation, maintainability and further development) are important when considering the sustainability and cost efficiency of an open source system, and we outline a set of key points for evaluating an open source software in terms of cost of system adoption. Furthermore we identify a range of pedagogical concepts and criteria to emphasize the importance of considering the relation between the local pedagogical practice and the pedagogical design of the open source learning environment. This we illustrate through an analysis of an open source system and our own pedagogical practice at Aalborg University, Denmark (POPP).

Introduction

The aim of this article is to describe some institutional and pedagogical criteria for choosing and identifying productive open source learning environments. Though open source software is free of charge it is not free of cost, therefore we argue that three concepts (implementation, maintainability and further development) can become instrumental in choosing a viable open source system. Furthermore we argue that in order to identify a productive open source learning environment it is not enough to consider the cost related aspects, but also we emphasize the importance of identifying the suitability of the pedagogical design of the learning environment in relation to the local pedagogical practice.

Cost of system adoption

There are several good reasons to why looking closer at open source software can be a good idea, i.e. the possibility for adaptation and reshaping the system to the local pedagogical practice. Another obvious argument for looking at open source is that the software itself is free. But naturally this doesn't mean that adopting open source software is free of cost. Paradoxically the very incentive for looking at open source because of reduced costs on acquiring the software may in the end prove to be more tantalizing than remunerative due to the specific characteristics of the open source development process. This first part of the article will examine the cost of system adoption when looking at open source software – adoption in this sense being both implementation, maintainability and further development – and point out a series of key attention points to asses when considering using open source software.

Since the development of the open source software is not controlled by one company one might worry that the process is somewhat out of control. Normally, the company owning the code has a procedure that deals with the development of new features, handling of reported bugs, testing of the code on the user equipment, ensuring that the code fulfils the requirement specifications and so on. Most open source communities have (tried to implement) a similar set of guidelines for developers to follow, nevertheless it is clear, that the open source software development often depends on a relatively loosely coupled community of developers that engage in a project for different reasons, different time spans and are backed by varying resources. These are all factors that are critical to the longer term sustainability of a piece of open source software and hence this aspect is closely related to the economical incentives of looking at open source software; the reduced costs of acquiring the software may indeed be lost on increased costs for support, increased time spend on finding help/documentation etc. When looking for a viable open source solution it becomes necessary (or highly beneficial at the least) to examine the general structure of the open source community underlying the desired software, as the community is the driving force of the development and elaboration of the software. Indeed it seems that the "community aspect of open source means that user

communities, not the products themselves, may be the key determinants of a project's success" (O'Reilly, 1999, p. 36). The characteristics of the open source community itself can in other words in many cases reveal whether or not the particular system is worth considering to adopt.

This implies that when organisations consider using open source software, intentions and general needs for using the system should be taken into account. This is the case both in regard to system features and functionalities and the pedagogical way of thinking that is the base of the system, but also in regard to one's commitment when adopting the system. Is it for example ones intention to contribute to the actual development of the open source software then it would be advantageous to examine how active/strong the developer and "bug fixer" segments of the community are, because as the phrase goes "given enough eyes, all bugs are shallow" (Raymond, 2003).

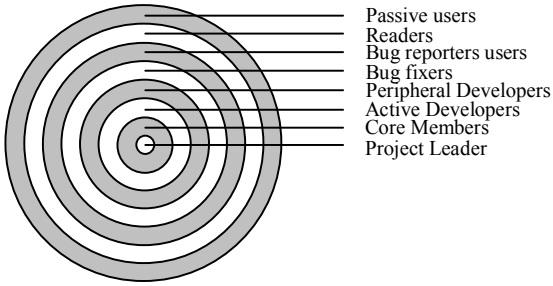

Figure 1: The general structure of an open source community (adapted from Nakakoji et al., 2002)

The foundation of an open source community is the often very committed people contributing to the development of the software. "Giving users of a product access to its source code and the right to create derivative works allows them to help themselves, and encourages natural product evolution as well as preplanned product design" (O'Reilly, 1999, p. 34). For the open source software to become a success outside of the community it is however a principal factor that some of this commitment is channelled into what are often considered less rewarding tasks such as the development of the documentation. The lack of contractual responsibility to develop the satisfactory documentation for users not belonging to the community may reduce the system propagation (Levesque, 2004). When considering open source software conducting preliminary studies on the existing documentation and the politics on the development of documentation may save you quite some anguish in a long-term perspective. Evidence of such can usually be found at the website of the open source community.

The level of activity of the community is of great importance in all the adoption phases mentioned here (implementation, maintainability and further development). In advance to the actual implementation of the system, one should assess the required hardware and software specifications – obviously both server side and client side; i.e. will the system operate on an open source operating system, what are the requirements in regard to server, database, client browser etc.[i] Furthermore, an assessment of the required training of the end-users should be taken into consideration. Open Source projects in general seem to have some trouble with user interface design (Levesque, 2004), so preliminary usability tests are recommended, as extensive end-user training might consume a lot of local support resources.

When maintaining the system the question of reliability arises. This can obviously be difficult to asses personally beforehand, but the necessary information can usually be found at the website of the open source community via release notes/logs, bug tracking and so on (which document the evolution of the system or classify system status (i.e. "stable", "beta" etc.)). The level of support, which should be viewed as dual-stringed should also be assessed; both externally in regard to the development of the system (many open source software solutions offer access to a range of optional commercial services for users of the system[ii]- often offered by core group members or active developers), but also locally at the organisation/institution wanting to adopt the system (does it possess the necessary resources/competences?).

Intentions of further developing the system require the attention of some other key points. This is the case both in regard to the actual openness of the code, the quality of the code specifications, but also the architectural structure of

the system code, as "[…] many successful open-source projects have a modular architecture, which allows users to extend the system's functionality without having to change existing core functionality." (O'Reilly, 1999, p. 37). The latter would allow the core members/developers of the community to retain some control of the system crux code whilst the community itself may expand and the evolution of new modules and features may occur. Furthermore, looking at the systems compatibility with existing systems in the organisation should be taken into account when considering developing the open source software further. Investigating these matters and relating them to the local resources and competences is crucial when considering adopting the system and subsequent plans for further development.

In sum - some of the key points for evaluating the sustainability and viability of an open source software, which in turn will indicate the cost of system adoption can be listed as follows:

Implementation:	Activity of the community Documentation of the system Requirements in hardware and software (server side and client side) Training of end-users (level of usability)
Maintainability:	Activity of the community Reliability of the system Support
Further development:	Activity of the community Access to code and (usable) code specifications Modular system architecture Compatibility with existing systems in the organisation Support

One might argue that the attention points presented here also apply when dealing with proprietary software, and this is true to some extent. Nevertheless it is our conviction that these matters are especially pronounced when considering adopting open source software as the community underlying the system and the specific characteristics of the open source development process are determinant factors in regard to cost of system adoption.

When an open source solution looks sustainable and viable in terms of the listed items above it still remains to be investigated how it fits the pedagogical aims of the educational institution or organisation that considers using it. In the next section we will go into detail with criteria for evaluation based on pedagogical criteria and learning theory.

Pedagogical considerations in the selection of an open source virtual learning environment

Apart from the considerations regarding the sustainability of the open source systems (implementation, maintainability and further development) important aspects to take into account are the pedagogical criteria for selecting a virtual learning environment (VLE). VLEs always incorporate a certain view on learning and pedagogy, whether this is conscious or not on part of the designers. In designing the features and the structure of the VLE, designers also co-design the range of activities that students and teachers can engage in (Nyvang and Tolsby, 2004). Therefore it is imperative not only to consider the sustainability of the VLE but also the pedagogical model implemented in the system in relation to the local pedagogical practice (or the institutional requirements). In this section we will address four different views on (or theories of) learning as to provide conceptual tools that can be useful in identifying the pedagogical model of a VLE and the compatibility with the local pedagogical practice; thereby enabling an informed decision of a VLE from a pedagogical perspective. Hereafter we will give a concrete example of our identification of specific needs for our own pedagogical practice at Aalborg University, Denmark.

Usually a learning theory is connected to a deeper philosophical understanding of how humans experience the world and how we can understand the complex notion of knowledge. Therefore we will present different paradigms[iii] or schools of thought within learning theory that reflect fundamentally different conceptions of the relations between knowledge, humans and how we experience the world. There are many ways to identify differences and distinctions between learning theories but for the purpose of this article we have chosen to adopt three of the paradigms listed by

(Dalsgaard, 2004) and add a fourth paradigm ourselves. Dalsgaard distinguishes between *cognitivism*, *radical constructivism* and *activity theory* to which we have added also a social theory of learning (Wenger 1998, 2004).

Dalsgaard characterises Cognitivism as the understanding of learning and experience as information processing. Humans experience the world on basis of biologically developed cognitive structures. Knowledge and learning happens when we actively process the objective information from the outer world. In that sense humans are active processors of information and knowledge, but as the information being processed is understood as objective, humans do not contribute to or actively construct knowledge. In that sense humans are passive receivers/processors of the objective information and knowledge, rather than the creators of it. Radical constructivism represents a very different epistemology in that knowledge building is viewed as an individual, subjective and cognitive construction. The world does not offer objective knowledge to be processed; rather knowledge building is understood as the continuous construction and development of cognitive schemata that frame the understanding and knowledge of the world. Learning in this view especially takes place when there are discrepancies between existing cognitive structures and new experiences; then the schemata have to be re-constructed. Activity theory also considers knowledge to be constructed but not as solely embedded in cognitive structures. Instead knowledge is seen as embedded in the cultural, social and material practices of humans. In this sense knowledge and cognition is regarded as distributed and constructed through our collective activities in the socio-material world (in contrast to embedded in individual cognitive schemata). As a fourth paradigm we have chosen to incorporate also a social theory of learning, which has much in common with activity theory but also some differences. In this framework knowledge construction is seen as being facilitated through mutual engagement and participation in communities of practice (Wenger, 1998). Identity is a key issue as individuals through multi-membership in a variety of communities build trajectories of learning. Knowledge rests in local regimes of competence that are negotiated in the communities of practice that one engages and participate in[iv], which also co-constitute a crucial part of ones identity; participation encompasses also the ability to (or not to) negotiate and reshape this very practice.

These paradigms or different views on what constitutes knowledge and learning do have practical importance in educational design and how learning situations are designed, both in the physical lecture rooms and in virtual environments, as they shape the type of activities and how these will be carried out. It must be noted that in much actual educational practice these paradigms are not very often clear-cut or exclusive, but often intermixed and pragmatically approached. However, the paradigms do suggest different implications for design of educational activities and different ways of teaching. In the schematization below, which is inspired by Dalsgaard (2004, p. 249-251) we have summarized some practical implications of each paradigm, when implementing their conceptual outlook in educational design (for further detail please refer to Dalsgaard, 2004).

	Cognitivism	Radical constructivism	Activity theory	Social Theory of Learning
Educational configuration	Process is controlled, structured and individual	Independent, flexible design, individually/In groups	Independent/Social, flexible design, collaboration in groups	Participation, engagement, negotiation of meaning
Content is decided by/takes departure	In the systematic of the subject matter, curriculum, predetermined units	In the student, problem situations, defined finalized topics	In the students, problems, project reports and processes	In students' identity and existing learning trajectory forms the content and activities
Relations between teachers/Students	Delivery of information, training, controlled by subject and the teacher. Knowledge delivered by teacher to student	Supervision and coordination, controlled by student and teacher	Coordination (supervision), controlled by the students and between the students	Engaging people in practices of communities. Facilitating the construction of learning trajectories

In deciding on a VLE it is important to identify the learning theoretical rationale and pedagogical activities that one wants to carry out and support in the system. Therefore an important question becomes "What is the local

pedagogical practice or the future wishes for an online pedagogical practice". Is the system supposed to deliver content in a highly controlled manner and incorporate assessments of how well the students have appropriated the subject matter? Is the system to support individual students dealing with problems within a certain topic? Is the system to support groups in their construction of a project report taking departure in a self-selected problem of interest? Should the system support engagement in real-world practices and reflections on learning trajectories of the students? Obviously this schematization does not provide an exhaustive list of questions to take into consideration, but it does give thought to underlying concepts of pedagogy and learning. Often there is a strong focus on features in the selection process of a VLE (3waynet Inc., 2003). However, it is important to keep in mind that features do not constitute their own use. A forum can be used for many different pedagogical purposes and with different outcomes. Therefore we would emphasize that in order to select a VLE for a local pedagogical practice it is crucial to be aware of the underlying view and values in relation to learning and pedagogy, both in the system but also in the local practice or at the institutional level. In the following we will describe our own local and institutional pedagogical practices and illustrate how this specific pedagogical model requires certain features, but also a special utilisation of the features

Problem Oriented Project Pedagogy

Problem Oriented Project Pedagogy (POPP[v]) was the institutional pedagogical foundation for establishing Aalborg University (1974) and Roskilde University Center (1972) in Denmark. The approach represented a radical change in the teaching and study methods applied at that time. The emphasis shifted from a model based on delivery of information and knowledge towards a critical, experientially based pedagogy favoring learning as knowledge construction through genuine collaboration. In the late 1980s, open education programs and research within the field of virtual learning environments also became based on the POPP-approach.

POPP includes a series of integrated didactical principles as a basis for the learning environment: problem formulation, enquiry of exemplary problems, participant control, joined projects, interdisciplinary approach, and action learning

The most important principles are *problem formulation* and *enquiry of exemplary problems* (anomalies). In other words an open learning environment, which makes the student wonder and makes them want to find an answer. The entire educational process is built upon the student's enquiry of scientific and social problems and is the focal center of the student's engagement in the learning process. In order to understand the problem and find a solution to the problem, the students have to go through different stages of systematic investigations: preliminary enquiry, problem formulation, theoretical and methodological considerations and investigations, experimentation and reflection.

According to Illeris (1981), *enquiry,* on its own, does not constitute the basis for an active process of acquiring knowledge through critical reflection: *"A problem is not a problem in a psychological sense if the person who has to work with it does not experience it as a problem."* (p. 83, our translation, Fjuk & Dirckinck-Holmfeld, 1999). Therefore, *participant control* is an interrelated principle. When students themselves define and formulate the enquiry, they have a conscious relation of ownership to it, and they experience it as a problem (anomaly), which implicitly encourages involvement and motivation. Participant control and the ownership of the problem setting are therefore seen as fundamental for the students' engagement in the learning process. However, participant control doesn't mean solely students control, however that the curriculum (project) has to be negotiated among the teachers and the students with the teachers as advocates for the relevance of the problem from a social, scientific and subject matter perspective.

The didactical principles of POPP may be understood from the learning theoretical principles presented above drawing upon characteristics from radical constructivism, activity theory and a social theory of learning.

Virtual learning environments mediating problem oriented project pedagogy

To extend our understanding of POPP and develop a theoretical understanding that can be transformed into a set of heuristics or questions that support evaluation of VLEs to test whether they are suitable for POPP we turn to Etienne Wenger and his work on communities of practice. We do so because communities of practice in his definition are characterised by interdependent learning in a community that exist to learn. Ideally the groups of students learning

by means of POPP engage in learning the same way even though students sometimes approach the POPP projects in a less ideal way (they have to pass exams and get a degree in the end). In his book Communities of Practice – Learning, Meaning and Identity Wenger talks about negotiation of meaning in communities of practice (Wenger 1998).

> ”The negotiation of meaning is a productive process, but negotiating meaning is not constructing it from scratch. Meaning is not pre-existing, but neither is it simply made up. Negotiated meaning is at once both historical and dynamic, contextual and unique (…) meaning is always the product of its negotiation, by which I mean that it exists in this process of negotiation. Meaning exists neither in us, nor in the world, but in the dynamic relation of living in the world.” (Wenger 1998, p. 54)

According to Wenger negotiation of meaning is a duality of two interrelated and interconnected processes; participation and reification. Participation means just that: To take part in a community by engaging in its practice. Reification refers to the process of turning participation into objects. It turns out that this definition comes close to what has been written about the constituents of POPP. The theory on communities of practice has thus already been used in several attempts to outline requirements for a VLE that supports POPP (Dirckinck-Holmfeld 2002; Tolsby, Nyvang et al. 2002; Nyvang and Tolsby 2004). Wenger has himself published a report that analyses the potential for community support in a number of VLEs and similar tools (Wenger 2001).

To understand how a VLE (or any other tool for that matter) supports learning in communities of practice and thus POPP it is necessary to understand how it supports negotiation of meaning as an interplay between participation and learning outcomes (reification). Prior studies have shown that coordination and resource management are special cases of negotiation of meaning that are important in POPP (Tolsby, Nyvang et al. 2002; Nyvang and Tolsby 2004). In the following paragraphs we will give a more elaborate definition of coordination and resource management.

Coordination plays an important role in learning processes that depends on mutual commitment in a group of learners as the case is within the POPP framework (Fjuk and Dirckinck-Holmfeld 1999). Wenger also stresses the importance of coordination by his list of the constituents of a community: Shared repertoire, mutual engagement and joint enterprise (Wenger 1998, p. 73). These constituents all call for a non-trivial sort of coordination of prior knowledge, perspectives and goals. Coordination also has to do with the way members engage in and belong to a community of practice. Wenger puts it this way:

> “The combination of engagement and alignment brings various perspectives together in the process of creating some coordination between them. There is something unique that we can come to understand when our diverse perspectives converge in our attempts to align them for some purpose.” (Wenger 1998, p. 218)

Resource management is a complex phenomenon in POPP and has links to both negotiation of meaning and coordination as discussed here. Resources in POPP can be either something produced/being produced by the students, a reification of their negotiation, or something supplied to support their learning process.

A short outline of questions that can be used to evaluate the support for POPP in VLEs includes the following questions:

- How does the VLE support negotiation of meaning through participation and reification?
- How is mutual dependency in the community of practice handled (in terms of shared repertoire, mutual engagement and joint enterprise)?
- How is production and sharing of resources supported?

The use of this framework for analysis of practices that has emerged around VLEs has shown that these questions make it relevant to question the flexibility of the VLE (Tolsby, Nyvang et al. 2002; Nyvang and Tolsby 2004; Nyvang, Tolsby et al. 2004). Does the VLE support structural flexibility, communicative flexibility and role-flexibility? These questions are also grounded in the fact that a POPP project is a process with different stages and the VLE thus have to support changes in structure, modes of communication and that students or teachers take different roles in the project over time.

A practical analysis of an open source VLE and problem oriented project pedagogy

In the following we shall unfold an analysis drawing on the pedagogical concepts presented in the former sections. The aim is to clarify the importance of identifying the local pedagogical approach in relation to the system. As will emerge from the analysis there are some discrepancies between the underlying pedagogical model of the OSS (Moodle) and the local pedagogical practices at Aalborg University. These discrepancies do not make the system unsuitable for POPP, but more careful consideration has to be put into the course design if one wants to use Moodle to support POPP.

The open source virtual learning environment Moodle[vi] is built on a social constructivist approach, according to the developer of the system, Martin Dougiamas. "Moodle is a software package for producing internet-based courses and web sites. It's an ongoing development project designed to support a social constructionist framework of education" (Dougiamas, 2003). The tools accessible in the system aim at supporting collaboration, activities and critical reflection. Some of these tools are: Forums, chat rooms, a dialogue tool, a journal, a glossary and a workshop tool. If a teacher wants to support the social construction of knowledge, the teacher adds some of these tools that allow students to contribute to the content in the course.

At Aalborg University POPP is as mentioned the main framework and group organized learning activities is thus a main activity that takes place during a whole semester, where the group of students has to produce a report The report is then used as a basis for an examination. This means that an important feature of group work is the production of this report. Moodle has not so far a resource management feature that allows the sharing of written documents (a document management system). One tool, however, that allows students to share files with other members of the course could be the forum, where the author of a topic can attach a file to the topic, since it is designed to let everybody that is allowed to enter the forum see the text and download the attached files.

At the department of Architecture and Design at Aalborg University a course was developed using Moodle as the VLE. The system was intended to support the group work and be a shared place between Danish, Norwegian and Thai master students. Architectural students often have a large file library with many kinds of files and extensive photographical empirical data – all of which may be reifications of negotiation of meaning and important to the ongoing learning process. It was estimated that the forum possibilities of sharing files would be too restrictive.

However, reification was not the only challenge. The formation of small-group communities of learners with easy access to participation and redesign of the community space posed another problem. In Moodle, groups are supported, but with the purpose of categorization and restricting participation in different tools. Different levels of categories support restrictions to different tools. Therefore to support the group work and to use Moodle as a collaboration tool each group of students was given the role of teachers in a course belonging only to the group. In this way the group had permissions to upload files and modify the contents of 'their' course – a way of bypassing the system to offer the possibility student collaboration. The drawback of using Moodle in this way is that students have to learn two different ways of using the tool. Furthermore, as Moodle is designed as a teaching help and not as collaboration tool, it requires detailed planning of how the tools are explained and how the communication structures and rules of use are set up. The students have to understand how to use the tool as a communication and collaboration medium, because of the changes of the roles (categories), when we want the system to support POPP.

In the course for Architecture and Design, another problem for student acceptance of using Moodle as a tool for collaboration was the existence of an alternative file management tool. The students were already familiar with this tool, which did not have the file size limitations they initially experienced in Moodle. This together with the fact that all groups were capable of meeting each other on a daily basis made the acceptance of Moodle as a collaboration tool very challenging.

From an analytical perspective on forums and other tools it is clear that Moodle is intended to support a social constructivist approach. However, social constructivist learning is about more than discussion in forums. Moodle as a system is quite teacher centred, as the teacher defines the topics and the tools for the course - in that regard Moodle could be claimed to draw on the cognitivist paradigm, as the subject matter expert becomes the locus for the design of the activities in the course. This analysis, however, is not fair to the Moodle system in that it does support relations and activities between students e.g. through the use of group forums or the workshop tool that is a peer assessment tool – but in the end it is up to the teacher to define, design and make available the tools needed for these activities to take place. Moodle certainly also draws on insights from both the radical constructivist paradigm and

also some notions from activity theory. But when it comes to resource management, which is central to groups in the POPP pedagogy, the problem is that apart from contributing to forums students can't affect the environment e.g. uploading a resource (e.g. a link or a document) in a topic as only teachers are allowed to do that. The participatory aspects are very well addressed in Moodle, whereas the process of reification from a student's perspective is possible only in the forums. This is tightly connected to the notion of role-flexibility, where the respective roles of being a teacher or a student in the system implies very different possibilities for affecting the course, and these roles are not flexible – either one is a student or a teacher in a course.

As the example also shows this does not make the Moodle system unsuitable for POPP as such, but it does imply that the course design and the distribution of roles in the system are taken into careful consideration. In practice this could mean giving the students privileges of teachers in some of the course rooms, as to allow for role-flexibility and structural flexibility. The latter concept encompassing students would be given the privileges to structure the course room to their own needs, which is an important of the POPP-model in online environments. It should be noted that from the analyses presented in (Tolsby, Nyvang et al. 2002; Nyvang and Tolsby 2004; Nyvang, Tolsby et al. 2004) it is often the case in learning management systems that the teacher has the most prominent role, whereas the students are not granted the same privileges to reify, re-structure and take on different roles throughout a course. In some cases this supports well the local pedagogical practices, but at Aalborg University it does not fit very well the pedagogical practices of POPP, and therefore it prompts us and others to carefully consider the local pedagogical practices in relation to identifying suitable systems – or at least to identify how these systems can be tweaked and bend for use in the local pedagogical practice.

Concluding remarks

In this paper we have identified and presented some key points to consider as part of selecting and implementing open source virtual learning environments. Two primary aspects have been identified and considered.

Firstly, it is important to examine the sustainability and viability of an open source system, which in turn will indicate the cost of system adoption. We have argued that three concepts are the key factors to consider: implementation, maintainability and further development. This encompasses amongst other things to examine in depth the activity of the community building the software, the documentation of the system, if it has modular system architecture suitable for further development and the reliability of the system.

Secondly, we have argued that it is important to examine the underlying pedagogical rationale of the virtual learning environment and its relation to the institutional and local pedagogical practices. For this purpose we have presented four different learning paradigms reflecting different pedagogical values. We argue that these paradigms can become instrumental in identifying the pedagogical rationale of the system and shed light on the local pedagogical practice. Furthermore we have given examples of the importance of identifying local pedagogical practice in relation to selection and implementation of a virtual learning environment by analysing our own pedagogical approach POPP. This led to an identification of central concepts important to supporting POPP in virtual environments expressed by how well the system support: Negotiation of meaning, coordination and resource management. Finally we have illustrated the importance of the pedagogical criteria by analysing our experiences with the open source system Moodle, identifying strengths and weaknesses in the system according to our local pedagogical practice.

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i For inspiration on further elaboration on some of these points and others - see the report "COL LMS Open Source", which describes the findings of a survey-style evaluation of Open Source Learning Management System Software commissioned by the Commonwealth of Learning from 3waynet Inc., June 2003. (Available at http://www.col.org/Consultancies/03LMSOpenSource.pdf)

ii For examples see: ATutor (http://www.atutor.ca/services/) or Moodle (http://moodle.com)

[iii] The use of the word paradigm does not refer to the Kuhnian notion of paradigms. We use the term paradigm in the sense of a set of fundamental beliefs or core issues within a school of thought.

[iv] Though the similarity to activity theory seems striking there are some fundamental differences in what constitutes practice and activities. The notion of activity stems from a dialectical materialist notion of activities, that bears more the flavour of labour, production or task-orientedness, whereas communities of practices has more a focus on an

ongoing production of a social interconnectedness. However the subtle, yet fundamental differences are not our aim to convey in this article.

[v] We use the abbreviation POPP to distinguish from the more well known concepts of PBL (Problem Based Learning). In PBL the teacher defines the problem before it is handed over to the students to explore and solve whereas in POPP students define the problem they want to explore and thus have full ownership of the project.

[vi] http://moodle.org