The development of a new methodology for knowledge sharing in the interface between university and society - an example from the meat sector

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Abstract

Design science research was used for the generation, use and evaluation of a model for knowledge sharing in the user community through open educational resources (OER). The focus of interest was on the development process of a model for knowledge sharing that emphasize the characteristics and the needs of the user community; the empowerment and democratic issues of openness; the collaboration between institutions and dialogue with society; and consider quality and sustainability issues. Initially, the community needs were analysed through surveys and workshops, and the findings used, through negotiations, to formulate the development process. An open-training platform served as an infrastructure and included a repository with OER, a wiki and a discussion forum. The purpose of this article is an attempt to provide universities with a plan and template for integrated knowledge sharing that responds to societal needs. Usability and usefulness has not been evaluated.

Keywords

Open educational resources; knowledge sharing; repository; community; design science research.

1.0 Introduction

The communication between university and society has traditionally been one-way but in contemporary society a more dynamic and network-based relationship is under development and therefore we experience changes in research and educational practices (Nowotny, Scott and Gibbons, 2001). In research a collaborative tradition exists whereby researchers build upon each other's work, conduct research together in big projects and discuss their findings with fellow researchers in order to get a shared understanding, write articles together and get

them peer-reviewed. In teaching a similar interactive tradition is gaining momentum through the open educational resource (OER) phenomenon (Iiyoshi & Kumar, 2008), which also opens communication between university and society. But, how can we design models for interactive knowledge sharing in the interface between university and society?

OER refer to "digitized material offered freely and openly to educators, students and self-learners for use and reuse for teaching, learning and research". The resources are accumulated digital assets (including learning content, software tools to develop, use and distribute content, and implementation resources such as open license), which can be adjusted and provide benefits without restricting the possibilities for others to enjoy them (OECD, 2007). Until recently, most digitized teaching material has been locked behind passwords, but the OER movement, which is often community based, is counteracting these barriers.

Communities of practice can be described as groups of people who share a concern or a passion about a topic and who deepen their knowledge by interacting (Wenger, 1998). Communities of interest bring together stakeholders from different communities of practice (Fischer, 2001), and in the interface between university and society the establishment of such a community can be important for the design process.

The society is increasingly more engaged in concerns for food, and specifically issues related to the meat sector. Animal welfare and sustainability related to the production of meat, and health and safety issues related to the consumption of meat are concerns of high priority to many consumers and citizens all over the world, and thus for industry and students in a global context.

From a more practical view-point there are a number of arguments for the development of a methodology based on OER within the meat sector: 1) It was anticipated that an open online educational approach would be most appropriate for sharing of knowledge and mutual learning when targeting industry and higher education institutions in a global context; 2) Because traditional meat science is a subject area of decreasing interest, OER in meat science could be a way to attract more students; 3) Sharing of aggregated knowledge is of benefit for other teachers in the same content area, in particular those in small research groups who have no possibility to develop resources of high quality standard. This is added value on taxpayers' money; 4) Sharing of knowledge through information and communication technology (ICT) is moreover beneficial to scientific articles in that it can include multimedia; 5) Scientific articles that arise from research, have a lag time before publication and the more speedy output of an OER using an online educational approach would therefore complement a later publication.

The learning philosophy underpinning the use of OER is grounded in the work of Dewey on inquiry-based learning (Dewey, 1916). He emphasized the importance of learners being active explorers of their environment and teachers facilitating learning by providing materials and guiding the learning path. Another source of influence is Vygotsky's theorizing on learning and development. Vygotsky (1978) argued that learning fundamentally is socially and culturally situated and the importance of other people (i.e. parents, teachers, peers) in guiding and scaffolding the learning process of the individual. Building on "root ideas" of Dewey and Vygotsky, contemporary educational theory argues for the importance of learners participating in collaborative learning activities and performative learning efforts (cf. Koschmann, Hall & Miyake, 2002) and the design of learning environments that offers

opportunities for such learning (Thomas & Brown, 2011). OER, then, is designed and developed for learner engagement, taking in consideration local adaptability by the following four steps: understanding the context, determining social commitments, reifying understandings and commitments into design, and scaling up to multiple contexts (Barab et al., 2004). The construction of the OER utilizes multimedia and was also influenced by the work on cognitive overload by Mayer & Moreno (2003).

The primary objective with this text is to describe how we developed a community and an infrastructure, an open-training platform, which comprises a structured collaborative space to share experiences and resources between teachers, trainers and trainees (Barrett et al., 2009). A secondary objective is to describe the empowerment process, to promote the information contained in the OER for non-commercial teaching and training and research purposes (Kanwar, Balasubramanian & Umar, 2010). A third objective is to describe how we made higher education responsive to society through a dialogue on the model and the content of the OER. An additional objective was to discuss quality and sustainability issues. To achieve these objectives it is necessary engage the user in order to design for online learning by the alignment of technology, learner needs, pedagogy, content and context. The assumption was that the OER could then be adapted and used by a multitude of existing teaching and training programmes, and because they were multimodal, videos could complement the content and be shared without any translation.

In educational sciences, design research is a research area for developing and refining theories about how people learn, and design-based research is a series of approaches, with the intend to produce new theories, artifacts and practices that impact learning and teaching in naturalistic settings (Barab & Squire, 2004).

Design science research is an established tradition that in general aims at producing and evaluating design guidelines and framworks that inform the design of artifacts addressing a certain class of problems (Hevner, March & Park, 2004). The methodology used for knowledge sharing via OER has similarities with design science research (Simon, 1996) in that both are characterised by relevance and novelty and require a systematic research structure: 1) defining the problem, 2) demonstrating that no adequate solution exists, 3) development and presentation of a novel ICT artifact (construction of models and methods) that addresses the problem, 4) evaluation of the IT artifact enabling the assessment of its utility, 5) articulation of the value added to the IT knowledge-base and to practice, and 6) explanation of the implications for IT management and practice (March & Storey, 2008). In other words, design science research focuses on the construction of situated artifacts and the evaluation of artifact performance following construction (Vaishnavi & Kuechler, 2008).

The purpose of this article is to describe how design science research methodology was used for the development and use of open educational resources as an ICT artifact for knowledge sharing. Furthermore, we describe the output of the design research as a model including a virtual community (a group of people that primarily communicate and interact via Internet), a repository (an archive containing digital content), and more than ten OER for knowledge sharing. It should be emphasised that this paper addresses only the design process; the impact evaluation is not covered.

2.0 Material and methods

A multi-disciplinary EU-project with the goal to improve the meat quality for the consumer was conducted 2007-2012. This project comprised a number of research areas; such as animal welfare and health, sustainability and chain management, and meat quality and safety. The project was an industry-academia partnership involving 62 partners of whom 20 were universities, 15 research institutes, and 27 enterprises and organizations. A segment of the EU project, focused on the development of a novel solution addressing the problem of global knowledge sharing responsive to society.

In the design science research approach, the definition of the problem was facilitated by the use of surveys and workshops, and the development of a novel solution was based on the negotiation between university and society for modelling of the OER and the infrastructure.

2.1 Surveys

Three electronic surveys were conducted during the first year of the project to obtain information about the level of development in teaching and training as well as the demand on future training needs. One survey was sent to over 250 teachers and trainers in all the countries involved with the project, soliciting details of currently used teaching and training methodology and about their interests and needs of various educational approaches and resources. Two surveys detailing training needs in industry were sent to trainers and to potential users of training material.

2.2 Workshops

Two half-day workshops, with invited participants, followed the surveys. One addressed industry demands for knowledge transfer. This workshop had 12 participants, which were mainly from industry organisations. The areas of interest were discussed first in a broader context and later as more detailed topics.

The second workshop on teaching methodologies had 8 participants from different European universities and vocational training organizations, and the following topics were discussed: Sharing of knowledge between institutions and in dialogue with society, Virtual Community, on-line training of trainers, delivery models and the use of a repository.

2.3 Negotiations to establish OER

Fundamental to this project was the establishment of close ties to industry partners with the intention to have close dialogue and interactive exchanges on issues facing the industry. A reference group (n=16) was established with a minimum of one from each of the research areas in the project. Based on the results from the workshops this group suggested potential OER to address demands for training in industry and for teaching at university level. Rather than develop a new academy of learning modules, they suggested OER that were stand-alone complements to traditional teaching activities with the possibility for users to add-on comments and recommended additional reading materials and secondary to make commitment with teachers and trainers in different curricula about the use of OER. In addition, the reference group provided an opportunity to test the learning resources.

An ICT-based infrastructure for the collaborative activities was discussed after the workshops. Key components of this infrastructure were 1) a repository that has free and easy access and practical, functional options for searches, bookmarking and alerts and for submission of user resources for reuse by others; 2) a discussion forum that can be used for dialogue with society and between users in the form of posted messages); and 3) a wiki in which users can add, modify, or delete its content via a web browser using a simplified markup language or a rich-text editor.

3.0 Results

The findings from the activities described above were used to identify the design problem, the community, the motivations and prerequisites for a novel solution, and to formulate the development process and the model. The following text is the result of the surveys, the workshops and the follow-up negotiations between university and society on the model of OER and the infrastructure.

3.1 Surveys

The response rate on the survey of the educators was 40 % (99 responses out of 250) whereas 70 responses came from presumptive users. However, the actual response rate was undeterminable because this survey was forwarded through contact lists by many different organisations.

Figure 1 shows the countries of the target group of educators, which included trainers in private, industrial and government organisations and academics in universities and research institutions. Responses were collected from 99 people based in 21 countries in Europe, America and Africa.

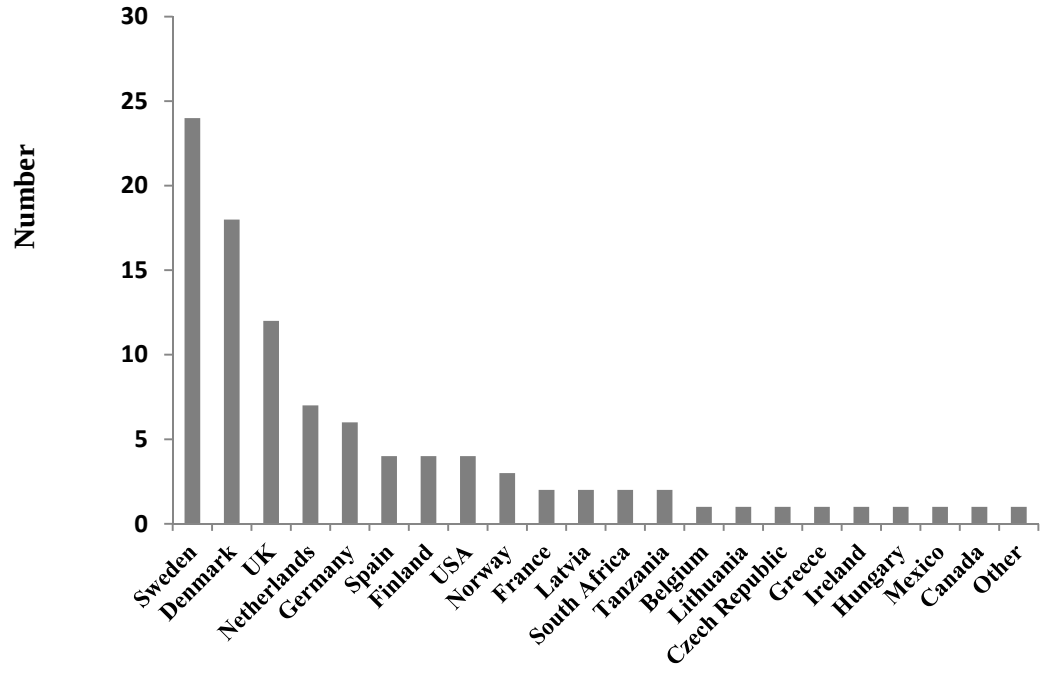

Figure 1. Number of responders and their country.

The target group responders represented every subject of relevance for the project (Figure 2). They covered all levels of education; undergraduate students, MS and PhD graduate students. Some were also involved with continuing education.

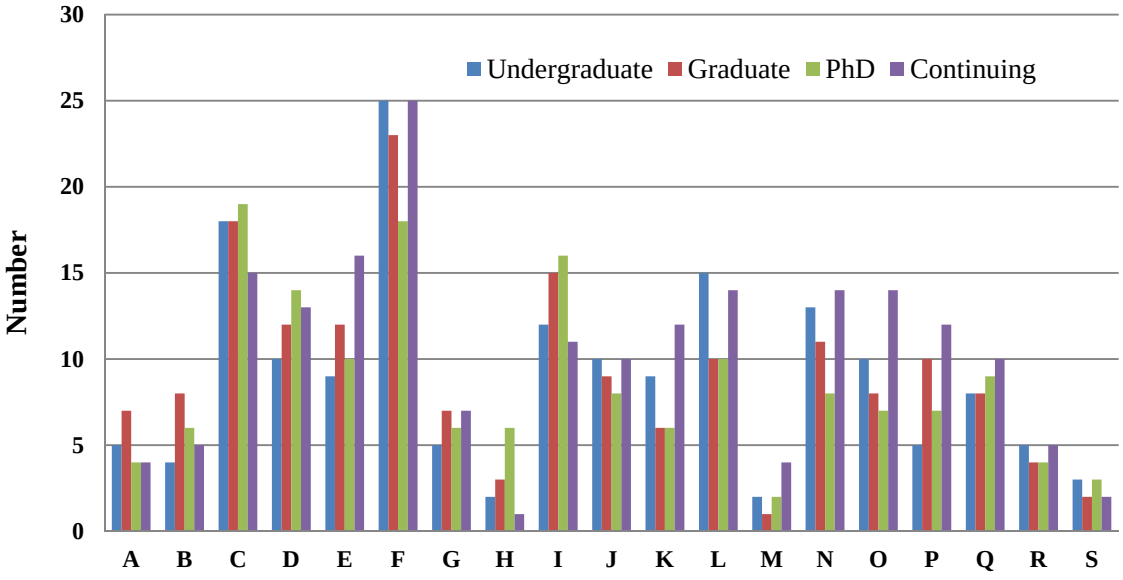

Figure 2. Number of responders teaching different subject areas (responders could tick more than one).

A) Consumer behaviour
B) Market research in relation to meat
C) Pig production
D) Sustainable pig production
E) Animal hygiene in relation to pig production
F) Pig welfare
G) Pig genetics
H) Molecular biology in relation to muscle biology
I) Meat science
J) Meat processing
K) Microbiology
L) Food safety
M) Food bio security
N) Quality management
O) HACCP / ISO systems
P) Disease control programmes
Q) Nutritional science
R) Logistics
S) Life cycle assessment in relation to meat

Survey results indicated that only a few people in 2007 who responded were actually using e-learning. Five percent indicated they used e-learning to a large extent, 27 % moderately, 40 % a little, 22 % not at all, 6 % did not know (data not shown graphically). Furthermore, it seemed likely that few OER were available, and that PowerPoint presentations were the main IT device used in both face-to-face teaching and distance teaching.

The surveys indicated, from the end-user perspective, that the development of OER should be demand-driven and based on well-defined needs, but that only half of the users were willing to pay for training. An additional important finding was that training material should be made available in different languages in order to reach users Europe-wide. Training material should be scenario based with real case challenges that encourage the users of training to apply theory to practice in their own work situation.

The surveys demonstrated an interest among most teachers and trainers (36% very interested and 23% moderately interested) to be part of a virtual community (Figure 3).

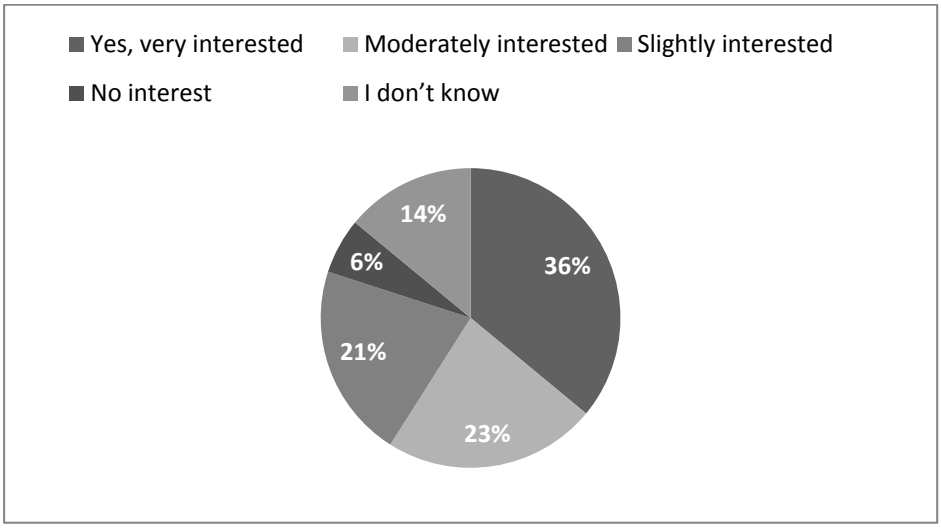

Figure 3. Proportion of responders who wanted to take part in a virtual community.

The responders believed that the use of e-learning in their institutions would increase during the next five years (79 % extremely likely/likely, 8 % unlikely/extremely unlikely and 13 % did not know; data not shown graphically). Thus, there seemed to be a need for new digital learning resources. A great proportion of teachers and trainers were interested in integrating

new learning resources developed within the project in their teaching activities (29% strongly interested, 33 % moderately interested, 12 % weakly interested, 2 % not at all and 24 % did not know; data not shown graphically).

Many responders were positive in sharing their existing electronic learning resources (Figure 4). Unfortunately, 24 % of the responders indicated that they did not have anything to share. One-third of the responders were positive in sharing their learning resources (24% of responders without a royalty fee and 13% responders with a royalty fee). Twelve per cent indicated "no" to sharing OER, whereas 27 % of the responders answered that they did not know if they were willing to share their learning resources.

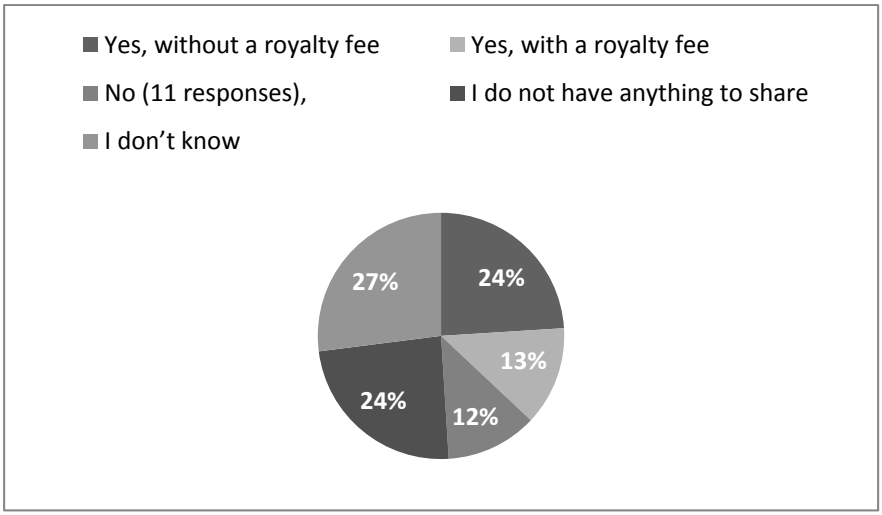

Figure 4. Proportion of responders who were willing to share existing OER.

3.2 Workshops

At the workshop on teaching methodologies it was decided to develop a repository for OER, a wiki and a discussion forum. Management and maintenance of control of the platform received considerable discussion and the following principles were delineated.

- A moderator would be needed at the beginning because limited interest and trust would leave the community inactive.
- Risk of spam (unsolicited bulk messages) related to open access would be controlled by passwords for writing in the wiki and discussion forum.
- An online etiquette was defined and would be made visible on the repository.

The list of topics from the survey on industry demands was analysed and refined at the workshop. The list was used continuously in the project as a guide for selecting research results for including in potential OER.

3.3 Negotiations to establish OER

A model for the teaching and training activities within the project was launched for internal use in the project. It included a first version of a description of the 10 OER that should be developed within the project in order to share the most recent knowledge from the project

between universities and the industrial sectors. The project team decided to enhance the value of the OER by incorporating a pedagogical design to enable the same OER to be used for different target groups.

Initially, a template was created for the learning resources. To encourage teachers to adapt the OER in their teaching, the OER itself included a navigation structure supporting the learning process and provided a "teacher page" suggesting a learning path in the subject, including the use of the OER, the wiki and the discussion forum. The template was launched together with the model and included the following characteristics:

- The *name* of the resource should capture the topic and content in a few words.
- The *introduction* should motivate teachers and learners to use the resource for their teaching and learning. It should also set the content and its significance in a broader context.
- The *objectives* of the resource should be very obvious to the target group. If appropriate, demarcations should be specified. The objectives should be editorially adapted for the specific target groups.
- The approximate number *of study hours* needed to complete the learning resource should be given for consideration by teachers and learners using the resource.
- For the benefit of teachers and learners, the e*quivalence to European Credit Transfer and Accumulation System (ECTS)* allocated to the learning resource must be given.
- The *prerequisites* for optimal use should be described in detail for the different target groups. Students and learners must know if they have the right background knowledge and/or experiences needed to understanding the subject at the level it's presented at.
- The *learning outcomes* should be described in behavioral terms of what the student should be able to do after having completing the resource. The vocabulary used should be adapted for specific target groups.
- On the *teacher page*, teachers and trainers are provided with ideas on how to use the learning resource in different settings and for different target groups. The teacher page should also include ideas for assessment.
- *Content* should be current, engaging, relevant, and rich in visual material, offer opportunities for self-reflection and generally be of high quality.
- The resource should be realistically challenging and include *interactive activities*.
- *Self-tests* should give learners an opportunity to apply the concept, skills, and attitudes they have learned.
- Every resource should include tests that provide a variety of reliable ways to objectively measure progress and comprehension. They should also include a "wrap up" of the content in *lessons learned*. This should guide students/employees in defining areas of importance. Suggestions for *further reading* should be included.
- Every student/employee should be able to *evaluate* the learning resource anonymously for further improvements.

The OER were developed on this standard template. The development of the learning content of OER was based on close collaboration between the researchers, who were leading experts in specific fields, and the e-learning group.

The openness at the open-training platform was discussed. Some thought it best to make it completely open and others thought it should be protected. It was decided that users can use the OER and read the wiki and discussion without registering, but participating to a greater degree needed to register in order to submit their own OER and to edit the wiki and write postings in the discussion forum.

The search for a well-structured repository resulted in contact with UNESCO, that developed and launched a repository in 2007 (www.opentrainingplatform.org) and we developed the first customised open-training platform based on the UNESCO-structure. This repository can be found at www.porktraining.org and Figure 5 is a model of the activities in the virtual community.

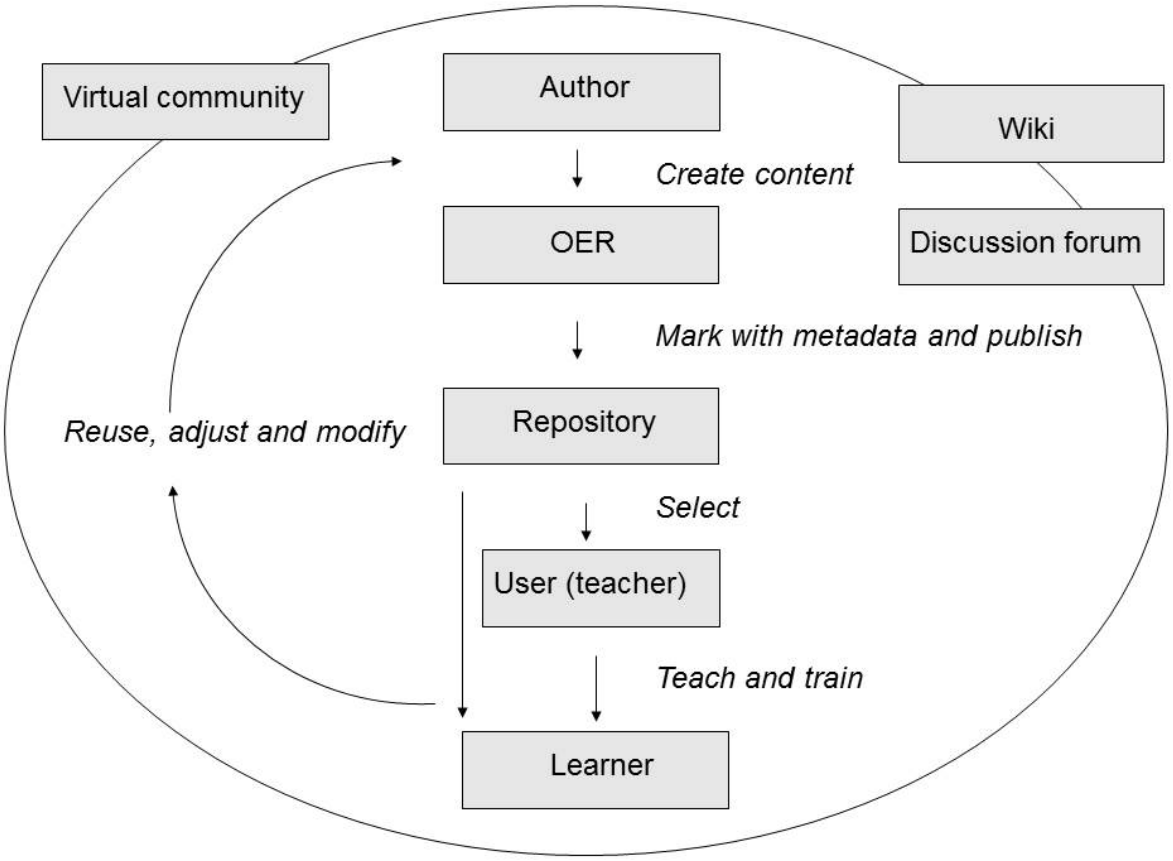

Figure 5. Model of the activities in the virtual community offered by the project.

In every case the OER was uploaded as HyperText Markup Language (HTML) and submitted to the repository by the e-learning group and accepted by the involved authors. The authors were acknowledged in the information about the OER in the repository. After the submission, a two page leaflet about each resource was developed in English and translated into 4 or 5 languages depending on subject (German, Spanish, Hungarian and Bulgarian and in some cases French and Polish). An alert email including a link to the repository and the leaflets was sent to the community each time a new OER was launched.

The surveys clearly showed that training of trainers in the use of OER was needed. At the industry level it is a major challenge for companies to integrate new knowledge into their own business performance. Therefore, the targeted user group was best-known by active trainers, training institutions and industry associations. It was expected that these groups could align the material to their target group and training session. Furthermore, regional contact partners with a strong network that enables a good distribution were involved in the process of implementing training resources.

The collaborative tools were developed because they were expected to be of high importance for the vitality of the virtual community, but they were not directly related to the OER. A wiki enabled web documents to be authored collectively without any coordinating body prior to its publication. The discussion forum was only moderated in a short period because of lack of resources. Advice on how to use the collaborative tools was offered in the repository but no training activities were undertaken.

4.0 Discussion

The results indicated a willingness to share existing resources and a demand for OER that teachers can adapt and use. The objectives of learning have in recent years become more geared towards producing competences and less toward the older, more traditional view of giving back what has been taught or to interpret and put the learning into one's own words (Säljö, 2010). Säljö pointed out that this performative nature of learning and knowing implies a focus on what is new, relevant and productive, rather than on what is true in an absolute sense. Research dissemination, especially to industry, shares these same ideas and philosophy of producing competences. Thus, sharing of knowledge through OER based on a dialogue with society on the demands is of special interest to the user community.

OER have been advocated as one of the major building blocks in future education, "… creating the conditions for the emergence of new kinds of open participatory learning ecosystems that will support active, passion-based learning" (Brown & Adler, 2008). This was confirmed by the survey of the user community in that a large increase in the use of e-learning resources in the teaching institutions was expected.

In the last decade, the number of available OER has rapidly increased, but the rate of adoption in educational practice is still low (Ochoa & Duval, 2009). Among the limited group of users, very few contribute with adapted resources given back to the community (Clements & Pawlowski, 2012). The question about reuse and efficiency in education has been of main concern in research on OER, but complementing perspectives must be included to analyze and explain success and failure in designing and using OER and in learning with OER (Lundin, Svensson, Lundh-Snis, & Pareto, 2008). As teaching institutes compete for fee-paying learners in many countries, limitations in contribution to the free OER pool might seem inevitable, however recent development in open education led by top institutions such as MIT, Stanford and Harvard demonstrate that OER is a show-window for the courses and thus a way to attract new students. Thus, creating new learning environments or communities is not just a matter of implementing new technology, but in many cases, also applying new practices of learning and instruction (Lipponen, 2002) and addressing the underlying issues that prevent the wider adoption.

The development of the model, including the repository, the OER, the wiki and the discussion forum was based on a demand analysis and is consistent with society's needs. As the end users were involved throughout the planning and decision-making phase this user-centered design incorporated the elements that were important for the teachers and trainers. For example these included video clips from real life, based on the idea that a combination of theory and practice triggers learner reflection and that authenticity increases student motivation (Petraglia, 1998). The first three steps in the design science research methodology described above; the identification of the design problem, the motivations for a novel solution, and the development of the model and the IT artifacts are "..aiming at changing existing situations into preferred ones" (Simon, 1996, p. 111).

4.1 Context, quality and sustainability issues

One of the main questions is how easy it is to integrate the OER in a curriculum that is the teachers' own didactic interface. Because the teacher has to make a path for the student, each OER should instruct teachers how to adapt the OER for their own curricula. Incentives for using the OER, educational settings and difficulties when using them and the question of how dynamic (in contrast to static) an OER should be for the best uptake and reuse and for student involvement and collaborative learning is a point of interest for further exploration.

Any significant initiative aimed at changing teaching methods or introducing new learning resources should include training of trainers (Salmon, 2004); otherwise its outcomes are likely to be unsuccessful. This is also the experience from many higher education institutions and has, in most institutions, resulted in the launch of training programs when pedagogical changes are promoted.

Generally, the OER in this project have been developed for users with limited IT-literacy thus the possibility to add-on knowledge has been restricted to comments on the resources in a kind of a blog. Preliminary results show that users have only to a limited extent used the chance to add and comment on the OER, but a better understanding of the users who reuse and further develop the OER by adding knowledge to the OER is needed. It is still not clear how to foster community involvement in OER content design and to which degree the resources should be open in the light of the discussion on accuracy versus legitimacy.

Other studies have reported that language can be a serious problem in e-learning for industry (Beer et al., 2006). Thus, this project focused on developing resources rich in visual material and with limited text. However, there are reasons other than language that limits the uptake in different countries. These could be educational traditions and variable social and cultural contexts in different countries.

It is not only the context of the OER but also the quality of the content that is of high importance for good uptake by the user. In the field of animal welfare, an european strategy for teaching animal welfare is being considered. The idea is to set up a peer review system of OER so that quality checked OER could be awarded with resources for translation into the European languages.

Virtual communities use different tools to regulate the activities of participants and to manage the knowledge within the social group (Wenger, 1998). A moderator is normally needed for the activity in a virtual community but this can be time and resource consuming. In this

project it was intended or planned to test moderated on-line discussions for short periods on specific topics, but even with a moderator this was not successful. From the very beginning there was no password for the discussion forum which resulted in a huge amount of spam. This problem was solved by a spam filter based on reply with a quote.

The term wiki (from the Hawaiian wiki wiki meaning “fast”) gives reference to the speed with which content can be created with a wiki. A wiki enables web documents to be authored collectively; it uses a simple mark-up scheme; wiki content is not reviewed by any editor or coordinating body prior to its publication. These characteristics together make wikis a group learning environment for people not meeting face-to-face and it has been used in this community. At the time of writing this paper the wiki includes 175 terms. This is not a very impressive result and it is mainly used for sections on animal welfare. The evaluation of the model above is the step number 4 in the design science research cycle.

In this project, money from the EUwas used to customise UNESCO’s general open learning platform and pay a 10-year license fee for hosting the customised Open Training Platform. Each of the OER developed in the project were also uploaded to the UNESCO Open Training Platform (general) and this will guarantee accessibility for a longer period. When organisations pay the costs it is according to Downes (2007), a governmental model. He has explored how time-limited projects could handle the sustainability of repositories and OER, and describes nine different funding models currently in use of which no single model is predominant: 1) Endowment model, 2) membership model, 3) donations model, 4) conversion model, 5) contributor-pay model, 6) sponsorship model, 7) institutional model, 8) governmental model, and 9) partnerships and exchanges model.

The sustainable management solution and the methodology applied was useful within this context and will hopefully give feedback for further development and add value to the practice at a generic level. It is our belief that this methodology will identify design problems, and provide guidance in challenges related to OER such as professionalism of creators; collaboration and teamwork, unbiased and correct content, reuse and uptake, language and cultural diversity.

Future research in this area should focus more on quality of learning and less on efficiency. For global applications of OER, developers need to be knowledgeable about the contextual differences between cultures and countries, which should be taken into consideration when developing OER.

Wider issues to consider in the sharing of research results via OER should include the infrastructures that are required for training of teachers and trainers and the translation to other languages, some of which would require financial resources. A peer review process may be needed to provide trust and validation of the accuracy of the OER that would lead to the re-use of OER. The creation of an European peer review system of OER within the area of animal welfare is under consideration. With the articulation of the value added and implications for management and practice of this model for knowledge sharing within a user community, the design science research cycle is closed.

5.0 Summary

This article utilized design science research for the sharing of knowledge in the interface between university and society generated from a multi-disciplinary research project. This was achieved by the elaboration of a model for collaborative learning through the development of a virtual community and OER. It includes the first design cycle in an iterative process, embracing awareness of a problem, suggestion and development of a model and OER on specific research areas, evaluation and conclusion.

6.0 Conclusions

Following the systematic methodology described will provide scientists a model for knowledge sharing in the interface between university and society by the means of:

1. creating a pedagogical model suited for the community,
2. creating a model based on issues like empowerment, democracy and openness,
3. developing demand driven OER to share with the target audiences, and
4. considering quality and sustainability.

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