Open educational resources and informational ecosystems: Edutags as a connector for open learning

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Abstract

Teaching and learning in school essentially relies on analogous and digital media, artefacts and tools of all kinds. They are financed and provided by various players. The role of these players for providing learning infrastructures and the interaction between them are discussed in the following. Increasingly, Open Educational Resources (OER) become available and the question arises how the interaction between these players is effected by this. On the one hand, some players implement closed informational ecosystems that might provide a rich and coherent environment for learning, but also lock the users in a defined and often restricted environment. On the other hand, other players are interested in developing an infrastructure that supports open learning without the boundaries of closed informational ecosystems. Such open informational ecosystems must provide interconnections to numerous, in principal unlimited number of platforms for learning contents. In the context of the project "Edutags" a reference platform is being implemented by way of which the contents of various providers are being connected and enriched by user-generated tags, commentaries and evaluations. The discussion points out that such an independent reference platform, operated separately from content platforms, must be considered as an important element in an open and truly distributed infrastructure for learning resources. Hence, we do not only need open educational resources to support open learning, we also need to establish an open informational ecosystem that supports such approaches.

1) Background

In the cooperation project Edutags the Learning Lab of the University Duisburg-Essen is, together with the Deutsches Institut für Internationale Pädagogische Forschung (DIPF = *German Institute for International Pedagogical Research)* developing a reference platform for teaching and learning resources that is to be deployed in the context of the German Education Server (Heinen & Blees, 2011). The question is thereby raised as to the functions such a platform might have for teaching and learning in schools and how this may be embedded in the landscape of the different kinds of platforms and applications that are required for the scholastic usage of teaching and learning resources.

The starting point for the conception of Edutags as a "social bookmarking" tool was therefore an analysis of the interaction of the platforms and players that are necessary in order to make teaching-learning materials extensively available. In this context, the significance of a **reference platform** became evident wherever it is a matter of educational resources that are to be operated as an "open information ecosystem" in association with a number of other platforms

and players. Furthermore, it became clear that the availability of open educational resources alone is not sufficient to provide an appropriate environment for the sustainable use of these materials for teaching and learning in schools. We need to look broader at the informational ecosystem and how this informational ecosystem supports the use of (open) educational resources. Thus, we do not only need more open educational resource to support open learning, we also need to provide an open informational ecosystem that supports these approaches.

The following article presents the results of the analysis of the interaction between platforms and contrasts the conditions of usage of learning materials in closed as opposed to open ecological systems. It thereby tries to reach beyond analyses that have described and examined single plattforms for teaching materials (Gaiser, Hesse & Lütke-Entrup, 2007, Petko, 2010, Kos, Lehmann, Brenstein & Holtsch, 2005). The concept of the reference platform Edutags is outlined and what it has to offer as a go-between for establishing an open ecological system of educational resources.

2) Conditions for the use of learning resources

As a starting point for the planning of a reference platform the question was looked into as to how teaching staff find educational media and teaching materials for their lessons, how they prepare such materials for their lessons as well as the nature of obstacles they are faced with. To this end, the technique of working with focus groups was often applied in the course of the project. The focus group method proffers itself as the platform "Edutags" is still in its development process. The requirements and appraisals of the target group may thus be easily integrated into the development process (Morgan, 1997). The members of the focus groups were chosen taking a number of different aspects into consideration. The groups were made up both of regular teaching staff who considered themselves to have an affinity with digital media and of teachers who act as didactical advisors either in schools or of expert groups. They were joined by persons working in various phases of teacher training and future teachers currently being trained at college and in seminars for teacher training.

In the focus groups it became evident that teaching staff spend a not inconsiderable portion of their preparation time looking for materials of various kinds for their lessons. They wish to find as quickly and easily as possible resources that (a) are suitable for their intended purpose and have, as far as possible, been "tested" so that they may be certain of being able to make use thereof in their lessons (b) without any legal concerns and (c) without any additional costs.

These three requirements will be illuminated below in more detail. The first aspect addresses the question of quality and quality assurance in connection with teaching resources, the second deals with legal questions and the third relates to costs and thus to business models by way of which teaching resources are made available to schools.

a) Quality and quality assurance

In the case of the traditional school textbook, quality assurance is effected by way of a combination of measures. It arises, in close connection with teaching timetables and curricula, mostly within a team of authors who are supervised by an editorial office. Moreover, most of the Federal States in Germany have an approvals procedure for educational works. Educational works as defined in these approval procedures are textbooks that are oriented towards teaching plans or standards of a school subject. Deployable as a key medium in lessons, they encompass teaching materials for an entire school (half-) year (cf. Stöber, 2010, p.5).

These approval procedures fundamentally do *not* relate to supplementary teaching and learning materials; digital media in particular are explicitly excluded form the inspection process as a general rule. Whilst some Federal States implement detailed evaluation procedures, other States deploy simplified procedures in which the assurance given by a publisher to the fact that its materials conform to the require standard is sufficient. A number of Federal States in the meantime – for different reasons – entirely dispense with the approval of school textbooks (Stöber, 2010).

The focus groups show that the textbook is highly appreciated by the various players. It offers teachers and students alike a rapid and simple guide as to what is to be taught or learnt respectively. It symbolises the amount of material to be covered in the course of a school year; learning progress is made tangible by counting the pages and chapters covered. It simplifies coordination between teaching staff who are involved in the same subject at the same level. And finally, procedures for the approval of "official" school books have been an instrument for the educational administration to enforce state-wide standards and curricula (Oelkers & Reusser, 2008).

The increasing availability of worksheets and books, educational programmes and websites on the internet is putting the importance of the textbook into perspective, however. In the initial phases of some projects central educational servers have been brought forward that categorise and evaluate teaching resources extensively by editorial teams. This aspiration today has essentially been given way to two procedures: educational servers adopt materials from providers of whom it is generally assumed that they have suitable or high quality materials at their disposal without any further examination. This corresponds to the "simplified procedure of textbook approval" without inspection that increasingly is being applied in various German states. In other cases web resources are exemplarily gathered by a teacher or group of teachers on selected educational topics. Such compilations cover areas of a subject and do not raise any claim to completeness in the way in which a textbook covers the material for a school year.

It remains to be said that a comprehensive evaluation of internet resources for school lessons, for example on the basis of a catalogue of criteria, is to be regarded as illusory in view of the plethora and dynamism of the internet. There are, moreover, doubts as to whether such a quality inspection would achieve results that are helpful to the teacher and say something meaningful about the educational effect of the resources (cf. Biffi, 2002). In general, it seems questionable if a particular teaching material may per se be assessed as being of "a high quality" for

scholastic use. The educational quality or relevance of any material may not be determined on the basis of the material itself but is only brought to bear in its usage in the teaching-learning process, - the central proposition of the didactical-design approach elaborated in Kerres (2013). A multitude of sources on the internet have not been specifically developed as teaching or learning materials but may nonetheless be, for example, used as raw data, sources and authentic materials in lessons.

Alternative approaches for the quality assurance of learning materials arise when teachers (the users of the materials) themselves are included in the evaluation. This approach is applied in the reference platform "Edutags" and described in more detail in the following section. In the context of Web 2.0, mechanisms have been developed by means of which users may be actively involved in the evaluation of content and the collaborative development of knowledge (Kerres, 2006). This is achieved by processes where users themselves produce and deliver materials, provide tags and keywords and evaluate them. In the case of a larger number of users, it is also possible to provide information by way of indirect procedures that are based on user behaviour, e.g. it may be indicated which materials are called upon more frequently and recommendations can be given as to which materials might also be of interest, as the system can deduce the similarity of materials from the behaviour of users. Editorial teams still are needed for the (important) task of intervening in case of incorrect allocation or doubtful contents.

When teachers are looking for materials on the internet they can quickly find many resources. They complain, however, that it is a tiresome and time-consuming process to find the *right* material from the huge amount there is to choose from. This process can be simplified if keywords and evaluations from other peers are provided with the materials ("social tagging" or "social bookmarking"). Teachers collect references to materials and furnish these with metadata which do not conform to a prescribed taxonomy but are given by the users as free keywords ("Folksonomy") (Marlow et al., 2006).

This context offers a new approach to quality assurance of learning materials which is based on users' inputs. As the number of users increases a knowledge base is created which helps to retrieve learning contents more efficiently and increasingly find them more easily. The problem is that in the beginning when only few users have provided tags and evaluations the platform is not very informative for new users and, hence, a critical level of inputs provided must be ensured (Bertram, 2009, Peters, 2009).

b) Legal aspects

Many sources may be found on the internet that may be used for learning and teaching purposes. At the same time many teachers are uncertain as to the framework conditions under which this is possible because not everything that may be found on the internet may also be used in lessons. German copyright laws protect the initiators of intellectual property and the rights they have in connection with the exploitation of their works. At the same time society's demand for free access to knowledge for educational purposes is to be honoured. In the case of schools,

current copyright laws therefore have limits that allow teachers to copy parts of (educational) works and to pass them own to their pupils. The terms of use may, however, explicitly rule out making such copies available in *digital* form or on school servers (UrhG *(Copyright Act)* 52). Should a teacher wish that pupils should work with digital materials, alter them, integrate them in works of their own and make them available to others in digital form, many materials that are available on the internet, even if they may be accessed by the learners free of charge, may simply no longer be used for legal reasons.[1]

These legal framework conditions are a burden to many teachers, particularly as it is not easy for them to recognise which form of usage is allowed and which is excluded in a specific case. It is not very practical when several pages of terms of use need to be read through merely to determine the manner in which, for example, a worksheet may be used in a lesson. It is for this reason that, in the international discussion pursuant to educational materials the so-called "Creative Commons Licences (CC)" have been accepted as an instrument with the help of which permitted usage variations may be communicated quickly and easily between producer and user. The CC-licences are made up of several components (e.g. usage demands the naming of authors, must be forwarded under the same conditions, may not be processed, may not be distributed for commercial purposes) which the producer adds to the content by way of appropriate identifiers.

In addition to the CC-licences other, adapted licensing forms may be selected in order to characterise usage rights for teaching purposes. The terms of use of the Statistisches Bundesamt[2] *(Federal Statistics Office)* and of the online service for educational media of the media centres in NRW (EDMOND)[3] are hereby cited as examples. The Federal Office allows (independently of the context) forwarding and copying but reserves for itself the right to alter the data. EDMOND, on the other hand, also permits alteration and processing in the school context alongside digital forwarding, but not the publication of these altered products. From their context both regulations are understandable. The two examples cited make it clear that web resources are not per se teaching contents. Whereas EDMOND's offer is directly aimed at educational institutions, the target group for the *Federal Statistics Office* is significantly larger. The data stored there only become educational material when used in lessons.

It is a matter of some controversy in the discussion about OERs as to what exactly qualifies an internet source as an "Open Educational Resource"? First of all the question is asked whether

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[1] The legal pointers on the State Educational Server of Baden-Wurttemberg could serve as an example of this: "The sites may only be copied for private usage and, inasmuch as no third party rights are affected, made available to the public for viewing and use in non-commercial educational institutions, thereby quoting the sources, to the extent to which this is justified in connection with the respective purpose and the pursuit of non-commercial purposes. Online-input, alterations or further-reaching, in particular commercial, usages are only permissible if prior written consent is granted." This makes it clear: the contents may be used in lessons, but not posted online or altered in any way. It is assumed that online-input also includes usage of Learning Management Systems.

2 https://www.destatis.de/DE/Meta/Impressum/Impressum.html

3 http://www.medienzentrum.schulministerium.nrw.de/Edmond/nutzungsrechte.htm

"raw data" are to be regarded as OER or whether a certain degree of didacticism is required in order to count as an OER (Bretschneider, 2012). This in its turn raises the question of whether materials that have been created outside the context of an educational institution may be described as OER (DIPF (*German Institute for International Educational Research*) 2013). And finally, a further matter of controversy is whether a certain type of licence is mandatory for "Open Educational Resources"? Is it sufficient simply to make them available free of charge or is the permission to process and publish the material again connected herewith? Must commercial usage also be possible or may this by excluded? And where and/or when does the usage of the resource in educational contexts represent commercial usage (Klimpel 2012)?

For it is possible to differentiate between web resources from the perspective of usage thereof as teaching/learning context as follows:

- Contents that have been produced and published as teaching – learning material and are identified by way of a licence as OER

- Contents that have been produced and published as teaching – learning material and are furnished by their creator with an individually worded usage agreement that describes their possible usages in an educational context.

- Contents that have been produced and published as teaching – learning material and which have not been placed under a particular licence. To these, the limitations of the copyright laws apply.

- Contents that have not been produced and published as teaching – learning material but which are described by way of a generally comprehensible licence as free contents.

- Contents that have not been produced and published as teaching – learning material but which are subject to individual terns of use that clearly define the framework for that usage.

- Contents that have not been produced and published as teaching – learning material and which have not been placed under a particular licence. To these, the limitations of the copyright laws apply.

Thus the spectrum of "Open Educational Resources" is made clear, as well as the fact that a definition seems almost impossible: "Open Educational Resources" may only be defined as being resources that are available via the internet freely (without any further obstacles) and may be retrieved by the users free of charge. The usage of a generally comprehensible licence according, for example, to the CC-licence, is thereby a considerable aid to usage in learning contexts but cannot be phrased as a necessary condition for an OER. These must conform to the valid legal stipulations of a given country and should be simple to communicate. This also corresponds to the definition of OER that Atkins, Brown and Hammond (2007) give.

It should also be taken into account hereby that legal interpretations do, in part, fundamentally differ in different cultures and countries. For example, the release of a resource thereby waiv-

ing copyright laws in a "public domain", possible in the USA, is incompatible with German copyright laws and not until 2010 was a judgement passed according to which the CC-licences – in contrast to other forms of licences that one comes across in an international context – are compatible with German case law.[4]

- Costs and business models

In the focus groups, members of the teaching staff express the concern that, in the context of the increasing commercialisation of the internet, certain (high quality?) teaching-learning resources may possibly only be accessible in the future against payment. It is important to them that they should be able to have access to "open educational resources" (OER) for school.

Learning materials as well as the educational infrastructure for learning have always been financed by *various* players. School equipment, including networks, computers or beamers, in Germany is mostly to be guaranteed by the municipality. Textbooks, which are mostly loaned to the students, are also financed by the municipality; in most cases extra payments are to be made by parents.[5] In addition, parents have to finance further materials of general use and exercise books for lessons, for example those that accompany or supplement an "official" textbook. Opinions differ as to whether digital educational resources can be counted as an "official" textbook structuring the lessons over a school year. Whereas in NRW only approved school textbooks are financed by the municipality, Thuringia also includes educational software that substitutes a traditional textbook in its range of free teaching materials.[6] Usage licences for media that are provided by way of a State educational server or a State video library or media centre are, generally speaking, financed by the state.

This makes it clear that there is fundamentally a mixed financing system for educational infrastructure and media in schools in Germany like in most other countries. Essentially, the crucial question in the discussion about "Open Educational Resources" is whether students should pay to use the medium or whether this should be financed by others. The development, provision and quality assurance of educational resources never is free from costs. We may therefore also assume that in the future there will be a mixed financing system; the only question remains open as to who is to bear which parts of those costs and where the focus of state financing should lie in the future: still (only) on traditional textbooks or (which?) other resources or elements of the educational infrastructure?

The choice of cost model hereby has an impact on the pedagogical work. If billing relies on the frequency of the retrieval of materials ("pay per click"), this would influence the planning of a lesson. A school or a teacher could, for example, be compelled to reduce the number of retriev-

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[4] Regional Court of Berlin, Ref. 16O 458/10 dated 08.10.2010.

[5] In NRW, for example, schools may pass up to one-third of the costs on to the parents (§96SchulG (Schools Act) NRW)

[6] Thuringian Decree on Educational Resources (ThürLLVor §12, Para.2)

als if the quota of clicks that has been purchased has been used up. Cost models that rely on billing the individual access thereby do not appear particularly practicable or, from a pedagogical point of view, particularly sensible with regard to learning and teaching in schools.

It would therefore appear far more expedient to develop material pools that teachers and students can access "openly". In order to establish material pools as "Open Educational Resources" procedures are required how these can be produced and made accessible using funds that have been previously used for traditional textbooks. Teachers can and will help to build such a base of open learning resources by sharing their materials. Additionally and more important, the experience of publishers with producing materials of high quality can be used to implement a wide range of "Open Educational Resources".

We may summarise the results of the work with focus groups in the "Edutags" project as follows: Teachers have a high demand for finding high quality educational materials on the internet for teaching quickly and efficiently. They use the materials in lessons mainly in paper form but wish to make them increasingly available to their students digitally, if legal conditions are resolved and if no additional costs are incurred by students or the school. They do not wish to be bound to individual providers but want to be open for various providers and to also make their own contributions to the (further) development of learning materials.

3) Digital Educational Resources as a Component of the Educational Infrastructure in schools

Digital educational infrastructures are increasingly complicated entities in which many components (must necessarily) interact with one another: from the furnishing of the buildings and the IT hardware components to applications and platforms that are operated by various commercial and state institutions. They must all be technically and conceptually compatible with one another in order to be able to be integrated effectively into the teaching–learning context. In addition, a number of services, from installation, maintenance and upkeep to consultancy and training, are necessarily if these are to be used successfully (Kerres, Heinen, Stratmann 2012, Kerres, Heinen 2013).

3.1) School, Content and Reference Servers

Starting out from the analysis of the conditions for the usage of digital educational resources the question is examined in the following as to how an informational ecological system is to be shaped that corresponds to the requirements of scholastic teaching and learning. The concept of an "open informational ecological system" for educational resources has been developed thereby. It is based upon the idea of the interaction between various players and platforms which, in the final analysis, together provide the educational infrastructure. In the following, school, content and reference platforms are examined as components of such an ecological system.

a) School Platform

A teacher develops materials for his/her lesson or searches for them on the internet. He/she then posts these materials to a learning management system so that the students can use them. Learning management systems usually take the form of a school server run by the school itself or provided by a host (e.g. moodle, fronter, lo-net or similar.). The school platform offers students a central location where they can find relevant documents for learning activities. School platforms thereby frequently firstly and foremost serve the purpose of distributing learning materials. The students do not necessarily work with these "within" the school platform itself (Petko 2010). For this purpose, they mostly use other tools in their "personal learning environment" (PLE). In this sense learning management system are also to be regarded as social hubs that connect the PLEs of the students with the institutional platforms of the school (Hölterhof, Nattland, Kerres, 2012; Kerres, Hölterhof, Nattland, 2011).

b) Content Platform

Teaching and learning materials are available on various platforms (in Germany e.g. lehrer-online, 4teachers, ZUM, Educational servers etc.). The contents are posted either by an institution, a publishing house, an editorial team or, indeed by users themselves (usually teachers). Generally speaking, metadata pursuant to the resources are entered in order to enable the materials (at least within the respective platform) to be more easily found. A number of different standards exist for these learning objects and metadata (Weibel 1998, IEEE 2002) which, despite intensive endeavours (Van Assche et al, 2009) have not lead to a uniform standard. There is also some criticism that these standards are not flexible enough and say little about the actual potentials of educational objects in classrooms (Brooks, McCalla, 2009).

In any case, expenses are incurred for the operation and supervision of the platform which can be collected differently depending on the business model. As has already been mentioned, the users themselves can cover for the costs by an annual subscription (similar to a magazine) or they "pay per page" similar to a loose-leaf binder, or the costs are borne by another party, be it private initiators or institutions that may be active on behalf of a school maintaining body or a Federal State. Some content platforms are be operated e.g. by institutions, companies or associations.

These platforms can offer a wealth of materials for use in the classroom. Most often, they complement learning by way of an "official" textbook with exercise materials of all kinds. The "official" textbook contains a linear-structured and closed collection of didactically prepared material that is based on the curriculum of a school year and school type. An increasing number of publishers are producing digital textbooks that have a number of advantages when compared to traditional textbooks. In the first instance "digital textbooks" often are conceived as documents, e.g. in PDF-format, provided for reading on a laptop or tablet. Then, searching and navigating is easier in such a digital document; texts and images may be more easily annotated managed and commented. Digital documents can also integrate all forms of multimedia and

interactive exercises. Döbeli Honegger (2012) discusses future potential for textbooks as a consequence of digitalisation.

Publishers are beginning to build online-platforms around their digital textbooks which are made available to classes and courses that work with the particular textbook. Increasingly, rich online-environments with various materials are being set up for this purpose. Teachers are provided with various presentations and templates for examinations and tests. If the print-based textbook is available in a digital format and finds its way to the internet, the transition to other content platforms becomes blurred. The question remains open as to the direction in which the "digital textbook" will finally develop, whether it will tend towards a document with embedded and extended (multimedia) interaction or to an online-platform with a multifaceted pool of materials and an online-learning environment for courses based on digital textbooks.

c) Reference Platforms

With the diversity of available materials on the internet the question is raised as to how the teachers, but also their students may find materials for their learning activities. The first path will lead them to those search engines that they also use in their daily activities which will presumably guide them to one of the above-mentioned content platforms for learning materials. Should they already be familiar with such a content platform they may possibly take the second path and search directly within the content platform itself. The search is hereby restricted to materials of that platform or, to put it another way, it will be necessary for the teacher to conduct the search on a number of platforms consecutively. They may, however, also take the third path and search for materials on a educational platform that brings together references to materials to be found on a platforms of several providers. In this case, the reference platform merely *points* to materials on a content platform, but does not, as a rule, provide materials of its own.

Reference platforms may be filled with content in three ways:

(1) **Editorial Maintenance:** An editorial team looks for materials on the internet and posts references to these materials, usually furnishing them with keywords and / or allocating them to a taxonomy (e.g. according to school year and subjects). This corresponds roughly to the practice adopted by some State Educational Servers or the core service offered by the Federal Educational Server.

(2) **Automatic Aggregation**: So-called "Crawlers" comb their way through the resources on associated content platforms and register any newly posted materials. They analyse the contents thereof and attempt to classify them automatically or furnish them with keywords that may be extracted from their contents.

(3) **User-generated Content**: The users themselves enter references to valuable educational materials, assess these and provide keywords. On the basis of previous search inquiries and keywords used the platform is able to make recommendations for further materials.

Websites operated by editors are, for example, some States' educational servers which are supplemented by automatic aggregation. User-generated content often is to be found on websites that are run by teachers themselves. The German national educational server offers a mixed form. Alongside editorially maintained content we also find – with Edutags – a reference system that points to educational resources provided by users. Finally, a crawler automatically reaches out to check the resource and reads available attributes of the resource, inasmuch as this is possible.

3.2) Interaction between the Platforms

To describe the full picture of a learning infrastructure further platforms – beyond school, content and reference platforms – could and should be added: e.g. repositories, portfolios or systems for assessment or administrative purposes. In any case, it becomes evident that the – successful and sustainable – provision of educational resources beyond the scope of a single school is not a trivial matter: the mere posting of a resource on a server cannot guarantee that the materials – often compiled with a great deal of effort – will be reliably found and integrated into classroom learning. There are several obstacles to be overcome from the production of a learning resource by a teacher, the uploading onto the "right" platform and the usage by another teacher in another school.

The complexity of this workflow can be reduced to some extent if the sub-processes described are brought together in a single platform or environment. This is the approach that is to be found in so-called closed informational ecosystems and which is outlined in the following. In contrast, open information ecosystems are explained subsequently.

3.3) Open and closed informational ecosystems

The brief overview of platforms that come into play in the provision of resources for learning and teaching demonstrates the complexity of the informational infrastructure necessary for providing learning resources. These processes can - without further ado - technically be grouped together and implemented on *a single* platform or an internet environment (consisting of several components that are attuned to one another) that is designed and controlled by one provider.

A publisher may, for example, operate a platform,
- on which teachers share (links to) contents,
- on which available contents are uploaded,
- on which contents are classified and tagged with keywords,
- on which contents are reviewed and processed where necessary,
- on which other teachers search for contents, comment and evaluate them and finally
- copy these contents into a course room in which
- students learn with these materials.

An approach of this kind can provide a coherent and uniform environment. From the provider's point of view, the environment can tie teachers and students to the platform. In such a closed

environment all aspects of the ecosystem can be controlled by a central agent: not only the contents, but also the hard- and software components for viewing and processing these contents. Such a "closed informational ecological system" for the provision of educational resources has far-reaching implications and social consequences beyond education and learning in schools. It is, finally, a question how the production and dissemination of knowledge should, could and must take place in an open society.

A closed environment of this kind can offer many advantages to the individual user. The "vendor lock-in" effect does, however, result in a dependency that is, perspectively speaking, problematic for a society that is dependent upon the free development of and access to knowledge. From the perspective of education such an aggregation of knowledge in "closed informational ecological systems" must be regarded as problematic. It can be seen as a significant cultural achievement that knowledge is available for education which belong to "everyone" and that education, as a state duty and civil concern, is borne "by everyone". The commercialisation of the internet could bring a closure to knowledge platforms in the long term without the far-reaching effects and implications for the individual user being experienceable in the short term.

Yochai Benkler coined the concept of "commons-based peer production" (Benkler 2002). The origin of the internet encyclopaedia revealed these possibilities that may be linked to a commons-based production of knowledge where individuals contribute to a work that is the property of "all". However, in most cases there are rather few active users that actively contribute and share their knowledge contrasted with a large amount of users who "consume" these resources and do not actively participate in the knowledge building.

Aigran (2012) refers to Doueihi (2009) and a new form of "digital humanism" which feeds off three factors: a) already existing knowledge and infrastructures that are used and shared jointly, b) the ability of each individual to make a contribution to the pool of world knowledge and c) tolerance to gaps in knowledge and lack of knowledge accompanied by the endeavour to compensate for this as much as possible. A commons-based peer production of knowledge has to guarantee that each individual may make a contribution to the body of knowledge from anywhere, some tools and resources must be available for the functioning of the project and it must be possible that the results of this process are available for the others. (Aigran, 2012).

The concept of "open informational ecological systems" can directly be derived from this. It is an environment that is open for a commons-based production of knowledge resources by peers, whereby the participation of commercial producers is not ruled out. In the context of projects such as Wikipedia, it also becomes clear that the provision of "open resources" does require a rather sophisticated technical and social infrastructure as well as financial means.

4) Edutags: A Reference Platform for Educational Resources

In the following the significance of a reference platform as a basic technology for an open informational ecological system will be explained in more detail. Edutags is a reaction to the problems described above; it uses the assignment of keywords to educational resources as a

measure to the quality assurance of these resources. Also, the importance of providing licence information for educational resources is highlighted.

4.1) Keywords for the Description of Educational Resources

Edutags contains a platform on which teachers create references to web resources of all kinds which they deploy in an educational context. They describe these by way of keywords (tags) and other information. The choice of keywords is the prerogative of the users. Terms from a subject-specific list of keywords as well as other terms based upon individual criteria of a single person or group may be assigned. The decisive factor is that users, by way of assigning keywords, illustrate and reflect their own concepts pursuant to the resources (Kimmerle, Cress, Held, 2010). These tags do not represent a complete set of metadata but do offer descriptions that relate to the actual use of the resource by a teacher in a "real-life" context. If several users assign keywords to a resource, the describing metadata become more substantial and the resources can be found more easily by other users (Weinberger, 2007, Ihme, Möller, & Pohlmann, 2009, Richter & Ehlers, 2010).

In contrast to other reference platforms, it is possible in Edutags to store not only materials that have been explicitly defined as teaching materials but also all other kind of materials, e.g. from platforms like YouTube or Flickr. The only important question is whether and how an internet resource is used in a classroom context by a teacher who creates such a link to a resource.

4.2) Allocation of Synonyms and Classification within Hierarchies

A widespread problem with "free tagging" by users is that several keywords (= tags) can be found for one concept or resource. This can make it difficult to find some resources; some valuable resources might remain undiscovered. Such a "folksonomy" is not aware of any relationships between the individual terms and does not order them in a hierarchical structure like a taxonomy. Such a hierarchical structure, however, is very important especially for school contexts. Edutags addresses both of these deficiencies: Synonyms are allocated to one another and to other keywords. Both of these measures contribute to an improvement of search results.

4.3) Identification of Licences

Teachers should immediately be able to recognise the legal conditions how a certain resource may be used in their classroom. In the best case, this information is incorporated into the source code of an internet resource so that this can be deciphered automatically by Edutags.

For each resource, Edutags checks the resource on the target platform to test whether a machine-readable licence is provided with the resource. In case a CC-licence is provided the appropriate licence tag and pictogram will be presented in the description of the resource. Furthermore, in order to raise the awareness of openness of materials and to give greater publicity to existing OER materials, providers of CC-licensed materials can input these to Edutags directly via standardised interfaces (RSS-Feed, Meta-Keywords according to LOM, LMR or

similar.). In this way Edutags complies with demands made in the UNESCO Paris declaration (UNESCO, 2012) and supports the realisation thereof in Germany (D'Antoni, 2009).

4.4) Interfaces to Use in Lessons

A teacher who compiles web resources as a result of a search inquiry on Edutags intends, as a second step, to make those resources available to students. To this end, Edutags offers four interfaces. Results lists may be issued as PDF files, printed out and distributed among students, they may be embedded as a tag cloud or list on websites and LMS or passed on as an RSS-Feed. These tag clouds and RSS-feeds do not only reflect current search results but are dynamically generated on-the-fly and enhanced by information added later. Edutags thus represents a link between various content platforms and content providers that may be used as educational material and the schools' learning platform. By this, teachers profits from resources that have been shared by other teachers.

5) Summary and Conclusions

The analysis of the framework conditions for the use of educational resources in school contexts has revealed a number of aspects that are of particular concern to teachers. They wish to be able to quickly access a large number of high quality (quality-assured) materials that they may use in their lessons free of charge and without any legal problems. At the next stage the interaction between the players and their offers or platforms has been investigated. It was revealed thereby that (only) an "open informational ecosystem" redeems the demands of approaches for open learning as well as other pedagogical criteria.

Our position is based on the observation that despite the availability of a vast amount of open and free resources for learning and teaching, closed informational ecosystems are currently affecting the development of open educational resources. Thus, we do not only need more open educational resources to support open learning, we also need to establish an open informational ecosystem that sustainably supports strategies of open learning.

Our argumentation can be summarised briefly as follows:

- Access to a multitude of digital educational resources is a pre-condition for learning in which the search for, assessment and processing of digital information is an important component of learning. It is always of urgent necessity when it is a question of the individual and cooperative confrontation with knowledge from multiple perspectives in which the students make active constructive contributions.

- Digital educational resources may be made available for learning in various forms. They may be provided by commercial companies such as textbook publishers or developed and/or provided by private or state institutions.

- There are different types of licences with which digital educational resources may be used in schools. Some licences merely permit a reference to be made to a resource,

others open up far-reaching possibilities of modifying and distributing a resource that has been processed. In the case of materials that have not been licensed the restrictions imposed by copyright laws take effect.

- "Open Educational Resources" is a term referring to educational materials that are available to teachers and students free of charge. This includes variants of different ranges within which they may be approved for use.

- CC-licences are an instrument which helps to easily communicate which usage variants have been granted pursuant to a specific educational resource. They are, however, – and also in perspective – not the only variant for the licensing of (also "open") educational resources.

- The compilation and distribution of educational materials is always connected with expenditure. In the case of "Open Educational Resources (OER)" it is essentially a matter of the students not paying for access themselves, but of another institution covering such costs. To this extent, the discussion of OERs is essentially concentrated on business and operating models for the provision of educational resources. Commercial providers may also provide OERs if alternative ways of covering the costs are available.

- Closed informational ecological systems for educational resources provide contents and offer schools a complete and (often) convenient environment for their teaching and learning activities. They are thus able to create a coherent and consistent environment for learning with, however, little systematic exchange with external platforms and resources.

- Open informational ecosystems create an environment for community-based production of knowledge by peers, where resources and services of various players may be bundled together. By way of exchange formats, interfaces and services they ensure that their platforms cooperate.

- Contents are (only) turned into educational resources by active use in a teaching-learning context. The active participation of users in collecting, tagging and evaluating contents as well as providing metadata are important means for the quality assurance proves on the internet.

- An essential component of an "open informational ecological system" is the availability of an (independent) reference platform that is open to all providers of contents on the internet. This should be fed by contributions from users, automatic searches and recommendation mechanisms as well as from an editorial staff.

- Access to the diversity, dynamic, and openness of knowledge is a central prerequisite of education. Open informational ecological systems in which various players and platforms are incorporated are then an essential condition for future education in gen-

eral. Open Educational Resources are thus dependent upon open informational eco-systems.

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