Open Educational Resources

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1 Open Educational Resources

The popularity of the concept of Open Educational Resources (OER) has increased since the MIT announced the opening of their educational materials for the public in the Open Courseware Initiative in 2001. Many organizations, institutions, and individuals have joined this idea and initiative. Simultaneously, researchers in education, business and information systems engineering (BISE), and other disciplines have developed concepts and solutions how to make these resources available, utilize them, and how to embed them into educators' and trainers' daily work life. Even though the idea – as an analogy to the Open Source/Free Software movement – has attracted attention from both research and practice, it still has not achieved the adoption expected. However, the potentials for research as well as practice remain enormous, in particular in view of the given economic and organizational constraints for the education and training sector.

2 What Are OER? Understanding a Fuzzy Concept

The term Open Educational Resources (with the synonyms Open Content, Open Learning Materials) is understood differently by the diverse communities and stakeholders involved. In general, it is an equivalent to Open Source in the software development community and denotes openly accessible resources for educational purposes.

The UNESCO defines OER as "technology-enabled, open provision of educational resources for consultation, use, and adaptation by a community of users for non-commercial purposes" (UNESCO 2002). However, this definition is somehow incomplete as OER are not always altruistic or non-commercial. It is one of today's key challenges to establish successful business models around OER as seen in the Open Source movement (see section below). In principle, any digital object used for educational purposes which can be freely accessed and is re-usable under different licensing conditions can be termed OER. In a wider sense OER can be defined as *freely accessible resources for educational purposes*. This comprehensive definition includes the following types of artefacts (cf. Pirkkalainen and Pawlowski 2010):

- Learning objects/resources: In a narrow sense of the term, learning resources/learning objects are specific digital objects created for learning purposes (cf. Knolmayer 2004). Currently, the main research field is how to make learning objects available and re-usable. This class includes for example multimedia documents, simulations, but also simple HTML/web resources.
- Articles, textbooks, and digital equivalents: This class of resources contains typical objects provided by libraries, such as articles, papers, books, or journals. As far as they are freely available, these objects are connected to the concept of Open Access (Bailey 2005).
- Software tools: Software tools are used for different purposes, such as producing/editing learning resources but also for communication and collaboration. Objects of this class are usually referred to as Open Source or Free Software (Raymond 1999).
- Instructional/didactical designs and experiences: Educators are highly dependent on successfully planning and designing the learning experiences – this class of resources includes access to instructional designs, didactical plans such as lesson plans, case studies, or curricula. It also includes one of the most valuable resources: sharing experience about materials and lessons between colleagues. This class of objects is also called Open Educational Practices (Geser 2007).
- Assets: These are simple resources (assets) like pictures, links, or short texts which are not usable on their own in a learning context but can be used to support or illustrate a certain topic. In many cases these are objects found by Google or similar search engines.

Concluding, no common understanding has so far been achieved regarding the boundaries of OER. However, the above classification provides a definition of OER in both a broad and a narrower sense.

3 Current Developments: Applications and Research Perspectives

Different development and research perspectives can be identified, focusing on processes, technologies, resources as well as business models. **Table 1** summarizes key questions for each perspective.

The design/technology view covers tools and services which are related to OER. The first question concerns the access to OER: Currently, there is a wide discussion on the use of centralized repositories, referatories, or semantic web solutions. Most initiatives have

Table 1 OER research perspectives

Perspective	Key questions and challenges
Design/technology view	Which systems, tools, and services are able to successfully improve the OER process? (e.g., Ochoa and Duval 2009)
Resource view	How can resources be designed in an accessible, interoperable way? (e.g., Knolmayer 2004); How can resources be embedded in successful learning scenarios?
Business view	Which business models are promising for OER? Which business models have proven successful in practice or will be used in future? (e.g., Downes 2007)
Process view	How can processes (search, adoption, adaptation, validation) relevant for OER be designed? (e.g., Pawlowski and Zimmermann 2007); How can the usage of OER be integrated into stakeholders' routines?

started to create isolated, stand-alone repositories (mostly on an organizational level) to access and publish OER. In the past years, different infrastructures have been used to enlarge the access opportunities. There is currently a strong trend to federate repositories to enable search and re-use for a larger number of repositories. This is either done by federated search (across different repositories during runtime) or by harvesting (retrieving and using metadata in certain periods). At the next stage, semantic web-oriented technologies will be increasingly applied. However, it is still a challenge how to provide technologies which are easy to use (such as google-like solutions) but allow access to a comprehensive amount of relevant resources. This view also deals with the question which tools and services should be used for adaptation, delivery, and usage activities of OER. As most users are unlikely to use OER "as-is", it is necessary to provide tools and services to allow stakeholders to modify OER according to their needs. Whereas this is rather simple for well-established tools (such as wikis, word processors, slide shows), other specialized resources are more difficult to modify (e.g., simulations, animations). Here, new services need to be developed to enable adaptation by users without specialized skills.

The resource view covers design, development and deployment of resources as well as their acceptance and (re-)use. The creation of learning objects/resources was a key effort in the beginning (e.g., simulations, hypermedia environments, animations, electronic textbooks, intelligent tutoring systems). In the past years, the focus has changed towards embedding resources in learning scenarios (e.g., by using learning designs, creating social environments). The trend of utilizing social software can also be observed for OER. Many developments provide for example social networks around OER to facilitate and improve the teaching and learning process. However, the utilization of OER has not yet reached similar adoption levels as some Open Source products. Main reasons for this are in particular lack of trust (in resources), insecurities concerning quality and legal aspects as well as the not-invented-here syndrome (cf. Clements and Pawlowski 2012). Thus, one of the current key research issues is the adaptation of resources and corresponding efforts. The success of OER mainly depends on how easily they can be adapted and modified to the re-users' context. A specific case is the internationalization in which aspects such as translation, cultural adaption, and user interface adaptation are addressed.

The business view focuses on business models for OER for both non-profit and profit-oriented organizations (cf. Downes 2007). A starting point here are business models from the Open Source community. Currently, OER initiatives mainly use membership models (revenue achieved by subscriptions, but also endowment/governmental/sponsorship models with basic funding by government or sponsors or institutional models with institution's funding). These models were applied for OER but did not prove commercially successful and sustainable. Most repositories and collections of OER are either project-funded, voluntary or used for marketing purposes. Thus, further models need to be explored, amongst them exchange/sharing models (gaining access by contributions of your own), donation models (donations by users), conversion models (replacing free use by obligation to pay) or add-on models (developing add-on services such as consulting around free resources). The key aspect in this field will be to develop add-on services such as consulting services, facilitation/training services, and support services.

The process view analyzes how OER and their use are embedded into organizations' business processes. It has been found that this is a general problem for education and training departments as they are often separated from core business processes and seen as additional efforts. Thus, it is necessary to align and to optimize educational activities within organizations in a consistent way. Initial efforts have been made to create reference models for educational activities and their integration into organizational processes (cf. JISC 2007).

Both business and process views can be seen as key elements to success (Clements and Pawlowski 2012), for example in Higher Education collaborative sharing models and collaborative teaching and development models need to be established. Once institutions (e.g. Higher Education) understand their core responsibility to provide high quality teaching and learning as a common effort, these models can lead to a new culture of collaboration and openness.

4 The Role of Business and Information Systems Engineering

As shown above, it is obvious that the BISE research community plays an active role in designing, analyzing and validating design-based solutions as well as integrating different stakeholder and research perspectives.

From a methodological point of view, both quantitative and qualitative methods are applied in the field. The BISE focus has been mainly on Design Science Research approaches in analyzing and designing processes, infrastructures, tools, and technologies. However, several publications also focus on acceptance or success analyses as well as on phenomenological analyses. Besides, original methods of BISE such as reference modeling or simulations can also be found. The methodological variety in the field is as broad as in other BISE sub-domains.

The key challenge for BISE as an interdisciplinary, integrative discipline is the integration of OER and related processes

into organizations' enterprise architectures and business processes as well as into the corresponding business models. Secondly, technological aspects such as the interoperability of solutions need to be addressed. Thirdly, the research area of adaptive and adaptable systems is a major concern as mere re-use is in most cases neither wanted nor promising. It is necessary to enable users to adapt OER to their contexts and requirements.

As a conclusion, it can be stated that the BISE research community has contributed and will contribute by applying research methods to the domain as well as constructing potential solutions. As the BISE community has successfully explored a variety of application domains, further key findings and breakthroughs can be expected from the community and interdisciplinary collaborators.

5 A Sample Case: OER for Management and Business

The following case is intended to illustrate how OER can be applied in order to reveal motivations of users as well as sample research and development challenges. Main questions are: How to apply OER in a particular domain? Which research questions as well as practical challenges emerge in such a scenario? The corresponding answers will be illustrated from a developer's point of view.

Scenario: In many settings, new course materials have to be developed in limited time and with budget constraints. Therefore OER are a promising starting point. As an example, a Finnish university teacher has been assigned to develop a new course about HR management starting in three months. Based on this seemingly simple problem, several questions arise:

- How can OER providers enable efficient search processes?
- How should the adaptation process be organized and designed?
- Which tools can support the process?
- What are success factors and obstacles for organizations engaging in the provision and use of OER?

Search and validation process: There are two main alternatives when searching for OER: employing web-based materials which use search engines such as Google (which is the most common practice), or searching in specialized repositories. In the sample case, the university teacher would enter a specific manage-

ment repository, such as the OpenScout portal (Kalz et al. 2010), and run a search on HR management. The results are then validated from the teacher's point of view by browsing keywords, screening short descriptions/metadata but also incorporating possible additional quality indications such as comments, ratings, and also cultural information for each piece of material. The decision whether the material suits the context depends on if materials fulfill the user's requirements such as fitting the curriculum, having an appropriate quality level and adequate licensing conditions, and, most importantly, being modifiable with small efforts.

Adaptation process: As a next step, the material needs to be adapted towards the user's needs and requirements; in the sample case this means adapting materials to the Finnish language and the university curriculum. For this process, it is necessary to provide a selection of adaptation and internationalization tools. Typical common adaptation processes are the translation to other language or adjusting cultural and context specific examples.

Tool support for adaptation and re-publishing: The first process would be the translation and cultural adaptation since many materials are available in English and need to be transferred to Finnish. A further constraint is the type of document to be modified (such as text documents, animations, graphics, simulations). In many cases, no format change is necessary, only editing tools need to be provided to modify the documents. What is more important is the provision of collaborative editing options as OER are often used in collaborative teaching settings. For the above problem, a tool would be recommended to provide collaborative writing (for example GoogleDocs) as well as automatic translation support. Thus, two tools need to be combined, additionally providing advice for the adaptation of the documents. In many cases, the translation is just a rough first orientation and needs to be improved manually. Furthermore, a supplementing collaboration process is launched where the teachers exchange ideas using both synchronous and asynchronous tools. Besides, it is useful to have good practices available on cultural and context specific information. This includes changing examples by considering Finnish traditions, changing symbols, icons, pictures and other culturally sensitive factors to fit the course and the

students. Finally, it is necessary to notify original authors, provide feedback, and—to achieve further collaboration—to re-publish materials.

Research Challenges: This case illustrates just a few sample questions and challenges which are currently under investigation. Generalizing from this simple case, the German-speaking BISE research community faces several research and development challenges, amongst them:

- Designing an interoperable architecture for federated repositories
- Modeling adaptation and internationalization processes
- Analysis of usage barriers and opportunities
- Integration of existing tools and services
- Creating a community of users
- Constructing connectors to other systems such as Learning Management Systems and Social Networks

As OER in general aim at massive user participation, such concepts must be cooperatively developed, implemented and validated in a real context with users and different clusters of organizations (such as small and medium sized enterprises, Higher Education, or the civil service sector).

6 Conclusions

The concept of OER is a core reserach area of the BISE community, in particular as it is directly related to its core spectrum of methods and concepts. In contrast to Open Source or Open Access, OER have not yet reached a critical mass of stakeholders and users. However, the concept is promising, both for researchers (e.g., regarding process design, tools, and systems, or business models) and practitioners (e.g., development of interoperable solutions, creating new tools, or exploiting existing resources). The German-speaking BISE research community as well as practitioners should become actively involved in OER so as to stimulate the discussion of successful or emerging scenarios and to identify related research challenges as well as recommendations for future research.

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