



UNESCO INTERNATIONAL COMMUNITY ON
OPEN EDUCATIONAL RESOURCES

Access to Open Educational Resources

Report of a UNESCO OER Community discussion

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DR BJÖERN HÄBLER

CENTRE FOR APPLIED RESEARCH IN EDUCATIONAL TECHNOLOGIES,
UNIVERSITY OF CAMBRIDGE, UK

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Table of Contents

Introduction	4
Part One. Issues	
1. The meaning of access	5
2. Classification of access issues	8
3. The SuperOER	21
Part Two. Solutions	25
4. Solutions criteria	26
5. Stories and solutions	32
6. Case studies	43
Part Three. Proposals	
7. Proposals	49
Conclusion and next steps	58

Introduction

UNESCO's international Community on Open Educational Resources has been active since 2005. It connects some 900 individuals in 109 countries to share information and discuss issues surrounding the production and use of Open Educational Resources – web-based materials offered freely and openly for use and reuse in teaching, learning and research.

The community periodically holds discussions on high-interest topics. During an earlier discussion (in June 2008), it was suggested that there should be a discussion devoted to access to OER. It should consider access very broadly, but have a focus on access issues specific to less resourced environments.

OER has the potential to extend access to knowledge worldwide, but there exist certain barriers to achieving this objective. Access is one potential barrier – and a crucial challenge. The community's initial interaction on the issue started with a consideration of access in a context of limited or no connectivity, although lack of electricity was soon identified as an even more basic barrier to access. There are many other potential barriers or constraints and it was decided that it would be useful to identify the full range of them, for there are emerging solutions or approaches that have the potential to mitigate the problems. Developers of OER would benefit from having these in mind; donors and other agencies may be able to contribute to addressing them.

The community thus returned to the issue of access in a new discussion, held in February and March 2009. The new discussion took up the issues first raised in June 2008, and explored access challenges and some of the potential solutions at hand. It was an opportunity to share creative responses from different situations. Broadly speaking, the discussion was conducted in three phases:

- Week 1: Identification and description of the main problems associated with access, and an initial development of a classification scheme.
- Week 2: Exploration of solutions and approaches, and their potential for the various types of barriers identified.
- Week 3: A concrete attempt to develop specific proposals.

The present document is the summary report of this discussion. It is divided into three parts, following the themes of the three weeks. Part One gives an overview of the various constraints that limit access to OER, while Part Two documents some tested or proposed solutions or approaches. The access challenges and solutions identified may justify further exploration and follow-up action – proposals for which can be found in Part Three. The form that this follow-up action takes will depend on the OER community.

Björn Haßler
July 2009

Part One. Issues

1. The meaning of access

The first week of the discussion concerned access issues. This chapter begins the discussion by asking ‘What is access?’ The following two chapters discuss access issues in detail and provide a classification, and then imagine a super-accessible OER, the ‘SuperOER’.

1.1 What is access?

The topic of the community discussion was **access to Open Educational Resources**. More fully, it was concerned with OER access **issues, barriers** and **solutions**. Broadly speaking, there is a resource (the OER itself) and somebody who wishes to access that resource (the user). Between them, potentially, there are barriers:

oer | user

In the first part of the discussion, the community examined the barriers that prevent successful access to OER. But before coming to that, it is helpful to examine briefly what we mean by the terms **Open Educational Resources, access** and **barrier**.

1.2 Open Educational Resources

The issue of what constitutes an Open Educational Resource was raised several times. For instance, it was highlighted that OER encompasses a broad range of resources, not just course-related materials:

I get the impression that many participants are thinking of ‘OER’ as on-line university courses. The definitions are generally much broader (e.g. Wikipedia) spanning individual images, text sections, video clips, modules, courses, entire curricula, FLOSS for education, etc.

Many of the definitions go beyond content, as demonstrated by the definition in Wikipedia, mentioned above:

Open educational resources include:

- *Learning content: full courses, course materials, content modules, learning objects, collections, and journals.*
- *Tools: software to support the creation, delivery, use and improvement of open learning content including searching and organization of content, content and learning management systems, content development tools, and on-line learning communities.*
- *Implementation resources: intellectual property licenses to promote open publishing of materials, design-principles, and localization of content.¹*

The William and Flora Hewlett Foundation definition concludes that OER:

¹ http://en.wikipedia.org/wiki/Open_educational_resources

... can include full courses, textbooks, streaming videos, exams, software, and any other materials or techniques supporting learning.²

The community focused on the issue of **access to resources**, rather than looking at the vast range of issues around **access to education**. However, in as much as resources are relevant to education, the discussion was relevant to access to education as well. More importantly, many of the access issues discussed are also directly relevant to open education, and may help to inform the discussion around **access to open education**.

Similarly, the discussion focused on **open** resources, although the barriers identified may prevent access to other resources, irrespective of whether they are closed or open, commercial or non-commercial. Why focus on barriers to open resources? Barriers to accessing open resources are particularly tragic, because these resources would otherwise be fully available. For this reason it makes sense to focus specifically on access to **Open** Educational Resources.

1.3 Access: who is accessing what resource?

Access is the means, place, or way by which a thing may be approached (Webster's Revised Unabridged Dictionary), the right to use or look at something (Cambridge Advanced Learner's Dictionary), the right or opportunity to use or benefit from something. Access involves a subject and an object: a person who accesses a resource.

It was agreed that the community should aim to make as few assumptions as possible as to who, what and where the personal and resources may be, or the location of the person accessing those resources. Importantly, in the first week of the discussion, the following issue was raised:

The barriers to access that have been mentioned so far, mostly focus on those barriers that prevent 'users' in developing countries from accessing materials that were produced in developed countries.

In the context of international development, there can be an implicit assumption that frames 'access' as a problem of consumers in the South that are unable to access materials produced in the North. However, access issues are more complex than this. It is equally justified to ask, what are the barriers that prevent users in developed countries from accessing, say, African OER?

Many of the barriers that are discussed in this report cut both ways. Indeed, it may be harder to access Southern materials than those produced in the North. There is no question that it would be very valuable to make Southern materials more easily available in the North, as well as to be able to share materials 'South to South'. This is not to say that access barriers are symmetric. There are, of course, additional and more significant barriers to access in the South, such as a lack of basic infrastructure or funding.

Indeed, it could be argued that general access discussions focus primarily on North-North access barriers, and that there is a tacit assumption that South-South access issues are broadly the same. But 'access', in a limited North-North way, fails to include some North-South issues, not to speak of South-North and South-South issues. It thereby misses many important questions. Unsurprisingly, given the profile of the community, North-South and South-South barriers, such as the digital divide and bandwidth, featured strongly in the discussion, while these are often only discussed in passing in the literature on access.

² <http://www.hewlett.org/oer>

1.4 Barriers to access – and to other activities

... many OER initiatives can be characterised as unidirectional broadcasters, which is not a bad thing per se, since it can have certain benefits. However, it is also important to look for alternative models of communication and the respective infrastructure. Do we look for radio receivers or do we look for telephones? Do we want consume OER or do we want to 'rip, mix and burn'? As educators, we cannot only teach reading, we also have to teach (and therefore do) writing.

Clearly, considering barriers to 'access' only does not constitute the whole picture, because barriers to access may also be barriers to other activities. Two quotes highlight this:

*[Barriers to access] is an important perspective, but it leaves out the barriers to *participation* of people and institutions from developing countries in the OER movement. By participation I mean, publishing local materials, rather than just translating and adapting imported ones. The question then becomes, what are the barriers that prevent 'users' in developed countries from accessing African OER?*

Coming back to the discussion, we have talked about 'barriers to access', that is to say: 'Go once from the North to the South' (or, as you raised, once from the South to North). But participation also means collaboration.

This can be approached in a different way, by asking whether providing access to content is as important ultimately as developing skills to develop content. Both, however, are necessary. Access to existing content is an important first step for developing new content – especially for developing new content *efficiently*. For instance, the UK Higher Education system draws on existing encyclopedias, rather than developing new encyclopedias themselves. Others should also be able to benefit in this way. But, ultimately, participation and collaboration may be far more important than simple one-way access. And many of the barriers to access identified during the discussion are also barriers to participation and collaboration.

Finally, if participation and collaboration are to take place, content needs to be relevant:

I'd like to introduce another 'barrier to access', which is 'access in terms of relevance'. It's really just another slant on some of the issues already discussed (around adaptation/remix/re-use), but I do think it's relevant. If there was more participation and collaboration, then OERs could be made more relevant.

In summary, while we sometimes pursue narrow notions of 'resources' as 'content', and 'access' as access to consuming this content, the broader issues need to be kept in mind.

2. Classification of access issues

2.1 The classification

The community began by surveying a broad range of access issues. The discussion was introduced as follows:

Although our initial interaction on the issue started with the consideration of limited or no connectivity, lack of electricity was identified as an even more basic barrier to access to OER. However, there are many other potential barriers or constraints and it will be useful to identify the range of them, for there are emerging solutions or approaches that would mitigate the problems. Developers of OER will benefit from having these in mind – donors and other agencies may be able to contribute to addressing them.

In response to this, a large range of access issues was put forward. Later in the week, it was proposed that we classify the issues, and a discussion on the classification followed. The report will start with the classification, so that the issues can be presented according to the classification.

Purpose of classification

The first step in any classification process is to identify and understand the purpose of the classification. What is the purpose in this case?

This question was raised early in the discussion. Why develop a classification? The following reasons were put forward:

- To help identify the issues that this community could address and those that should be left to others.
- To determine whether they are hard or easy to fix, i.e. ‘This issue has a clear, easy to implement, acceptable solution’ compared to ‘This issue doesn’t have a clear solution, or would take a very long time to fix’.
- To determine whether a particular issue is important, i.e. whether finding a solution is of high priority.
- To group issues that may have similar solutions.

For this report, the purpose of the classification is to group issues strategically, according to possible solutions, with a particular view to issues that could be addressed within the community (or other established OER communities, such as the OpenCourseWare Consortium (OCWC) or WikiEducator).

Classification of access issues

An important division of potential barriers is into ‘social’ and ‘technical’ barriers, as it informs the type of solution proposed:

I classify them into two: social barriers and technical barriers which are mostly due economical reasons. For social barriers, ... cultural obstacles ... fear of the unknown ... lack of awareness ... no institutional or national champion to drive the initiative. For technical barriers (which I think is mostly due to economic reasons), I consider the following ... infrastructure requirements / bandwidth ... lack of skills to use or innovate or to localize the contents.

Another commentator made the distinction between challenges due to the (technical) nature of the content and challenges due to the wider educational context:

This of course does not speak to the many challenges that have been cited in this discussion related to the nature of content (open formatting, granularity, bandwidth, use of 3rd party/proprietary content, etc.), institutional incentives and culture (tenure and promotion, lack of trust, etc.), understanding of OER, and skills needed to effectively modify and reuse content for local contexts, but it does at least point us to the potential importance of focused and thoughtful faculty development, mindful learning design and content creation (tagging, consistent use of open licences, ease of accommodation for disabilities and language, etc.).

These broad classifications of potential barriers can be subdivided according to different types of access:

- Social, awareness, policy, attitude, cultural:
 - Access in terms of awareness (lack of awareness as a barrier to OER)
 - Access in terms of local policy/attitude (do attitudes or policies pose barriers to using OER?)
 - Access in terms of language (how well does the user understand/speak the language of the OER?)
 - Access in terms of relevance (is the OER relevant to the user?)
- Legal:
 - Access in terms of licensing (is the licensing suitable?)
- Technical: provision of OER:
 - Access in terms of file formats (are the file formats accessible?)
 - Access in terms of disability (does the OER meet WAI accessibility criteria?)
- Technical: receiving OER:
 - Access in terms of infrastructure (lack of power/computers makes access hard)
 - Access in terms of internet connectivity/bandwidth (slow connections pose a barrier to access)
 - Access in terms of discovery (if the OER is hidden, not searchable, not indexed, it will be hard to find)
 - Access in terms of ability and skills (does the end user have the right skills to access the OER?)

An important secondary classification, in order to determine importance, is to ask which are barriers to both North-South and South-North sharing, and which barriers also apply to participation and collaboration. This was articulated by one participant as the distinction between access to content and access to production facilities (and the ability to adapt and re-use content):

I ... want to paraphrase them as the difference between the access to products (OER, OCW) and the access to the means of production (e.g. production and publication facilities, editorial support units, etc.). Means of production go far beyond mere internet connection and bandwidth. With respect to accessibility to the means of production, the infrastructure e.g. of institutional repositories differs strongly from infrastructure e.g. for WikiEducator. One limits access to facilities for members of the institution only, while the other provides equal access to more participants (if they have [an] internet connection). However, sometimes it can be necessary to restrict access to some elements of production facilities (e.g. to secure the integrity/stability of a product).

Finally, it should be noted that, while this classification provides a useful conceptual framework for this report, it is not the only possible system or measure for accessibility.

2.2 Overarching access issues

Having presented a broad classification for the issues, the report now moves to the issues themselves. As discussed in the first chapter, there are narrow and broad views one can take regarding the meaning of ‘barriers to OER access’. Initially, the community took a broad view and identified overarching issues.

Overarching issues

First, if content is not made available as **open** content, it cannot be used freely:

I think that making the content available (OPEN) to all is the first barrier to use.

Another overarching issue is that of available funding:

One key obstacle to African participation in OER has been the lack of funding. The most successful international OER projects have all received substantive grants, often in the millions of US\$, to create the infrastructure and capacity to publish educational resources openly. It is not possible for African universities, given the lack of capacity and resources mentioned by others, to fully participate in this movement without financial support.

Of course this lack of funding is the root cause of many of the other issues discussed:

I ... wanted to make sure that we don't ignore the elephant that is standing in the corner: lack of capacity and bandwidth (as examples) are also related to lack of funding to pay for capacity and bandwidth.

This brings us to infrastructural issues, particularly ‘gross’ infrastructural issues, such as lack of information and communication equipment, lack of electricity – even lack of peace. All of these are barriers to accessing education in general, as well as barriers to accessing and developing OER:

Infrastructure: *Most of Africa suffers from poor infrastructure due to lack of physical facilities, electricity and transportation. To this end, a respondent from Nigeria stated the following, "in my university, there are infrastructural limitations; students often have to sit on windows or squat by doors to receive lectures. Furthermore, our public power supply is epileptic and there seems to be no solution for this at the moment". There are also places where there are no roads to facilitate communication and telephones are a luxury to many. In addition, lack of ICT policies within governments make it difficult to supply bandwidth and connectivity. These infrastructural barriers therefore militate against advancements in accessing digital learning resources.³*

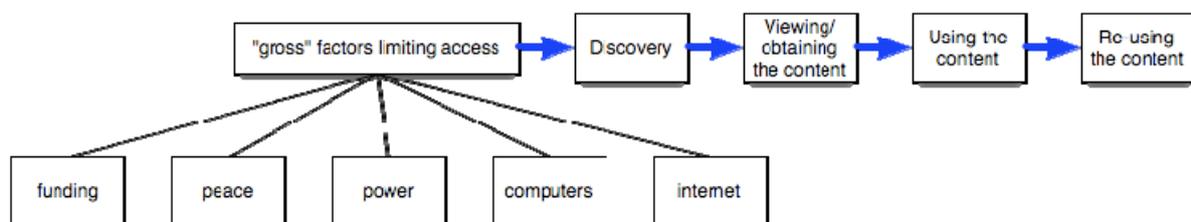


Figure 1. The content access chain (modelled on the bandwidth management chain⁴)

³ Rasugu, P. 2006. Laying the foundations for Open Educational Resources in higher education in Africa: a survey on perceptions of African academics. Project report submitted to the University of Southern Queensland, Australia as the final assignment for a Masters degree.

⁴ See <http://www.apivate.org/> for more on the bandwidth management chain.

Lack of access to computers or to a reliable power supply is one set of barriers linked to poverty. Participants also highlighted the following barriers to OER as outcomes of poverty:

- distance from local telecentres or Internet cafes (in areas where personal computer purchase and an Internet subscription are beyond the means of most people);
- time available (where pay is low, people may work two or three full-time jobs to earn sufficient money to live. Time spent creating or accessing OER may be a luxury that they cannot afford);
- opposition of family or friends (this was thought to affect women in particular, who may be told that they should tend to cooking, cleaning and caring for their families when not out at work).

Overarching issues: the case of the Zimbabwe Universities ICT Consortium

At what level does access need to be addressed? To what extent are individuals empowered to make a change? In the Zimbabwean Universities ICT Consortium university ICT heads came together to chart a unified path for the servicing of the ICT needs of universities, other tertiary institutions, schools and the community.

The consortium met and produced a detailed document as a blueprint. It considered the individual university environments and the overall Zimbabwean environment, the needs, expectations and the roles universities could play in affording access to knowledge and knowledge creation. The goal was to consider the obstacles of the varying digital divides and to find ways of overcoming them.

The project proposal was sent to vice chancellors and the ministry responsible for higher education. It contained the network design, the equipment, the local university-developed ERP, required skills, skills retention and the budget. It also assigned responsibilities to each university in the consortium.

The main issues relating to access and connectivity were:

- Internet access – if the government were to waive its licensing requirement, there would be enough resources to design and build an academic backbone network.
- Bandwidth – collectively the overall budgets were enough to obtain good bandwidth provision, though individually institutions were getting mediocre service.
- Technical constraints – different universities were facing different issues, but collectively there was enough skill available.
- Access to information was highlighted as a challenge due to a host of reasons.
- Human resource development.

Universities have the potential to be key drivers in local content production and dissemination. Another important element was gender imbalance. ICT cannot be a men-only club: gender issues need to be considered as part of all initiatives.

Unfortunately the proposal document did not have an impact, and it is important to reflect on why this is the case. Key questions one might ask include:

- Why is the digital/access divide still widening when academic ICT leaders are willing to work together?
- Why is it that finance was not highlighted as the primary issue when heads of ICT met, but became an issue only when it came to remuneration and skills retention?
- Why is it that the requests and views of ICT professionals were not acted on?

Primary vs. secondary barriers

Focusing more narrowly on OER, there are still some issues that are more important than others – some issues are ‘primary’ while others are ‘secondary’. For instance, if a resource does not have a suitable open license it cannot be used; other issues preventing access will not matter. Similarly, localization is important, but if a user cannot access the content in the first place, then having the

ability (or skill) to adapt content to the local context is irrelevant. Someone with no books at all might be quite happy to get hold of a book, even if it is not perfectly adapted to his or her local context.

Where (either in developing countries or in ... North American countries) the cost of educational materials such as textbooks or videos blocks access to a knowledge base, having access is a more primary issue than the ability to localize.

Primary issues may be particularly important in blocking participation and collaboration. However, it should be remembered that even primary issues, such as lack of bandwidth, can be mitigated by cleverly designing discovery and resource access.

Finally, to return briefly to the last quote, what does ‘having access’ really mean? Access is not a clear-cut issue. It is not a question of either having access or not having it at all. There are degrees – shades – of accessibility in between. Accessibility has different dimensions; dimensions that this report will visit in turn.

2.3 Access issues to do with awareness, policy, attitude, culture

The discussion of individual issues that follows uses the classification of different types of access barriers presented in the previous section.

Access in terms of awareness

Case study: lack of awareness and the lack of a critical mass of experts

A head of ICT in an institution with a severe shortage of learning materials, observed that students and lecturers were not aware of the availability of open resources. However, highlighting the existence of useful courseware and other OER did not lead to change. The key issues preventing access remained a general lack of awareness about the existence of OER. The non-existence of a critical mass of OER experts prevented the training of teaching staff and a lack of skills to find, adapt, use and create OER.

As the story above illustrates, there is not enough awareness of OER. Individuals may not be aware of the existence of OER, the range of OER available – even the concept of OER itself.

Many people ignore that they have the opportunity to improve their knowledge freely through OER. They look very astonished when you ask them what they know about OER. ... I would like you to take ignorance as a serious barrier to OER.

Access in terms of attitude

Resistance to using resources developed by others, a fear of openness, and a fear of the new or unknown can be barriers to many. Lack of support in the form of an institutional or national champion can be an additional barrier, especially in the face of resistance and negative attitudes. These issues were articulated very widely, by participants from many different regions and cultures.

Fear of losing financial gain: in recent decades, there has been (as there is in most developed countries) fierce competition for the decreasing education dollar. In some states, some educational areas were supposed to finance themselves from the money they made – in most cases, delusional. So there is extreme unwillingness to share anything that might be financially rewarding – at least on the part of managers.

Fear of not being 'good enough': if you share what you have done, your contribution may not be worthwhile; you may be exposed as being less experienced and/or less 'educationally sound' than other contributors. ... I believe it is a real disincentive where competition between providers means they are all spruiking [promoting] themselves as being 'world class'...

Access in terms of policy

An important policy issue is that sites that enable sharing of content (such as YouTube, which has a large amount of educational content) may be banned or censored in some institutions and countries. For instance, because of its appeal to younger people, YouTube may be considered a good medium for delivering content aimed at students. While this may be true, some institutions block access to YouTube, for fear of distracting or inappropriate content. Policy of course does not just concern particular sites. It is also relevant for a computer network as a whole and, in particular, bandwidth use.⁵

Policy can have an enabling function directly related to OER, for instance by setting policies to encourage OER use, or to publish learning materials as Open Educational Resources or research outputs in Open Access journals or repositories.

Access in terms of language and culture

Language is a barrier to accessing OER. One participant had this to say about working in a university in a non English-speaking country:

English Language is a barrier as well. 90% people can not read, write or speak English.

Lack of OER in local languages may be a particular barrier for speakers of some minority languages.

Of course, understanding a language is about more than just being able to translate words and phrases:

I would add one additional barrier that is a variant on language: understanding and feeling comfortable with the mental models, terminology, idioms and contextual examples of the OER. This could be referred to as a cultural barrier.

This leads to the related issue of localization:

... it struck me again how the learning objects are tied to the local culture. Illustrative examples and exercises in topics such as math and science are based on an assumption that the learner is familiar with our subway system, our popular culture, our local food, our winter based sports, and especially our idioms, metaphors and similes. Translation is going to take far more than translating the words and sentences. The learning objects will need to be localized as well.

Finally, the distinction should be made between the language of the resource itself and the lack of metadata in a particular language (which reduces searchability).

2.4 Legal issues and access in terms of licensing

In many ways open licensing has become synonymous with Open Educational Resources. Today's users are more likely to be suspicious of something that calls itself 'open' but is all rights reserved

⁵ A list of characteristics of good bandwidth management policy can be found in the open book, *How to accelerate your internet* (<http://wiki.bwmo.net/moin/English/Chapter2>).

2.5 Technical access issues: provision of OER

The discussion of access issues now turns to ‘technical’ barriers to access. The solutions to the barriers presented in this section are principally on the provider rather than the user side. That said, the distinction between provider and user issues is overly simplistic. Many ‘provider issues’ can be mitigated on the user side and vice versa.

Access in terms of file formats

Some formats are more accessible than others. The following statement was made with regard to adaptation/remixing, but it applies equally well to simply using the content in the first place:

... more of the material [should] be made ‘easily remixable’. This is not only a matter of licenses, but of file formats, etc. Already, people who translate OERs into Chinese are complaining about receiving PDFs with graphs and illustrations – if they had access to the original PPTs, they could much more easily change the language, or reuse parts. In this regard, sites like WikiEducator, Connexions and Open University, that presents the material in HTML, XML, Wiki markup or other ‘structured’ ways, are preferable – but of course, this must be weighed against the desire to make a lot of material available quickly.

Ensuring greater access through the provision of resources in easily accessible file formats is the responsibility of the provider. They have access to the raw materials and can make additional formats available. It is harder for the user – particularly the non-specialist user – to mitigate this.

Access in terms of disability

Physical, emotional and learning difficulties provide a series of complex challenges in [the] developed and developing world. The technology can overcome barriers (speaking web pages, Braille printers and so on). This requires good design and thought. In the UK Techdis <http://www.techdis.ac.uk> has done some really useful work.

Disability access is a well-recognised issue, at least in the global North. A number of governments have developed policies relating to disability access, while guidelines, such as those of the Web Accessibility Initiative (WAI⁹), are well established. In many ways it would be unacceptable for a public institution to publish a website that did not meet WAI standards. In developing countries, however, where web penetration is so much lower overall, there may be less awareness of disability access issues.

Access in terms of discovery

If it is hard to search for and find resources, then it follows that it will be hard to access them. Resources need to have good metadata and need to be indexable. However, even if OER has good metadata, differences in curricula can make it hard to search across resources from different education systems:

... the differences in curriculum making it difficult to get the precise information you need ...

⁸ See, for example, tools to support the development of libre knowledge resources (http://www.wikieducator.org/Libre_Knowledge_Resources_Development_Cycle) or the OER life cycle (http://www.wikieducator.org/OER_Handbook/educator/OER_Lifecycle). For related discussion, see the copyright and open content licensing section of the UNESCO OER Toolkit (http://oerwiki.iiep-unesco.org/index.php?title=UNESCO_OER_Toolkit/Copyright_and_Open_Content_Licensing).

⁹ <http://www.w3.org/WAI/>

This is a provider-side issue, although it also speaks to the need for standards and general OER infrastructure.

Access in terms of ability and skills (available to the end user)

There needs to be a match between the skills required to access an OER, and the skills that the user has at their disposal at a particular moment in time (i.e. ‘Is the content in a format that users are likely to be familiar with, or one that they will find hard to use?’). This is relevant for use and reuse of content:

A lack of local skills and knowledge for adapting and revising OERs is a significant barrier. Without these skills, OER cannot be localized and made appropriate for use by the local community.

Another quote, from a report by Philise Rasugu, illustrates this further:

***Computer Literacy:** Majority of students and teachers are not computer literate and those who have the opportunity to use OERs have very low computer literacy levels. One respondent stated that "unfortunately the majority of students are not computer literate, the curriculum is country based and there is very little country-based information available for the students. Mostly one gets information on how the developed countries are operating since our country is currently recovering from civil war." And apparently, they live in remote rural areas where computers, like in many remote parts of Africa, are unheard of.¹⁰*

This is a user-side issue, although providers can take care to make their resources as easy-to-use as possible.

Access in terms of design information provided with the resources

Of course the ‘ability and skills’ the end user needs are (to some extent) mitigated by the information provided with the resource. That is to say, if only the (bare) resource is made available, it can be hard for a user to know what to do with it – where, when and how to use it. If additional information is shared, such as the learning design or production notes, then the resource will be easier to use. Moreover, this additional information offers a blueprint for creating similar resources.

We have found a lot of interest in using OER as a route to sharing the learning design (or should that be teaching design?) of how to structure online resources. Most materials do not explain how they are meant to work so someone who wants to reuse or change has to first be a learner. If there were an overview or consistent way to show designs then more reuse may take place.

2.6 Technical issues: reception of OER

Access issues in terms of infrastructure

Lack of access due to poor infrastructure was flagged early in the discussion as an overarching concern. Inadequate infrastructure is a particularly severe problem in sub-Saharan Africa:

... upon further probing on how often they used/accessed OERs, a significant 55.8% indicated that they had occasionally or never used OERs, this was largely attributed

¹⁰ Rasugu, P. 2006. Laying the foundations for Open Educational Resources in higher education in Africa: a survey on perceptions of African academics.

*to the technological or/and infrastructural challenges that African academics face. And thus, it can be concluded that OERs are largely underutilized in Africa.*¹¹

Participants touched briefly on non-digital distribution of OER for regions and groups without access to computers or Internet access. Methods include distribution through paper, television or radio. They are important where digital access is not available, although even they can be difficult to access for some:

Traditional resources (e.g. paper, traditional books etc.) are very expensive as compared to digital media (ebooks, audio and video material etc.).

Participants also stressed that infrastructure is not a black and white issue; it is not a question of ‘no access’ vs. ‘full access’:

[Poverty] ... is not the same as the technical access issues. In most developing countries, access is extremely expensive, and educators mostly have to use computers on their own time (and budget). In consequence, they have to make radical choices about how they use the internet: browsing and experimentation are often not options.

More often than not, the problem is not solely that there is no infrastructure. Instead, it is a lack of infrastructure combined with a lack of appropriate OER for resource-poor environments. With good bandwidth, a user can wait for a large resource to load or download. However, with poor infrastructure that same resource will be inaccessible. It is important to note that there are two possible solutions: the OER community can call for improvements to the infrastructure; but it can also call on producers to reduce the size of resources or to make alternative formats available. So, although this is more a user-side issue, it can be mitigated in part by the provider.

Access in terms of internet connectivity and bandwidth

Access in terms of internet connectivity and bandwidth featured strongly in the discussion. The main issues are that:

- there is little bandwidth;
- where bandwidth is available, it is expensive;
- bandwidth is often poorly managed.

Case study: the challenge of access in Eritrea

In promoting computer education in Eritrean schools and colleges, the contributor was faced with the challenges of lack of electricity, connectivity, teacher training, or capacity for maintaining devices. As an Assistant Professor of Education in Eritrea, the contributor's experience was to sit for hours in front of computers in internet cafes waiting for websites to open. While cities, such as Asmara, offered some access to internet, small towns and remote areas remained cut off from the world wide web in spite of there being computers in many locations. These challenges, affecting the equality of connectivity and access, continue to divide our world. We need to find more viable and sustainable solutions to develop access to educational resources.

In the context of OER, these issues are particularly tragic because, as this participant from Rwanda pointed out, these resources have been made freely available to be used – in some cases with little need for further adaptation or translation:

¹¹ Ibid.

One of the barriers of using OERs in central and southern African universities is the issue of BANDWIDTH. They must pay very expensive for that and they have no money or/and the national authorities do not understand enough the importance and benefits of OERs for their education and do not consider them as a national priority. The good thing is that these universities use European languages and don't need translation in their native languages. OERs can just be adapted to the local environment without translating in African languages.

The following story from Aptivate,¹² a UK-based NGO that works on ICTs and development in several African countries, highlights an additional issue for low bandwidth environments.

Case study: the need for bandwidth management

An often overlooked point in institutional Internet accessibility is bandwidth management. It is true, as a discussion contribution from Rwanda reminded us, that bandwidth is particularly expensive in Africa. African universities typically pay thousands of dollars a month for the same capacity connection as a US user might pay \$20 for. But whatever size the connection (however much bandwidth there is) it needs to be well managed. An unmanaged network of computers connected to the Internet will quickly become clogged with viruses, spam, peer-to-peer traffic and other useless traffic. This means there is no capacity left to access useful things like OER.

A few years ago, Aptivate were working in Ghana to improve the usability of a free journal access portal. In one research institution they realised that the main reason their network was performing so poorly was that it was flooded with viruses. Working with their staff to put tools in place, we were able to improve the speed of the connection by a factor of 15.

A 2006 African Tertiary Institution Survey found that almost 2/3 of universities practice little or no management of their connections. Universities have a hard time retaining skilled staff; there has been a lack of awareness among management and funders as to the need and means to build up good network administration and policy, less training than required and, to some extent, tools are expensive and/or very difficult to use.

Managing bandwidth well helps to make internet connections more effective for academic purposes, and enables OER to be accessed more effectively.

This is an important issue, perhaps particularly because it receives far less attention. Connectivity is not just a question of the absolute bandwidth available, but also of how that bandwidth is managed.

This comment, from a participant working in Mexico, makes a similar point:

... we often restrict ourselves to think only about the 'physical bandwidth' to a certain location, and neglect to think about all the other factors that can impede transfer speed. I have similar experiences from a computer lab in a village in Mexico – I have never seen so many and [such] fierce viruses in my life, busy spamming thousands of emails across the world, on a tenuous and expensive satellite link.

The following quote makes an additional point:

The flip side of the bandwidth problem is that OER resources are not often designed to work well over low bandwidth connections. Users sometimes give up after 'bandwidth heavy' sites (lots of images, flash and less than critical scripting) keep crashing or are prohibitively slow to load.

¹² <http://www.aptivate.org/>

Bandwidth is thus *not* just a user-side issue. Lack of access due to lack of (affordable) bandwidth is compounded by providers, who fail to make resources available in low bandwidth friendly formats:

If OER projects want to be helpful for developing countries ... there is a crucial need to develop resources accessible in low bandwidth ... and by low ... I mean almost dial-up! Also, the emergence of the use of cellphones can contribute ... but this is the reality of just a handful of countries. I hope OER developers keep this in mind ...

This view also received support from a participant in Brazil:

I would like to enthusiastically embrace the idea of working harder on bandwidth management. The Aptivate guidelines are very useful and edifying,¹³ and more effort should go into making resources usable in low bandwidth environments (which is after all the target audience of this group).

Indeed, the issue of bandwidth drew comment from participants from all over the globe, eager to share their stories:

Working in ICT at a developing world university/academic institution comes with many challenges restricting access. It is always difficult to set up the right infrastructure and design the right and the best bandwidth utilisation plan. (Zimbabwe)

Whenever I send the web sites of free available e-resources to our students, teachers and researchers they complain that they could not download the materials because of slow internet or some times non accessibility. (Pakistan)

Last time we participated on the identification of OER materials but what we faced was the trouble of having access to internet connectivity. Sometime back some schools had internet connectivity with the local ISP but what we discovered was that to maintain this connectivity was an issue and it became extremely expensive and at the moment some schools cannot even afford to continue to have this connectivity. Some have been disconnected. ... If by chance you go to an internet cafe here in Zambia, the time you log in and the time you start accessing the internet you will discover that you may spend a lot of money because some of the internet cafes connectivity is very slow. No wonder people can't afford to utilise the resources from the internet. (Zambia)

There are institutions in developing nations which cannot afford dedicated bandwidth and have to share bandwidth to reduce costs; there are those that have to contract out their bandwidth and even website management. In situations like these, such institutions have no control over the bandwidth and thus cannot control the rate at which viruses attack not only their sites but through the sites their systems. (Nigeria)

... not to forget the issue of the bandwidth, which is much exaggerated by the cost. It is quite often to loose connection in a University because of the high bill to be paid. (Sudan)

With reference to bandwidth, this is an ongoing issue for teaches in my project. They cannot download videos, or watch them, because the CTC where they go to use the Internet has measured service via satellite, and once the bytes are used in a month, service is shut down until the bill is paid. This is a major impediment and also affects

¹³ Aptivate's Web design guidelines for low bandwidth environments can be accessed at <http://www.aptivate.org/webguidelines/Home.html>.

regular attendance at the CTC because freedom of usage and availability is placed in doubt. (Guatemala)

Finally, as US-based participant reminded the group that low bandwidth can also be an access barrier in remote rural areas in developed countries. The ‘digital divide’ generally brings to mind the gap between developed and developing countries. But it may also evoke the gap between urban and rural areas within a country:

In some informal research I did on bandwidth management in developing countries because there was an interest at my institution in establishing elearning classes with African institutions, I read a number of documents on difficulties in access due to low bandwidth. I was struck by the number of times it was mentioned that viruses, spam, etc. took over the desktop because there weren't any technically trained administrators on board who knew how to repair and maintain the system. Another problem was that well-trained network administrators quickly left for better jobs. Funders did not seem to include ongoing training of network support in their workshops. Where funding is concerned, the result is that the investment will then look wasted, for reasons that could have been avoided. Interestingly, in the US, these same issues can affect colleges and internet cafes (however few) in rural areas. In my experience, the dichotomy between ‘developed’ and ‘developing’ sometimes ignores similar problems in access and technology usage that can afflict both.

To summarise the argument:

- There is low bandwidth in the global South (often slower than dial-up, around 20kb/s).
- Bandwidth is much more expensive in the South than in the North.
- Institutional bandwidth provision is not optimised. Many improvements could be made by improving local networks.
- Resources are not provided in low bandwidth friendly formats. Often the websites that point to resources are not low bandwidth friendly.
- Internet access may not be desktop-based, but may be via mobile phone.
- The issue affects large parts of the global South, as well as some rural areas of the global North.

It is worth noting that while improvements in bandwidth are under way, it is likely to take a substantial time before the South catches up, particularly in rural areas (referred to as ‘last-mile delivery’).

In conclusion, the discussion highlights that bandwidth constraints are a primary barrier to OER access. Other factors are undoubtedly important but, at the moment, a large proportion of potential creators and users of OER are struggling with low bandwidth. One reason that OER providers make resources available is to support international development goals. Yet many resources do not meet low bandwidth accessibility criteria. While there is growing awareness of low bandwidth issues, this awareness is yet to penetrate the OER community.

3. The SuperOER

Having discussed various barriers to access, participants were asked to consider the idea of a ‘super-accessible’ OER and to describe its qualities. What would such an OER look like in terms of accessibility? The ideas did not have to be realistic. Discussion participants were invited to ask ‘What if?’ and put forward ambitious ideas. The superOER idea was a helpful lead into the more structured discussion of solutions presented in the second part of this report.

As a first summary, it was suggested that a superOER would be something that:

- *is easily downloadable*
- *I can use offline*
- *is truly platform independent*
- *I can use on all the available mobile devices*
- *is relevant*
- *can be easily modified.*

The super-accessible OER is **incentivised**:

Poverty has been raised as an important issue, so my super-accessible OER has a financial incentive: Every time you access it, you get \$1.

The super-accessible OER is **movable**:

It's a resource that I can move between a blog, a wiki, a static web-page at the click of a button. For example, someone published a short course on public health management as a set of pages in a Mediawiki. I import it into my Wordpress blog and add pages to it, then re-publish it into my university's learning management system. Finally, I burn it onto a CD so that I can send it to some of our distance education students, who lack access to the Internet. All of this, just by clicking export and import.

Building on that, the super-accessible OER is **portable, transferable and customisable**:

... particularly the issues of portability (downloadable, offline use), transferability (easy import/export), and customizability within a standards-based framework.

The super-accessible OER is **printable**:

... it should be easy to move to print media and produce a well formatted printout as well.

The super-accessible OER is **fast**:

With a poor connection at school and no (or very few) computers, not even the most devoted and engaged teacher pay the minutes in a lan house to wait until the screen unfreezes or spend hours to convert files from one platform to another.

The super-accessible OER is **bandwidth aware**:

When accessing or downloading the super-accessible OER, it knows what bandwidth is available, and transforms itself according to available bandwidth.

The ideal OER would also help users and institutions download appropriate resources and manage bandwidth and caching.

The super-accessible OER is **easy to find**:

Accessibility means also finding the resource. Having it both categorized (taxonomy) and tagged (folksonomy) and being able to retrieve them through search from interconnected platforms (instead of visiting each one or having just one) would be a bonus.

The super-accessible OER is **machine readable**:

The super-accessible OER is not just discoverable and sharable by humans, but is also automatically discoverable and sharable ('discoverable by machines'). In other words, the super-accessible OER announces itself (in a 'machine-readable' way) and makes itself available to OER platforms and portals, enabling discovery, collaborative filtering, recommendations.

If it is machine readable the super-accessible OER can be **cached and mirrored automatically**. It is fast, discoverable, and can be easily filed within local collections of resources:

Accessibility for me means, not wasting time, and for that, I would love some good search engine for OERs, specially scientific ones, that understands formulas and text and allows me to search for ideas that are being taught and developed and are related to what I am learning or investigating, maybe by semantic web technologies. Utopian accessibility would also come with one user interface for all objects available, everything downloadable with one click, and everything automatically classified in my hard drive once downloaded.

I was thinking that one thing that would be really nice is if all OER platforms and OERs could talk to each other and interact through tags and categories/plugins. Wordpress users for instance have access to all posts and have suggestions on what to read that might relate to the subject. If one could invent some sort of OER plugin or widget that any of us could install on OS platforms (+ blogs and wikis) and activate it with a special tag every time we create material and decide to make it OER, then this resource would stay with us and also be automatically sent to more centralized platforms.

The super-accessible OER can **transform itself into appropriate formats**:

The ideal OER platform would allow the contributor to submit media in as few formats as possible and would then automate the transcoding into a variety of forms for various users.

The super-accessible OER is **easy to adapt**:

... one should create and produce rather than be told about. It's not the static OER per se (result/artefact) but the process of looking for it, adapting it, remixing with other materials and creating a new one that counts and 'developing' countries should be developing and not just using developed materials. ... Frozen structures format our way of thinking/seeing thing, limiting creativity and innovation. ... People learn by

seeing what others are doing and adapting this to their taste/cultural characteristics and needs (stereotyping: tropical countries favour colours, while Northern countries favour a minimalist and cool design).

The super-accessible OER has **clear terms of use**:

If the metadata of the OER provides the terms and conditions of the license of use (legal terms) will be a plus for the final user.

Does not automatically assume existing Intellectual Property concepts are viable for this distribution, because this distribution will provide fair remuneration for the creators of work on the OER space. CC license support for each object, LOM and Dublin Core metadata, print view, 'send to wiki' capability, WCAG and XHTML compliance, and IMS/.zip file import/export, ... new IMS Common Cartridge and Wordpress import/export functionality, ... publishing to static HTML ... mobile device support ...

The super-accessible OER is accessible to those with disabilities:

We need to remember what are needs of disabled people. WAI http://en.wikipedia.org/wiki/Web_Accessibility_Initiative set of guidelines version 2.0 recently proposed: <http://www.w3.org/TR/WCAG20/> definitely is important to understand accessibility issues.

The super-accessible OER is **easy to use**:

Fluid/clean design and navigation on platforms were mentioned as well so people do not spend too much time, overwhelmed by the amount of text or sidetracked by links that do not lead them to their objective.

The super-accessible OER is also **easy to learn from**:

... the OER should be responsive to the learner's needs and preferences. This means that characteristics such as the following would transform to match the learner's individual needs:

- *the presentation (e.g., large print, high contrast, small screen version, low bandwidth version, etc.)*
- *the organization and navigation structure (e.g., serial presentation, hierarchical, list of links, etc.)*
- *augmentative material and tools (grammar checker, captioning, description, background material, language supports)*
- *localization*
- *method of control (without mouse or pointer, large buttons and input fields)*
- *learning approach (external vs. internal rewards, etc.)*

This has been implemented in a number of learning object repositories and is supported by the ISO 24751 'AccessForAll' standard (e.g., <http://www.atutor.ca/atutor/content.php>). Part of this is dependent on a collection of equivalent content (best created by pooling resources from many sources with informative metadata), authoring tools that support the creation of transformable OERs and learning management systems that match the needs of the learner with the best available OER or OER configuration.

Finally, a participant proposed that the superOER should have the following characteristic:

[The super-OER is recognised by the] United Nations ... as a part of the method for transmitting knowledge.

And linked to this:

The super-OER complies with the Convention for Human Rights.

Part Two. Solutions

Having spent the first week identifying and classifying access issues, the second week of the discussion was concerned with sharing ideas about possible solutions. As ever, participants were keen to share their experiences.

The discussion can be separated into a number of threads, regarding:

- improving access to OER by providing training to potential content developers and users;
- technical issues around provision of appropriate ICT resources, such as:
 - appropriate hardware, including computers (necessary for accessing OER digitally);
 - appropriate bandwidth and bandwidth management;
- wiki hosting and wiki content transformation (for instance for WikiEducator or Wikipedia);
- ‘hybrid’ or ‘mixed-mode’ information delivery (online/offline, desktop/handheld devices).

The record of the solutions discussion is distributed across the following chapters of this report:

- ‘Solutions criteria’, covering best practice recommendations for improving the accessibility of OER;
- Stories that showcase innovative approaches to increasing access to knowledge and learning;
- Case studies, in which participants presented more extensive analyses of some initiatives to extend access to knowledge and learning.

The original stories and case studies, as shared by participants, are available on the wiki.¹⁴

¹⁴ <http://oerwiki.iiep-unesco.org/index.php?title=Access2OER/Solutions>

4. Solutions criteria

Early in the discussion participants made a number of general recommendations regarding criteria that potential access solutions should satisfy, or that embody best practice. The recommendations build on the idea of a super-accessible OER, as discussed during the first week.

4.1 The importance of good design

Access requirements should be built into delivery mechanisms, etc. right from the start:

We need to make sure that the educational delivery mechanisms and the authoring tools for creating the content or curriculum have the necessary supports for integrated accessible design. Special, separate accommodations for language or accessibility needs are not sustainable and are vulnerable to marginalization when other priorities arise. It is very difficult to retrofit delivery systems or content for accessibility. The precarious values of accessibility and internationalization must be considered from the start and integrated into the general approach.

One concern is the separation of logically separate elements, such as form and presentation:

Digital resources and tools are adaptable or plastic, transformable and much more capable of handling modularization. You create a core system that is extensible and amenable to reconfiguration. This means concrete and simple things like keeping the text intended for the user separate from the code so that it can be translated without needing to touch the code in an application, or keeping the formatting separate from the content and structure in curriculum so you can change the presentation for different devices or someone who is visually impaired. You have to do this from the start or you will be starting over or sticking on strange untenable appendages to address the barriers you didn't think of. Inclusive design need not look any different from any other design, it is just more flexible and therefore also more sustainable and easier to update.

There are a number of projects that give a powerful practical demonstration of what can be achieved with good design and a little thought:

- The WAI authoring tool guidelines¹⁵ provide a good example of how to support web content authors to create accessible content, even if they are not knowledgeable – or particularly motivated – about accessibility.
- The work on the popular Dojo¹⁶ and JQuery¹⁷ software development toolkits shows how accessibility supports can be incorporated in the building blocks of software applications and educational delivery systems.
- The translation packs of the ATutor Learning Management System,¹⁸ which is translated by volunteers around the world into more than 36 languages a few weeks after each release, show how integrated support can help us achieve a challenging goal.
- The international Fluid Project¹⁹ demonstrates that solving accessibility and diversity problems can benefit all users.

¹⁵ <http://www.w3.org/WAI/intro/atag.php>

¹⁶ <http://dojotoolkit.org/>

¹⁷ <http://ui.jquery.com/>

¹⁸ <http://www.atutor.ca/atutor/translate/index.php>

- Large international collaborations like the Raising the Floor initiative²⁰ or the AEGIS project²¹, show how multi-sector collaborations can create an integrated approach to this complex challenge.
- In the UK, Techdis²² has done some useful work to show that technology can overcome barriers (speaking web pages, Braille printers, and so on).

4.2 The need for flexible formats

It is important that OER uses flexible formats that can be transformed easily:

The best OER example of a small technical innovation with potential impact is the WikiEducator and Wikimedia Foundation collaboration to produce customised print collections from a collection of wiki pages. This makes it possible for learners to access the largest free knowledge base in the world without the need for connectivity! (We have some examples here: http://www.wikieducator.org/WikiPublishing#How_It_Works). This innovation has established the foundations for the development of an open document format export using the same technology. In effect this means that educators around the world will be able to download OER collections and work offline adapting and modifying content using a free software word processor!

4.3 The need for good metadata and other solutions to help users find OER

Metadata standards should be established to make it easier to find, index and search resources:

One issue that we discover last year working with the project Knowledge Hub in Mexico (see http://oerwiki.iiep-unesco.org/index.php?title=OER_stories/Knowledge_Hub) is that many projects that provide open courses (CourseWare), and resources (OER) do not follow a consensus standard to publish basic metadata of the resources (i.e. Dublin Core, SCORM); while some sources provide at least 5-8 elements of data others only provides 2 or 3 elements of data making difficult to index this resources to facilitate access to faculty and students.

- *Some entities publish their resources in a basic standard of HTML instead Web 2.0 to provide feeds of RSS for the web pages.*
- *Others efforts like OAI (Open Archives Initiative) [provide] some guidelines but still is difficult to reach those repositories to index them into a single and intuitive search engine for the user (faculty, students, others).*
- *And some others publish their resources with[out] any license like CC making them doubtful in a ethical or legal way.*

Considering theses barriers we encounter several difficulties finding the resources, documenting and classifying the resources to filtering them in a reliable way through a single search engine (<http://khub.itesm.mx/>). If the projects or consortiums define a basic structure of metadata to publish their CourseWares or Resources like OER will be a lot more easy to find, index and search.

¹⁹ <http://fluidproject.org/>

²⁰ <http://raisingthefloor.net/>

²¹ <http://www.aegis-project.eu/>

²² <http://www.techdis.ac.uk/>

Standardised metadata would make it easier to find resources. But there is also a need to think about the sort of metadata that would be most useful to educators and learners:

In the project of Knowledge Hub in Mexico (<http://khub.itesm.mx/>) we started thinking [of] the needs of the teachers in the classroom and their needs to improve educational practice, foster a better learning environment and enrich their courses with OERs to reach different learning styles. So we include in the index process of our database basic metadata like for example ‘Observations’ for the use of the resource in classroom, ‘Benefits’ of the resource for students and teachers in terms of didactic use, ‘Learning Resource Type’ to help filtering materials that adjust to the local needs, and ‘Installation remarks’ to [make users] aware of technical requirements to provide the most information to the final user that requires to adopt that resource in the local learning environment.

Participants also suggested technical solutions to make it easier to publish and aggregate resources:

I was thinking that one thing that would be really nice is if all OER platforms and OERs could talk to each other and interact through tags and categories/plugins. Wordpress users for instance have access to all posts and have suggestions on what to read that might relate to the subject. If one could invent some sort of OER plugin or widget that any of us could install on OS platforms (+ blogs and wikis) and activate it with a special tag every time we create material and decide to make it OER, then this resource would stay with us and also be automatically sent to more centralized platforms.

Finally, participants shared links to the following sites, which can help users discover resources:

- Knowledge Hub²³ (UNESCO OER Community story);
- Open Archives Initiative;²⁴
- OAister;²⁵
- Universia OCW²⁶ (search engine through RSS feeds);
- OpenCourseWare Consortium;²⁷
- OPML feed for OCW initiatives.²⁸

4.4 The need for practical solutions to overcome bandwidth restraints

Use of mirror sites

‘Mirroring’ refers to duplicating OER materials from the main site (such as a website) to a ‘mirror site’. The mirror site could be another website, or a local repository that may or may not be connected to the internet:

If we are able to select the best quality materials we can send them in hard drives and promote that new materials are also downloaded and centralized in a local server, so

²³ http://oerwiki.iiep-unesco.org/index.php?title=OER_stories/Knowledge_Hub

²⁴ <http://www.openarchives.org/>

²⁵ <http://www.oaister.org/>

²⁶ <http://ocw.universia.net/es/buscador.php>

²⁷ <http://www.ocwconsortium.org/>

²⁸ <http://ocwblog.org/2009/01/15/play-with-our-opml-seriously/>

that bandwidth access to these are only limited to the local network. It may seem un-technological but it's fast and easy, and can be used on a short term basis. It should be a temporary solution, but it's similar to the idea of mirroring web sites for faster regional access.

External hosting to overcome South-North bandwidth restraints

There are a number of web-based services that can be useful to institutions that have little bandwidth and/or face high costs of internet connectivity. For instance:

- WikiEducator²⁹ is a wiki that can be used to store educational content, or to act as a platform for project coordination;
- YouTube³⁰ can be used to host videos without cost to the provider; and
- the hosted version of WordPress³¹ can be used to build basic websites and blogs.

Case study: use of WordPress at the UNESCO ICTP workshop on rich media streaming

Participants of the UNESCO Abdus Salam International Centre for Theoretical Physics (ICTP) workshop on rich media streaming, held in December 2007, reported good success in working with WordPress. For a limited website, there is no cost to the individual setting up the site, either for storing the content or for bandwidth. When the user outgrows the facilities provided by the basic site additional space can be purchased, or the content can be migrated to a stand-alone installation elsewhere. The system is thus suitable for a soft start (at no cost) and, if facilities improve (e.g. at a university in a developing country), the system can be rehosted by the institution itself. A disadvantage of WordPress is that it does not generate particularly bandwidth-friendly websites. The administration interface also requires good bandwidth. Finally, similar services are available from other providers, so prospective users should get an overview and try different systems before committing.

Using students to assist with network administration

A well-run network is of crucial importance to being able to use OER efficiently. It should not be assumed that current ways of resourcing networks are the only possible solutions:

True, network administration training is important and has to involve the teaching staff and students. Practical experience has shown that where staff loss is high students are a useful resource and can help in keeping the running ICT infrastructure running. So the curriculum has to be changed to answer to needs of the university as well.

4.5 Developing awareness-raising strategies

Any solution needs to have a dissemination strategy. The issue of awareness raising is particularly important for OER since it is such a new development:

What strategies can be looked in raising the awareness?

- *Holding seminars, workshops and like or what we do now as a community are excellent ways to spark level of awareness. I, for one, got very much interested. By having a venue to listen to stories and experiences of others while being able to*

²⁹ <http://www.wikieducator.org/>

³⁰ <http://www.youtube.com/>

³¹ <http://www.wordpress.com/>

express my own opinions, concerns and views definitely works. I would be glad if through the views shared, we can come up with a concrete action.

- *Peer support can be another strategy, where we involve, train and support members. The educator in this case becomes a target group, and being a target group, we then consider target needs so the carry-on barriers such as but not limited to language, religion, culture and the like are initially considered. This became a ‘big-brother’ taking care of a ‘teething-brother’. When done properly, I think this can be the multiplier factor that would translate awareness into action.*
- *Networking: In the same token that we use the Internet resource to access open resource, we also increase the internet community tools for raising the level of awareness. Tapping the major educational players of the countries to be part of the community, can just maybe bring about a nudge to some oversleeping (not necessarily be choice but maybe because of ignorance) educational institutions.*

4.6 Rethinking models for OER production and funding

It should not be assumed that the ways that OER is created and used today are the best – or only – possible ways. Some rethinking of OER funding efforts, in particular, may be needed, if the OER movement is to grow beyond donor-funded initiatives principally in developed countries. Participants felt that the following developments were needed:

- participative, collaborative OER production across the digital/economic divide;
- sharing of OER tools and technologies, rather than just content;
- funding opportunities for institutions in developing countries to develop OER initiatives of their own.

The following quote, which was used in the section on access issues, underlines this final point:

One key obstacle to African participation in OER has been the lack of funding. The most successful international OER projects have all received substantive grants, often in the millions of US\$, to create the infrastructure and capacity to publish educational resources openly. It is not possible for African universities, given the lack of capacity and resources mentioned by others, to fully participate in this movement without financial support.

OER production models – particularly collaborative models – can also influence methods of working, teaching and learning elsewhere in an institution. Course content, for example, can be made available through a wiki, with contributions from students and academics. Through an approved revisions system, academics could indicate the official version, without preventing students from continuing to contribute content. With suitable guidance, students can produce high quality content, as exemplified by BlueSci,³² a student-produced popular science magazine.

4.7 Rethinking education

Finally, building on the comment from the Knowledge Hub team member about education-specific metadata, it is important to consider the educational framework in which resources are used:

I think that there are a few critical success factors for the evolution of next-generation education:

³² <http://www.bluesci.org/>

- *Disaggregation of educational 'services'*
- *Empowerment of individuals through self organisation*
- *Ensuring that the essential freedoms associated with the free software movement are the foundation for OER.*

5. Stories and solutions

At some point in the not-so-distant future I find myself in a go-slow in some big city like Lagos, Nigeria. A small boy walks up to my car window with a wooden shelf neatly packed with biscuits, cigarettes, gum, and toiletries. I see he has some OER chips. I roll down the Window and ask, "Do you have a Nigerian secondary school chip?" He smiles and pulls a card from the rubberbanded collection. Five dollars later, I'm plugging the chip into my handheld and watching the introductory video by the minister of education. (And the boy is left smiling, because only foreigners actually pay full price.) Story contributed by Cliff Missen.

5.1 Why share stories?

Kim Tucker suggested that space be made on the wiki for people to share inspirational success stories of access to knowledge and learning. The purpose was to showcase the diverse and innovative solutions invented by communities with limited access. These stories add to our understanding of access to OER and, more generally, of access to knowledge and learning. Participants were reminded that ‘access’ is taken to mean both physical access (via a computer, print material, audio, etc.) and the ability to use a resource effectively (i.e. a resource is not truly accessible if it is in a foreign language, or pitched at a level beyond the learner’s prior learning, etc.).

5.2 Increasing access to resources: solutions for effective resource use

For this first set of stories, the suggestion was to recount inspirational stories of access to knowledge and learning, from which we can draw lessons for facilitating access to OER.

Using teamwork to overcome language barriers

This story focussed on a group of relatively inexperienced programmers of varying levels of multi-lingualism and programming ability. They interacted and learned from each other while working on a learning task. One member of the group was bilingual and able to understand the material in an online tutorial. She explained the concepts to her co-workers in English first. The conversation switched from English to Xhosa as they became engrossed in developing and working with the code, discussing the details of the task, the content of the tutorial and the concepts required for implementing the coding solution.

In terms of access, the story is relevant to questions around localization: when do we need to translate resources and how do we do this translation? The story illustrates that the language barrier may be mitigated in certain situations via bilingual team members or culture brokers. Although it is desirable to create localized learning resources, in some situations – such as the one described above – there is not the time.

Improving the accessibility of audio and video resources

This story is based on Attreman Junior's experience of learning English in Côte d'Ivoire. Officially Côte d'Ivoire is French speaking. In the first week of their first academic year, students had problems understanding their teacher, because of the different English accents. The way teachers pronounced words in US/UK English was quite different from the way their teachers at secondary school had spoken.

The situation became worse when the ‘listening course’ started. The task was to listen to tape recordings of native English speakers, but the experience was as if listening to an entirely foreign language. Attreman explained: ‘We caught nothing. But when we followed it reading a text exhibit, we noticed that there was nothing strange. The conversation was really in English, and in this way we understood very well.’ Reading text is easy. In terms of better access to OER, it is a good idea to subtitle audio and video resources, or make transcripts available.

North-South collaboration

This story is about a North-South collaboration where materials have flowed in both directions. A faculty member in a US public health programme partnered with three east African schools to co-author content. The university had developed a comprehensive e-learning system (based on open source software), and this was also shared with the southern collaborators.

The programme has been running for three years, on a very small budget. It has faltered and re-started several times, and all the barriers discussed during the first week of the present discussion have played a role. However, the collaboration still stands. Some content has been created jointly, and there have been asynchronous discussions on public health topics involving students from the US, together with partners in East Africa and India. These discussions have been tremendously interesting – again not without barriers coming into play – but still a start.

Making the most of local innovation

This is a story from William Kamkwamba about finding out how to make windmills to generate electricity in rural Malawi. It is a testimony to local innovation serving local needs using global knowledge. A video about the project is available on YouTube.³³

How might the OER community catalyse this kind of local innovation? It was proposed that we need to engage communities, foster social entrepreneurship and package resources, drawing on a range of materials, such as Appropedia³⁴ and the Social Entrepreneurship curriculum.³⁵

5.3 Increasing access to resources: providing training

Infrastructure issues (such as equipment, connectivity and power) are, of course, of paramount importance. However, once that infrastructure is in place, if it is to be used to its full extent – for which it must be maintained – training is one of the key issues.

Participatory ICT training in Zambia

In December 2008, Aptivate facilitated a three-week ICT training at a CAMFED-run summer school in Samfya province (Zambia). One hundred and fifty young women attended the summer school. The majority of the students had left school and had no experience with computers. However, most had a mobile phone, and a few had even used their phone to browse the internet.

The short time frame and the lack of prior exposure meant that it was impossible to transmit anywhere near enough knowledge to equip students to deal with most ICT situations. A key element of the training was therefore to employ a participatory approach that did not aim to ‘teach’ students, but rather to foster participation and inquiry-based learning. The training consisted of a graded programme to provide basic skills to all students, more skills to a smaller group of thirty students, and yet more in-depth skills to just four local trainers, who would then be able to run the resource centre and continue to train students.

³³ <http://www.youtube.com/watch?v=arD374MFk4w>

³⁴ <http://www.appropedia.org/>

³⁵ http://en.wikiversity.org/wiki/Portal:Social_entrepreneurship/Curriculum

The facilitators taught classes of thirty students in a 15-seat computer lab. Sharing hardware works well as a pedagogical tool as students are encouraged to help each other. If one person in the pair took over (because, say, they were able to type a bit faster), this provided an excellent opportunity to discuss the need to give everybody a fair chance and to let them explore for themselves, rather than just telling them what to do. Storytelling and role play – in a mix of English and Bemba (the local language) – were also important elements of the teaching to introduce new concepts such as privacy issues for email.³⁶

5.4 Increasing access to resources: technical solutions

This section contains the second set of stories gathered, which had a focus on technical aspects.

Appropriate devices

Low-cost devices: Rwanda and One Laptop Per Child

Rwanda has adopted the policy of introducing cheap laptops in primary schools through the One Laptop Per Child (OLPC) project. This story was contributed by Gerald Rwagasana, who is a member of the OLPC Steering Committee. The government intends to buy laptops for all primary school pupils so that by 2015 every child should be able to use a laptop for learning. The project began in December 2008.

This is a forward-looking decision, but one that will not be easy to implement. There are many issues to be resolved, such as: lack of electricity in most schools, lack of infrastructure in some schools, lack of connectivity, the need for teacher training, the need for maintenance – and, of course, the cost of purchasing millions of laptops. (In the beginning the cost per unit was USD 100; now it is USD 200). The contributor added that, despite these problems, ‘We must try to do what we can. We must be always positive and keep in mind that nothing is impossible.’

There was much discussion on the mailing list regarding the OLPC initiative.³⁷ It highlighted the need to make a distinction between providing access to computers, and providing access to learning resources, the internet or, indeed, to education. For instance, one needs to consider the cost of purchasing a computer, compared to the total cost of ownership of that computer within an educational institution (i.e. the cost of electricity, internet connectivity, maintenance, repairs, appropriate staff training, etc.).

Walking in Liberia: the potential of hand-held devices

Cliff Missen visited Liberia recently to install an eGranary lab at the medical school. He contributed this story about his visit:

Having lived in Liberia many years earlier, I spent my evenings wandering around the packed residential areas looking for old friends. It was dark. There was no moon and the electricity had been off for years. It was so dark that people would bump into each other even in the uncrowded streets. Every once in awhile there would be a single lit candle that would help guide us pedestrians, but more often there was the eerie blue, green glow of a cell phone. I'd stop and talk to those with cell phones. (Largely because I could see their faces and they could see mine to better understand my awkward attempts at Liberian English.) It turns out that they were not making phone calls. They didn't have credit on their handheld to make calls. But they were negotiating the menus, reading the user's manual, playing games, and making

³⁶ For more information see <http://www.sciencemedianetwork.org/wiki/Samfya>.

³⁷ See http://oerwiki.iiep-unesco.org/index.php?title=Access2OER/Solutions_Discussion#OLPC_related_discussion.

ringtones. I thought, 'If only we had books, health information, and lectures in local languages on those things..'

There are some small eGranaries for the World Dental Federation and Ponseti International that fit onto a chip the size of a little fingernail. They contain 'only' 200,000 web pages, books and videos, and they are remarkably portable. USB flash drive versions can hold a million documents.

Cliff comments:

There's been a lot of discussion about using cell phones for Internet. This may be a solution for some types of communication needs, but I doubt that many people are going to spend hours of their precious airtime reading a book or listening to a podcast – even if the cost of airtime drops considerably. However, we could distribute OERs and local content on \$5 chips and turn every compatible cell phone into a tiny digital library.

Cliff also contributed the short vision story used at the start and end of this chapter.

mLearning in Tecnológico de Monterrey

José Vladimir Burgos Aguilar shared some results of the mobile learning initiative that was started in 2006 at the Virtual University of the Tecnológico de Monterrey (ITESM) in Mexico. Initially, in 2007, one Master's programme was enriched with mobile resources and learning materials, which were made available through podcasts, text (SMS) alerts and educational messages to mobile phones, and access to courses with audiovisual instructional content and learning resources (i.e. audiolectures, audiobooks, videolectures, videoconferences and videoclips). By 2008 the mobile learning strategy had grown to 14 Master's programmes, covering 77 courses, and reaching 14,593 students across five campuses through 3,500 mobile devices (BlackBerrys).

The success was the evolution from chalk and blackboard to blended and online education has been the commitment of teachers to change and adapt with the resources available, and to improve the way that they teach others. We are exploring new initiatives through the design of mobile learning environments to reach new audiences with Open Educational Resources (OER) in different educational levels like k-12 education and social programs, empowering teachers and social leaders through the creation of educational programs and strategies for sharing best practices through social networks, using the potential of multimedia learning, Internet and other information and communication technologies through our Community Learning Centers (<http://www.cca.org.mx>).

The Internet connection is used to 'upgrade' courses, content and learning resources. Resources can be downloaded for offline consultation through a pocket or mobile device like a mobile phone or digital music player, exploring new spaces and access points for learning.

Appropriate bandwidth and bandwidth management

Aptivate: the human side to bandwidth

This story was contributed by Alan Jackson from Aptivate, an NGO focussing on the global use of ICTs and particularly bandwidth and power issues. It responds in part to earlier comments regarding the challenges of electricity, connectivity, teacher training and maintenance. On the one hand, there is a need to address global disparities in access. But at the same time, we should not ignore how to make better use of what is available right now:

There is a human side to bandwidth. Bandwidth must be viewed as a shared, and often scarce, resource. If you cannot immediately increase your bandwidth you can think

about how it is used, how it is shared, who uses it and what it is used for. Through effective bandwidth management and optimisation (BMO) the effective use of existing connections can be vastly improved.

The last ATICS report found that the majority of African universities did not have an effective ‘Acceptable Use Policy’ (AUP). An AUP is an important part of a bandwidth management policy. For instance, is it acceptable within a university for students to be downloading copyrighted music for non-educational purposes while others are unable to download research papers because they are competing for the connection? Users must realise how their actions on-line affect the access of their colleagues.

*It is useful to think of effective bandwidth management requiring three main elements which we call the ‘BMO triangle’. These are policy, monitoring and tools. For more on this, see the Creative Commons book *How To Accelerate Your Internet* (<http://bwmo.net/index.html>). The authors discuss all aspects of the BMO triangle, describing various tools, techniques and approaches.*

It is useful to use a Content Delivery Chain model as a framework for thinking about bandwidth issues. We refer to this as a chain because success is dependent on the weakest link. It is a simple idea and looks like this:

Content -> Connection -> Local Network -> User

It would be a mistake to concentrate solely on the connection and not spend equal effort considering the other links in the chain:

- **Content:** content providers have their role to play. They must ensure that content is usable over existing connections. Aptivate has written web design guidelines (<http://www.aptivate.org/webguidelines/Home.html>) that describe techniques for optimising on-line content.
- **Local network:** BMO, which we mentioned above, is something that needs to be carried out at the local network level.
- **Users:** users are also critical. User behaviour is the largest factor determining the effectiveness of any Internet connection.

As an example, using web-based email, like Hotmail or Yahoo!, can add a massive overhead to the size of an email, sometimes multiplying its size by a factor of one hundred or more. A university in the UK might typically have email take less than 5% of its Internet bandwidth. However an institution that relies solely on web-based email - and there are many - can see 25% or more of its bandwidth taken by email.

Users can empower themselves by using bandwidth optimising tools. For instance Aptivate hosts a free web-based service called Loband (<http://www.loband.org/>) that reformats any web page into a text-only form that radically reduces its size. Adobe also offer a similar service for PDF files. For OER we may want to think about transcoding services for other types of media (video, audio, composite learning objects, etc), which many providers are offering.

Finally, as food for thought and as an example of effective bandwidth use, one may download the entire works of Shakespeare as compressed text (only 2MB) from <http://www.it.usyd.edu.au/~matty/Shakespeare/shakespeare.tar.gz> (or <http://www.brouhaha.com/~eric/tgz.html>). It is possible to download six average web pages only for the same bandwidth (see

<http://www.websiteoptimization.com/speed/tweak/average-web-page/> for web page size information).

5.5 Increasing access to resources: hybrid solutions

Ending the Internet obsession: identifying hybrid information delivery solutions to serve the poor

This is the second story contributed by Cliff Missen, Director of the WiderNet Project, a non-profit service group based at the University of Iowa. Since 2000, WiderNet has provided IT training to over 4,000 people in sub-Saharan Africa. Volunteers have refurbished over 1,200 computers and have put in over 10,000 hours developing the offline eGranary Digital Library. The library, now installed at 275 locations worldwide, contains over 10 million digital resources that have been copied, with permission, from the web so that the collection can be made freely available over local area networks to users without Internet connectivity.

Cliff's interest is in developing multi-tiered, hybrid solutions to deliver information to the poorest people on the planet. Understanding that the digital divide is really a pernicious economic divide, WiderNet seeks low-cost, high impact solutions that are locally affordable and sustainable.

Over the last ten years, there have been hundreds of demonstration projects that deliver a few computers and a smattering of Internet connectivity to a handful of people. This is nice, but having seen computers sent to Mars and Internet connectivity delivered to remote sites in the Amazon and Antarctica, we knew that this was possible. The challenge is to scale computer access, information access and IT skills to the billions of people – health care practitioners, students, policy makers, entrepreneurs – in the majority of the world.

Cliff writes:

One of the lessons learned over the years is that there is no one 'user' and no single solution. In some places, for some people, electricity is adequate. For others, even for different economic classes in the same location, electricity is highly problematic. For some, Internet connectivity is available but expensive and slow. For others, adequate Internet connectivity is simply impossible without spending millions on infrastructure. (And more often than not, if such a sum were actually available, a community would probably choose to spend the money on health-giving or income-generating investments.) For some organizations, that have trained and talented technologists with ongoing salary support, open source software makes sense. For others, off-the-shelf solutions make them productive faster, using common tools with which the broader community is familiar.

It can be aggravating to see how some initiatives, like One Laptop Per Child, purposely confuse access to a computer as access to the Internet. In many communities, the cost of adequate Internet connectivity is more expensive, per person, than the computers themselves.

Cliff remains firmly convinced that the best 'bang for the buck' for most communities is to build local communication and information networks. External information has its value but, as the GSM revolution has shown us, most communication needs are local. It is critical to build capacity to share locally generated and locally stored information. For most institutions in developed countries, local network traffic is 7-9 times that of Internet traffic – and, since they own the networks, they do not pay costly 'rent' to Internet bandwidth providers to access the bulk of their information. The pursuit of Internet-centric solutions automatically marginalizes those who cannot afford it. The challenge is to

develop a hybrid suite of on- and off-line solutions that meet a wide range of information needs and environmental constraints.

The ever-growing eGranary Digital Library includes dozens of OER sites and demonstrates how effectively offline information stores can serve poorly connected communities. In early 2009 WiderNet installed a computer lab and eGranary Digital Library at the Dalai Lama's schools in Dharamsala, India. The teachers had been struggling with a slow, unreliable, shared 1mbit Internet connection for more than a year. They were experiencing a common disconnect: all of the external experts had told them that a connection to the Internet would be a panacea for their information access and teacher training needs, yet they mostly experienced frustration with their tiny but expensive wireless Internet connection. With the installation of a 100mbit switch and an eGranary Digital Library in their 12-computer lab, they had over 1,200mbit of bandwidth to access millions of documents in the blink of an eye. After opening hundreds of pages within minutes the teachers said, 'Ah-ha! Now we get it! This is what the experts were talking about!'

Recently, WiderNet has been developing a 'Community Information Platform' (sponsored by Intel), to make it easy for subscribers to set up and edit an unlimited number of local web sites, add local content, create Moodle courses, develop Drupal sites, and implement a host of Web 2.0 applications on their eGranary.

Finally, while few people paying for Internet bandwidth in developed countries would think of sharing it freely with their neighbours, several subscribers have chosen to share their eGranary with anyone within reach of their wired and wireless networks.³⁸

The ideas and solutions presented in this discussion demonstrate the potential of OER, offline information storage, bandwidth optimization and asynchronous information updates to create an inexpensive and powerful information delivery platform for a wide variety of institutions in underserved areas all around the world – an 'Internet extender'. Access can be scaled up by mixing in solar-powered systems, refurbished computers, low-powered laptops, handheld devices, kiosks and community centres. The technical solutions are at hand. Now it is a matter of finding the right mix to serve people appropriately.

Adapting a portable media player as a learning tool

At eLearning 2007 in Nairobi, Kenya, and at a Commonwealth of Learning (COL) workshop also in Nairobi, Moyomola Bolarin demonstrated to the mobile learning group how a child's toy – a black hawk portable media player – could be used to make a learning resource accessible where there was no access to a computer. It received an impressive amount of feedback from African participants.

Moyomola Bolarin is a Multimedia/Training Material Specialist at the International Center for Agricultural Research in the Dry Areas (ICARDA), Aleppo, Syria. He conducted an ICT resources pilot survey involving around 120 trainees from 21 countries in Central and West Asia and North Africa. The survey revealed that many respondents who did not have access to a computer or who used a shared computer in the work place owned mobile phones that were capable of recording and audio and video playback, and/or an iPod. Some had bought PlayStation Portable (PSP) or other Portable Media Player (PMP) devices for their children to play games.

That prompted Moyomola to start converting learning resources developed initially for online/CD-ROM delivery into a format that could be played on a PMP/PSP or mobile phone. Moyomola developed a keen interest in portable mobile learning devices – the different kinds that are available, their features and associated content media. Some cost as little as USD25. The disappointing aspect, as a learning specialist and instructional designer, was that there were little or no structured learning content for any of these devices. All that was available were games, movies and music. This prompted

³⁸ For more about the concept of eGranary 'Knowledgespheres', see this video on YouTube: <http://www.youtube.com/watch?v=WdOIJWkDaNw>.

him to ask why – why is the education sector not embracing, adopting and adapting learning content for these technologies in the same way as the music, movie and gaming industries?

Looking ahead, one could imagine a scenario where instructional videos could be downloaded from OER repositories to be viewed on a PMP/PSP. Instructors could prepare audio and video content and provide course guidelines and assignments or discussion points in text e-books. Moyomola has used his child's device to record educational TV programmes. He has also downloaded online learning resources (e.g. instructional videos on YouTube) and converted them into a format that could be played on the device.

Some might comment that this solution still relies on Internet access. Moyomola replies: '... when we come to realize that technology is not an end in itself but a means to an end, we will begin to look into all options and choose the best technology for a given situation.'

Effective technology-supported learning is not a matter of using the most advanced technologies. What is important is the ability of the trainer to combine and use the technologies that are available and with which people are comfortable, with minimal operational cost to the learners, to bring about meaningful learning in a given situation. For example, the use of handheld, solar-powered digital devices may be a workable hybrid technology-based learning strategy for remote community schools without ready access to electricity, internet and computer resources.

Many countries have internet connectivity at least in the major cities; most have established Education Management Information Systems. This suggests that Cliff Missen's 'Community Information Platform' could be combined with handheld digital player devices. OER could be downloaded at education/information resource centres in the major cities, reformatted for other digital devices and made available to users through community learning resource centres, a Community Information Platform, or through school networks.

Finally, Moyomola suggests that UNESCO might consider initiating a study into the effectiveness of a 'one PMP or PSP per child' scheme.

5.6 Increasing access to resources: lessons from initiatives in southern Africa

Kim Tucker presented an overview of several initiatives in southern Africa that provide access to learning materials (among other resources). Some have also been designed to promote collaboration and communication.

Digital Doorway

The Digital Doorway³⁹ was inspired by the Hole in the Wall project.⁴⁰ Both employ the concept of 'minimally invasive education'. By providing access to the hardware, children learnt to use computers and even how to read via peer learning and experimentation. A few children in the community with a little knowledge, natural ability, and a lot of collective curiosity led to new opportunities for many. The Digital Doorway addresses the need for robust computers to enable access in some southern African communities and highlights unexpected learning and possible pedagogical advances. The concept is evolving continually and there are a growing number of deployments. There are anecdotes of learners queuing up daily for hours for a short time on a Digital Doorway, and curious parents walking up to 12km to find out what was keeping their children away from home (but off the streets).

³⁹ <http://www.digitaldoorway.org.za/>

⁴⁰ <http://www.hole-in-the-wall.com/Beginnings.html>

Wireless Africa

Wireless Africa⁴¹ enables communities to set up their own wireless networks. Starting from a position of ‘community-owned information networks’, enabling communities to empower themselves with knowledge, this project is now being extended to enable community innovation including (for example) entrepreneurial services for schools.

Freedom Toaster

Freedom Toaster⁴² is a facility to enable access to CDs/DVDs of FLOSS (Free/Libre and Open Source Software) and educational resources for those with limited Internet access but access to PCs (e.g. at the school computer lab or at a community centre, etc.).

SchoolNet Namibia

*... a local hands-on ICT deployment, training and support organization, ... to empower youth through the Internet and provide a sustainable low-cost technology solution for Internet to all Namibian schools.*⁴³

During the course of this initiative, which has deployed computers in more than 350 schools, a variety of approaches have been used to enable Internet access. The computers are generally arranged around circular tables to encourage interaction. The types of learning resources available are a combination of OER and non-free resources. Few are localized, but many are of great interest to the learners, most notably a local custom snapshot of Wikipedia (probably the SOS Children’s edition). A general observation is that learners are exposed to parts of learning resources in English but proceed to talk about the material in more familiar language(s) – an example of constructing collective understanding.

MobilED

MobilEd⁴⁴ was designed as a research project on mobile education using the most basic phones, which are used widely in developing countries. The first prototypes used Wikipedia as the source learning material. The process was to send a one-word query via SMS. The system would then phone the caller back and read from Wikipedia using a text-to-speech engine. The technology was designed to work in both directions (i.e. users could contribute text to Wikipedia) and could accommodate multimedia with a little extra thought and work (and a more sophisticated, more expensive – less common – phone).

Wizzy Digital Courier

A system for caching internet page requests and emails to be sent and received until the evening, when dial-up becomes more affordable. Alternatively, schools without access to the internet can have emails and internet pages delivered on a USB storage device by a human courier.⁴⁵

‘Dr Math’

A service for learners to ask questions about their maths homework via SMS and receive hints from connected educators.⁴⁶ The service could be expanded, so instead of ‘Dr Math’ there could be a ‘Professor Sociology’, or another subject, with mentors providing hints using access to OER that are not available to those on the SMS network.⁴⁷

⁴¹ <http://wirelessafrica.meraka.org.za/>

⁴² <http://freedomtoaster.org/>

⁴³ <http://www.schoolnet.na/>

⁴⁴ <http://mobiled.uiah.fi/>

⁴⁵ <http://www.wizzy.org.za/article/articlestatic/19/1/2/>

⁴⁶ http://107.cgpublisher.com/proposals/848/index_html

⁴⁷ There is more on taking this forward on WikiEducator (http://www.wikieducator.org/Metawikieducator/Mobile_Learning).

Ulwazi

The original Mamelodi Broadband E-Learning Pilot Project aimed to explore educational opportunities between five schools in the Pretoria area using a Motorola Canopy Radio Network. The project is now expanding to include Dinaledi schools along a radio corridor in the Mpumalanga region of Bronkhurstspruit, Witbank and Middleburg.⁴⁸

Lwazi

More and more South Africans have access to telephones, while most do not have reliable access to the Internet or even printed media. A telephone-based, speech-driven information system can build on existing infrastructure and communication methods to connect all South Africans to the benefits of information technology.⁴⁹

Some of the technology being developed may be available later in 2009.

ACEMaths

[An] Open Educational Resources (OER) materials adaptation initiative that has developed and piloted a six unit maths teaching and learning module called, Teaching and Learning in Diverse Classrooms. Six higher education institutions are using the materials in a variety of teacher education programmes.

... We think that it's important not only to produce and disseminate materials, but also to do this through sharing expertise and resources.⁵⁰

The project addresses the problem of a lack of local skills and knowledge for adapting and revising OER by setting up a community of educators and asking members of the community to focus on course design, rather than materials adaptation. For the latter, the project contracted a materials development and content expert.

Lessons learned

In an analysis of the lessons learned, Kim Tucker suggests that most of these projects were designed to overcome particular barriers or respond to the needs of a particular group. Looking at the initiatives overall, however, it can be seen that there is value in having access at multiple levels, for example to:

- raise awareness of technology;
- stimulate curiosity and local discussion about ICT readiness;
- see how others structure courses, even if the actual content has not been adapted for local use.

These projects can also result in unexpected community-led innovation. It needs only a few community members to succeed in using equipment and resources effectively, and then to channel some of their knowledge back into the community.

A common limitation in some of the initiatives is the degree to which participants could really engage with the resources and become user-producers. Kim asserts that participation in peer production of knowledge and learning resources is the next step towards participation in the global knowledge society – towards equality.

⁴⁸ <http://www.ulwaziproject.co.za/>

⁴⁹ <http://www.meraka.org.za/lwazi/>

⁵⁰ http://www.oerafrica.org/Communities/ACEMathematics_Home.aspx

Late at night in a remote village without electricity, a small child laying on a mat, knees in the air, elbows splayed, working cleverly to make a tent out of his blanket and dimming his screen as much as possible so that his mom can't tell that he's staying up late and reading a book on his handheld. Contributed by Cliff Missen.

6. Case studies

In requesting stories and solutions, some contributors provided more extensive analyses of initiatives to extend access to teaching and learning.

6.1 The 'Connectivism and Connective Knowledge' solution

Stephen Downes wrote a comprehensive summary of the 'Connectivism and Connective Knowledge' course – an experiment in open online teaching. This contribution fits into the present report particularly well, as it uses the classification of access issues presented in Chapter 2, to analyse the accessibility of the course.

The context

'Connectivism and Connective Knowledge' was a course run by George Siemens and Stephen Downes in October/November 2008. It was offered through the University of Manitoba, Canada, as a for-credit course, but it was also offered for free to any person interested. It came to be called the MOOC – Massive Open Online Course.

Participants

George Siemens and Stephen Downes acted as instructors. Logistical internet support was offered by the University of Manitoba, by Dave Cormier, and by Stephen Downes. Overall, 24 students registered and paid fees to the University of Manitoba. Another 2,200 people signed up for the course as non-paying participants. All aspects of the course were offered to both paying and non-paying participants, with the exception that paying participants submitted assignments for grading and received course credit.

Participants registered from around the world, with an emphasis on the English- and Spanish-speaking world. The course was offered in English; Spanish participants translated key materials for their own use. The course attracted a wide range of participants, from college and university students to researchers, professors and corporate practitioners.

Solution

The course was designed to operate in a distributed environment and was not tied to a single platform or technology. With the assistance of university staff and Dave Cormier, George Siemens and Stephen Downes set up the following course components:

- a wiki, in which the course outline and major links were provided;
- a blog, in which course announcements and updates were made;
- a Moodle installation, in which threaded discussions were held;
- an Elluminate environment, in which synchronous discussions were held;
- an aggregator and newsletter, in which student contributions were collected and distributed.

The instructors encouraged students to create their own course components, which would be linked with the course structure. Students contributed, among other things:

- three separate Second Life communities, two of which were in Spanish;
- 170 individual blogs, on platforms ranging from Blogger and edublogs, to WordPress and more;

- numerous concept maps and other diagrams;
- Wordle summaries;
- a Google group, with a separate group for registered participants.

Key barriers

- **Access in terms of awareness:** Given that the course attracted 2,200 people, the lack of awareness must have been addressed in some fashion! However, the course was not widely advertised; it had been posted on George Siemens' and Stephen Downes' newsletters, which in turn are leading sources of information to a community that would be interested in the course.
- **Access in terms of local policy/attitude:** One of the major attractions was that the course was offered by the University of Manitoba. It was necessary to convince the university to offer an open course, which George Siemens managed by adding the enrolment component. In one sense, the paying students funded the non-paying students; in another sense, offering it as an open course created sufficient marketing to attract the paying students. The university was satisfied with the results and will employ the same model again.
- **Access in terms of languages:** There was no multilingual access. However, because the instructors encouraged participants to create their own resources, they created the conditions that enabled a large, self-managed Spanish-language component to be added to the course.
- **Access in terms of relevance:** The design of the course – as a distributed connectivist-model course – was such that the content formed a cluster of resources around the subject area, rather than a linear set of materials that all students had to follow. Because participants were creating their own materials, in addition to the resources found and created by George Siemens and Stephen Downes, it became apparent in the first week that no participant could read or view all the materials. The instructors made it very clear that they expected participants to sample the materials only, selecting only those they found interesting and relevant, thereby creating a personal perspective on the materials that would inform their discussions.
- **Access in terms of licensing:** All course content and recordings were licensed as Creative Commons Attribution-Noncommercial-Share Alike.
- **Access in terms of file formats:** The instructors did not try to provide access in all formats; rather, they employed a wide variety of formats for different materials and encouraged mash-ups, translations and other adaptations.
- **Access in terms of infrastructure:** The distributed course structure provided a wide range of access types, making it possible for people with limited infrastructure to participate, while still employing more intensive applications. Basic course material was provided in HTML and plain text; however, various course components required more bandwidth. The use of UStream proved useful to nobody, as the bandwidth requirements were too great even for the instructors. Skype worked well for planning and recording, but not for instructing. Elluminate was effective with limited bandwidth, but had a limit on the number of seats could be offered (it was capped at 200, although Elluminate said they would extend this as needed). All audio MP3 recordings were made available for download. Second Life was accessible only to those with the platform and sufficient bandwidth.
- **Access in terms of discovery:** A search tool was not provided; indeed the major resource related to discovery had nothing to do with search. The provision of a daily newsletter to aggregate and distribute course content proved to be a vital link for participants. A steady enrolment of 1,870 persisted through the duration of the course. In evaluations and feedback participants said that the newsletter was their lifeline. A full set of archives was provided, allowing people to explore the material chronologically and make up days they had missed.
- **Access in terms of ability and skills:** One of the notable features of the course was that, by bringing together participants with a wide range of skills, people were able to – and did – help

each other out. This ranged from people answering questions and providing examples in the discussion areas, to people commenting on and supporting each others' blogs, to those with more skills setting up resources and facilities, such as the translations and Second Life discussion areas.

Scalability and transferability

How might the solution "scale"?

The connectivist model employed in this course might offer a unique approach to the problem of scalability. The instructors could not provide everything that was needed for 2,200 students – nor did they try. Rather, they encouraged and created the conditions for participants to provide additional resources for themselves. The role of the instructors is essential in this model, yet their role is not to provide solutions but rather to establish a basic structure.

Regarding marking and recognition, the course offered an insight that may prove useful in the future. While 24 students were graded by the University of Manitoba, the instructors received (and granted) a request for a student from another country to be assessed and graded by their own institution. All assignment descriptions were displayed as part of the open course, and the assessment metric was also distributed, so other institutions had access to everything they needed in order to provide evaluation and feedback.

What questions should we ask about this solution to add to our understanding of enabling access to knowledge and learning resources?

The main questions are in the area of applicability: would this model work in other areas? Would it work in other communities?

Stephen Downes is also exploring the question of whether this approach could be supported with technology designed specifically for this model – for example, the creation of serialized feeds to automatically create and conduct cohorts through the course material.

Implications and adoption: what are the implications of this solution for OER and enabling access to knowledge and learning?

The course, which came to be known as CCK08, was a landmark in open access because, while providing the formal requirements of open learning – course structure and content, recognition, assessment and credentials – it nonetheless operated on a very different model from other OER initiatives. Materials for the course were not 'produced' in the traditional sense. Rather, the instructors created a framework, populated that framework with open materials already extant on the web, added some commentary and videos of their own, conducted open online sessions and recordings, and created the infrastructure for wide student participation.⁵¹

6.2 The RECOUP manual

This description of the RECOUP manual⁵² was provided by the present author.

About RECOUP and the manual

RECOUP is the Research Consortium on Educational Outcomes and Poverty, based at the Faculty of Education, University of Cambridge, UK. The research undertaken by RECOUP examines the impact

⁵¹ Course materials may be accessed from the course wiki (<http://lrc.umanitoba.ca/wiki/Connectivism>). For further information see the course blog (<http://lrc.umanitoba.ca/connectivism/>), newsletter site (<http://connect.downes.ca/>) and a selection of participant feeds (<http://connect.downes.ca/feeds.htm>).

⁵² <http://manual.recoup.educ.cam.ac.uk/>

of education on the lives and livelihoods of people in developing countries, particularly those living in poorer households. Its purpose is to generate new knowledge that will improve education and poverty reduction strategies in developing countries, through an enhanced recognition of the actual and potential role of education.

RECOUP is a research partnership that brings together institutions in developed and developing countries. The partnership also brings together people from varied disciplines, making it crucial to foster a shared understanding not only of how to do research, but also of what is meant by research.

The RECOUP manual itself is an outcome of this partnership. Initially a manual was developed to support research workshops that were organised in India, Kenya, Ghana and Pakistan. It became apparent that the manual would be useful to help roll out further workshops and training in the required research skills. The lead authors (Nidhi Singal and Roger Jeffrey) decided to turn the manual into an Open Educational Resource.

Nidhi and Roger write:

The spirit of dialogue, experimentation and a belief in the value of qualitative research that we developed during the process of refining the manual underpins our desire to share this work. We do not believe the process is over now that the manual is on the web: we hope everyone who reads and uses this material will tell us how it went, and engage with us and other users to adapt and improve it.

How does the initiative address the access barriers previously discussed?

The RECOUP materials are accessible in terms of:

- language and culture – indeed, they have been developed specifically to bridge and connect research cultures;
- relevance: the content is highly relevant to the participants in the research consortium;
- licensing (Creative Commons);
- skills: at least within the consortium, the manual has become part of the training materials, and appropriate training can be provided.

There are two further aspects that merit attention.

OER for development

First, the process is (in the author's view) exemplary in terms of OER in a development context. The OER was created because there was an identified need for training. The process involved good communication and North-South partnership, resulting in a resource that is appropriate and suitable for the intended areas. The researchers themselves decided that best impact would be achieved by opening up the resource and making it available as widely as possible.

Formats and infrastructure

Second, there is a small addendum to the story concerning formats and infrastructure. The RECOUP site uses MediaWiki (like WikiEducator and Wikipedia) and, as such, it offers the same access features, including PDF printing. All additional documents are available for download, bundled as zip files. However, the standard MediaWiki design ('MonoBook') is quite large (~130kB). The authors wanted the manual to be as low bandwidth accessible as possible, so they produced an alternative low bandwidth version.⁵³ Users comparing the low bandwidth version with the original site will notice that the low bandwidth site is faster, even on a good connection. Users on a slow connection will see a

⁵³ http://www.ict4e.net/mirror_recoup/index.php?page=Main_Page

significant improvement. (Compare also on a mobile phone: even with Opera mini, the low bandwidth site is faster.) The same technologies can be applied to any MediaWiki, such as WikiEducator or Wikipedia.

As a final note, the computer hosting the low bandwidth version does not need to have a special relation to the site itself. It can be located anywhere, for instance, on the local area network of a university. Pages that have been accessed once remain available, even if the internet connection fails temporarily. (Of course, pages can only stay up to date when there is internet access. As soon as the internet is restored, pages update automatically.) The technology is relatively basic, but it would be feasible to develop it a little further, so that schools and universities could have a local version of WikiEducator, Wikipedia, Medpedia, etc. always running, irrespective of whether the internet connection was working.

6.3 The Global Grid for Learning

This case study was provided by Theo Lynn from Dublin City University, Ireland. Dublin City University is a partner in the Global Grid for Learning initiative with Cambridge University Press, the Cambridge University Centre for Applied Research in Educational Technologies (CARET), Arizona State University and Obeikan Research and Development. The Global Grid for Learning (GGfL) initiative is attempting to address many of the access issues raised during this discussion. Over the next ten years it aims to build a digital content pipeline to connect educators to a billion digital resources.

Regarding an earlier comment in the discussion, Theo notes that the ‘travel well’ concept is a tough nut to crack.⁵⁴ GGfL is dealing with the ‘travel well’ idea by breaking down content into learning assets and structured learning objects instead of keeping it in large aggregate units. The more granular a resource, the better it will ‘travel’. GGfL also recognises the need to provide scaffolding to enable users to shape content to suit their local needs.

GGfL has encountered three challenges:

- There needs to be a balance between commercial content, free but not open content, and open content, as well as the system, repository and enabling workflow process to distribute this in a device-agnostic, bandwidth-optimised way. To get to a billion resources, it is assumed that 80 to 90 per cent will be free or open. Ideally, content needs to be local and culturally appropriate; unfortunately neither content nor metadata has been adapted for local context.
- Many countries worldwide want content but have no way of finding it. There needs to be a hosted discovery, exchange and delivery system. Commercial publishers need to be convinced to price on a micro-object level and to index pricing for the economic capacity of the target country.
- Even when content and systems are provided, teachers often do not have the capacity to integrate them into their teaching, or to teach learners how to use them. Capacity to develop local content is also limited.

The GGfL project solution is to provide a central content repository and federated brokerage system, with common file and metadata standards, transcoding tools, etc. for commercial, free and open sources. To deal with free, as opposed to open, content GGfL has had to cater for two options for contributors – their own license or a Creative Commons license. To date, the focus has been on attracting commercial publishers as they will be the hardest to get on board for competitive reasons.

⁵⁴ The term, ‘travels well’, is used colloquially to describe resources that are easy to use and re-use. See also notes on the Global Teacher Network OER Workshop (http://oerwiki.iiep-unesco.org/index.php?title=Global_Teacher_Network_OER_Workshop_April_2009), held in April 2009.

So far, GGfL has over four million resources and has built a web service that plugs into common platforms. It has nearly finished building a free, centrally hosted portal with search, discovery, Google applications for education and some additional community features. GGfL hopes to extend this to include a Learning Management System (LMS) over time, although this has additional cost ramifications. GGfL is also putting together a free training programme (on searching, evaluating, downloading, modifying, describing and exposing content), and a twinning project to encourage educators to work together to create content. GGfL hopes to make a hosted LMS portal available to schools and colleges in developing countries. It will fund this through twinning commercial licenses between schools and education systems in developed and developing countries.

GGfL has developed a wide variety of tools to exchange content, match materials across curriculum standards and edit for cultural appropriateness. The project has begun in the US and Arab States nearly simultaneously. It hopes to expand once it is established in these initial regions.

Part Three

7. Proposals

7.1 Introduction

Having outlined the principle issues that affect access to OER and surveyed a broad range of potential solutions, the third week of the discussion was dedicated to developing proposals in areas where further work is needed. It was beyond the scope of the discussion to develop fully finished and detailed proposals; instead the aim was to explore which of the ideas from the previous weeks could be framed as viable proposals. In this sense what follows are really ‘proto-proposals’. They are collections of ideas in proposal form, to help stakeholders think creatively about how to move forward on the question of access to OER.

The suggestions for proposals can be grouped into three overlapping themes:

- training,
- Open Educational Resource centres,
- OER delivery.

Readers may also find it helpful to refer to the original discussion and accompanying notes on the OER community wiki.⁵⁵

7.2 OER training proposals to address lack of awareness and skills

The need for training is evident. Many participants testified to the fact that awareness of OER remains low among educators (see, for example, the case studies in Chapter 2). Teacher skills and behaviours required for identifying, using and sharing digital teaching and learning content need to be supported and incentivised.

Training is needed particularly in the areas of:

- ‘technology literacy’ for users that are not familiar or comfortable with computers or the internet and, at a higher level, for ICT officers to enable them to evaluate and choose appropriate educational platforms;
- ‘information literacy’ for users that do not know how to find and select information online;
- ‘design of learning environments’, for example for technology-supported face-to-face instruction (blended learning) and for educational strategies like ‘active learning’;
- ‘evaluation and assessment of educational programmes’, to evaluate the success of in-programme OER use;
- ‘OER policy issues’ for decision makers, to cover infrastructure, adoption, production and dissemination of OER, copyright issues, etc.

⁵⁵ See http://oerwiki.iiep-unesco.org/index.php?title=Access2OER/OER_training_proposal for the OER training proposal, http://oerwiki.iiep-unesco.org/index.php?title=Access2OER/Open_Educational_Resource_Centres for proposal notes for OER centres, and http://oerwiki.iiep-unesco.org/index.php?title=Access2OER/OER_exchange for notes on OER delivery.

In terms of the classification of access issues in Chapter 2, training proposals would address:

- Social, awareness, policy, attitude, cultural:
 - Access in terms of awareness;
 - Access in terms of local policy/attitude;
- Technical: receiving OER:
 - Access in terms of internet connectivity/bandwidth;
 - Access in terms of discovery;
 - Access in terms of ability and skills.

The key element in the design and execution of any training activity is the adoption of participative principles: participative development of course proposals; participative teaching of courses; and a train-the-trainer approach to maximise scalability and opportunities for independent replication. Workshops would need to be structured so that participants immediately become trainers, able to hold similar workshops themselves. Course could be delivered online initially; trainers could later expand this to face-to-face training in their respective countries. Finally, any new training initiative would need to integrate and build on existing initiatives, for example those of OER Commons.⁵⁶

7.3 A proposal to build documentation to support the setting up of OER centres

The following ideas build on the OER training proposal outlined above, but take a holistic approach to OER access and use, and also address infrastructure needs.

Scalable OER creation and use depends on ICTs – on improving existing structures and rural connectivity. It was proposed that the community attempt to sketch out what a comprehensive and coherent set of Open Educational Resources that address access issues would look like. Here are some of the questions that would need to be addressed:

- How do you connect a rural school? How do you get affordable connectivity? How do you share a connection?
- How do you manage the connection to make optimal use of the bandwidth?
- How do you design robust, maintainable, low-power ICT equipment? (What are the cost implications of solar power, deep cycle batteries or a generator?)
- How do you obtain OER materials for local use?
- What training do you provide on ICT and OER?
- How do you overcome ‘brain drain’, whereby trained people leave for better jobs?

There is of course much documentation available, but it focuses generally either on the ICT/hardware/connectivity aspects, or on the OER aspects – rarely both. For instance, there are plenty of instructions available for installing Ubuntu and plenty for installing Moodle. However, it appears that there is no comprehensive set of tutorials, organised as a training course, to take a novice user from a blank computer, through installing Ubuntu/LTSP, installing Moodle and adding OER packages into Moodle, to conducting meaningful training and learning with the installation and content packages. Individually, there are guides and instructions on the Internet for each of these elements, but they come from and are written for different communities. Of course, the creation and/or compilation of the course materials would only be the start: (community) colleges would need to use the materials to provide training. Moreover, in a rural context, the process described above is only one element.

⁵⁶ <http://wiki.oercommons.org/mediawiki/index.php/Projects>

More skills would be needed. Overall, there is a need for training (and associated OER materials) that give the whole picture, taking the user from an empty building, to an OER-equipped training centre.

In terms of the classification of access issues this proposal addresses:

- Technical: receiving OER:
 - Access in terms of infrastructure;
 - Access in terms of internet connectivity/bandwidth;
 - Access in terms of ability and skills.

Relation to existing institutions

Any proposal would need to build on existing structures in the target countries. To take the example of Nigeria, there is the National Educational Technology Centre in Kaduna, education resources centres in regional capitals, audiovisual centres in universities and local school management boards. Any new initiative would need to cooperate with these centres in an integrated and participatory way.

Selection of existing materials

Kim Tucker suggested that it would be useful to list existing resources that could be adapted and updated for each implementation. Links to the following resources were shared with the community:

- OpenCourseWare Consortium OCW Toolkit Initiative,⁵⁷
- How to set up a wireless mesh network from WirelessAfrica,⁵⁸
- tuXlab ‘Cookbook’.⁵⁹

Resources could be classified according to their suitability for different learning situations. A tool could then be designed to select and present the most suitable set for a given situation. The task of selecting relevant learning and other resources could be carried out when needed. Compiling a full list of resources, however, might be a significant challenge. The project could focus on methodology, research, collaboration, preparation of the custom guide and mobilising multidisciplinary teams for implementation.

There is a separate wiki page with notes for an add-on proposal on ‘guidelines in action and research’.⁶⁰

7.4 An OER exchange infrastructure

The third area of proposals focussed on improving infrastructure for OER. This was motivated by a number of ‘What if?’ questions:

- What if any computer or storage device (be it a netbook, desktop, server, hard drive or memory stick) could come preloaded with a free content collection?
- What if when you placed an order for a device, you could choose from a large catalogue of preloaded OER with no further connectivity needed? However, when and where you had connectivity, your chosen content could be updated and extended automatically. (And content collections freely installed, transferred and shared from the internet.)

⁵⁷ <http://www.ocwconsortium.org/share/toolkit.html>

⁵⁸ <http://wirelessafrica.meraka.org.za/wiki/index.php/HowTos>

⁵⁹ <http://www.upfrontsystems.co.za/Members/jean/cookbook/docbook/cookbook.html>

⁶⁰ http://oerwiki.iiep-unesco.org/index.php?title=Access2OER/Notes_on_add-on_proposal

- What if any computer could be pre-ordered with a free content production suite and set of training materials? The suite would include a complete set of key OER applications, including OpenOffice, Audacity for podcasting, and Moodle and EduCommons to enable course development.
- What if the content you created could then be contributed back to the global community, even where there was little or no connectivity?

In principle, many of these ideas could be realised now, but for the moment there is not enough coordination within the *worldwide* OER community. Participants proposed the following steps to move the community towards those goals:

- hybrid information delivery strategies (North-South, South-North, South-South, North-North; seamless online/offline content delivery; caching);
- suitable strategies for content packaging so that content could be delivered in this way;
- content transformation/transcoding methods (would include wiki content transformation options for Wikipedia, WikiEducator, etc.), including bandwidth management and bandwidth-managed resource delivery.

In terms of the classification of access issues this proposal addresses:

- Social, awareness, policy, attitude, cultural:
 - Access in terms of local policy/attitude;
- Technical: provision of OER:
 - Access in terms of file formats;
- Technical: receiving OER:
 - Access in terms of internet connectivity/bandwidth;
 - Access in terms of discovery;
 - Access in terms of ability and skills.

Scenarios

The worldwide OER community has yet to realise the goal of downloading OER materials easily, without bandwidth problems. However, there are a number of strategies that could be implemented quite quickly and relatively cheaply, as they just depend on software.

The possible options can be illustrated with a number of scenarios. Let us suppose that we are based in a rural school and have only slow connectivity available. We are using Miro⁶¹ – a free, open source application to download podcasts. However, we are using an enhanced hypothetical version of Miro, which we will call ‘SuperMiro’, which is geared for use with low bandwidth connections. SuperMiro is also able to understand specialised very low bandwidth formats, such as AMR narrowband.

Suppose we use the hypothetical SuperMiro application to download a podcast. Normally, the connection would be made straight to the podcast server and would put immediate strain on the network, preventing others from browsing the web, or sending and receiving email. However, with the new and improved SuperMiro application, the subscription does not go straight to the podcast server. Instead it goes first to a local server at the school, then via a national school gateway run by the national research and education network operator (NREN) to provide an internet exchange point for schools and universities. Only then does it go to the podcast server.

⁶¹ <http://www.getmiro.com/>

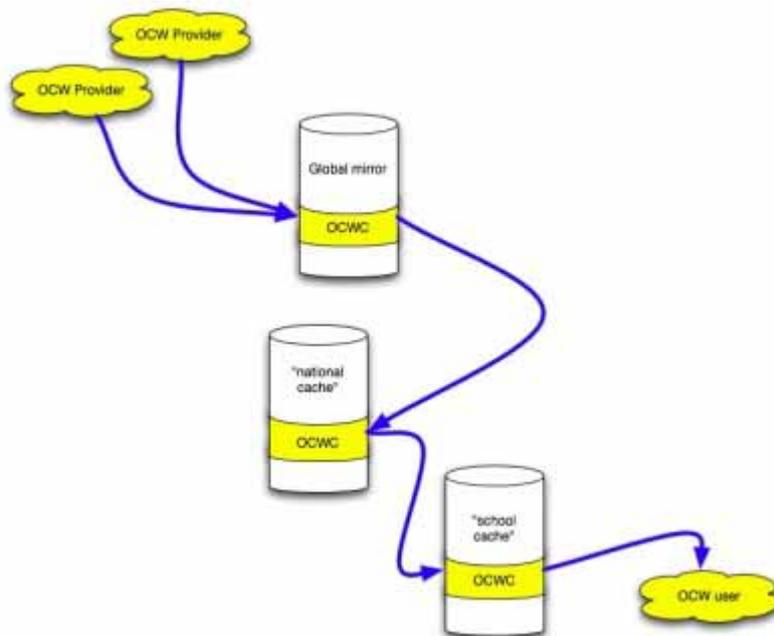


Figure 3. The downlink

Figure 3 illustrates this for generic OER/OCW content.⁶² Content providers have content on their website that is also mirrored into a global OER mirror. From the OER mirror the content is pushed to a national mirror (for instance with the NREN), and then to a local mirror in a school or university. To the user of the content this might be invisible: the user thinks that they are accessing (e.g. MIT OCW) content through their browser directly, just like any other web content, except that for some reason the OCW content is faster than the rest of the web.

Returning to the SuperMiro podcast scenario, it is important that the network talks back to the SuperMiro application, so that SuperMiro does not take up all available bandwidth. Instead, SuperMiro should be able to find out the total bandwidth available and restrict itself accordingly. The user is informed of the total download time and has the option to get a low resolution preview, while waiting for the high resolution file. This preview need not be generated by the podcast server itself: it could be generated ‘on the fly’ on the global mirror server. The user chooses audio/image preview and has the file in an hour. Once the user has listened to and/or watched the preview, SuperMiro says: ‘A higher resolution version is available – do you wish to download it?’ If the user proceeds they will receive an email in a day or so to notify them that the high resolution file is available on their school server. A copy of the audio/video file is kept by the full chain of servers: the school server, the national gateway server, and perhaps another regional internet exchange point. Others requesting the same file do not need to go back to the podcast server (or the global cache) to get the file. However, every time the file is requested from any of the servers, the originating podcast server gets a ‘ping’ so that they have good statistics about how their media are being used.

The same mechanism would work for open courseware and other content packages, as well as audio/video files. For content packages (provided as zip files), SuperMiro would be able to look inside the package and – just like the audio/video file – the user would have the option of downloading a lower bandwidth version of the materials first, before downloading the whole content package. (That is to say, the content package could be downloaded in pieces, to be reassembled by SuperMiro on the user side.)

Finally, the system could also be ‘primed’ with content packages downloaded elsewhere. A Zambian school server, for example, would not need to be on the internet. Teachers could request content

⁶² Diagrams illustrating more scenarios can be found on the wiki on the OER exchange cartoon page (http://oerwiki.iiep-unesco.org/index.php?title=Access2OER/OER_exchange_cartoon).

packages from the national Zambian school server to be put on a DVD/memory stick/hard drive and mailed to them. Those content packages would be installed on the school server and made available to teachers ‘as if’ the server were on the internet.

Uploading content

What happens when the user in the Zambian school becomes a re-mixer and wants to share content that they have created or adapted? They would normally just put it onto their school server, perhaps for other teachers to use. In the scenario outlined above, there would now be a channel back from the school, to the national server and the global mirror. This means that other users, whether elsewhere in Zambia, Africa or the rest of the world, would now have access to the content.

In this way the system is bi-directional: content produced by the Zambian school user is uploaded to their school server, but automatically mirrored to the national Zambian server and perhaps to the server near the African internet exchange point. When somebody from the North wants a learning resource from the Zambian school, they need not put any strain on the school network; the content comes instead from a server near the African internet exchange point.

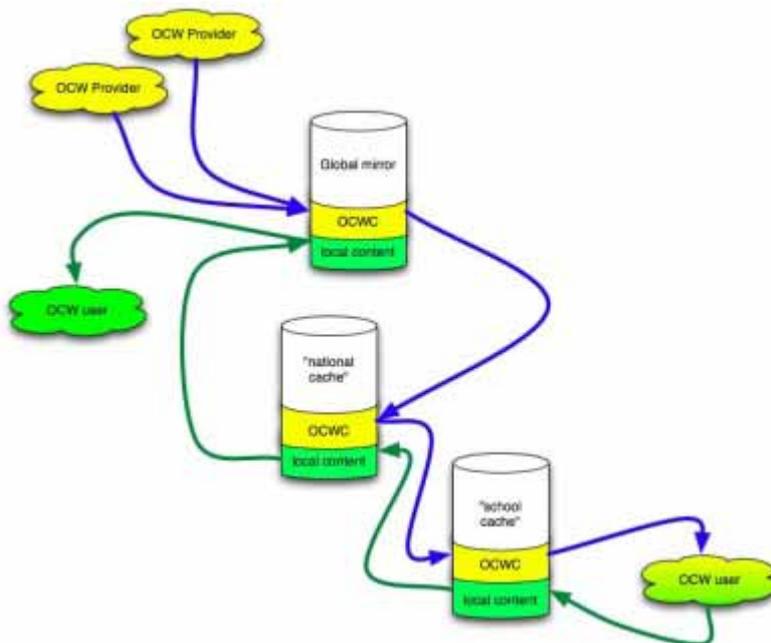


Figure 4. The uplink

Offline content

In the scenario described above there is at least a little connectivity. What happens when there is no connectivity and/or national server? (The server is greyed out in Figure 5.)

In this scenario, the content is taken off the global server in one location where there is connectivity. This might be in the nearest city, or while a teacher is abroad on an OER course. A content bundle could be transferred to a memory stick or perhaps fetched automatically using the hypothetical SuperMiro application. The teacher then returns to their school, where the content can be put onto the local server.

It is possible to imagine a scenario in which this happens seamlessly. The teacher clicks a few buttons while they have connectivity and SuperMiro downloads the required content packages. Once back at the school, SuperMiro talks to the school server and transfers the content. The content could even have been requested by other teachers and preselected with SuperMiro before the teacher left. To complete

the scenario, the teacher could also pick up local content from the school server, to share with the global server once he or she is in a place with good connectivity.

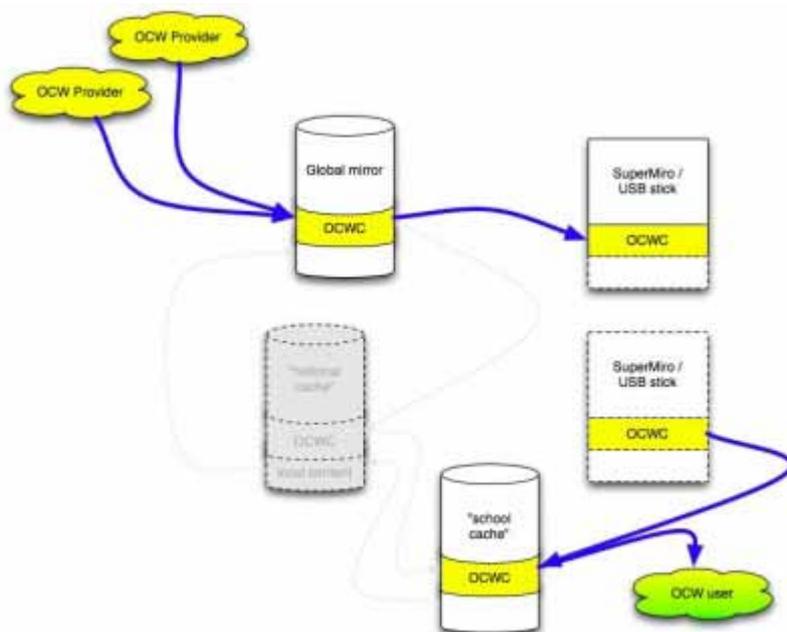


Figure 5. No connectivity

Peer-to-peer sharing of offline content

Centralized infrastructure may be missing in many locations, but it is also possible to envisage full peer-to-peer sharing of content, without central infrastructure either at the school or nationally.

Even over very low bandwidth, a content directory could be shared in SuperMiro, which would list all globally available OER. Each resource would have peer-to-peer sharing information next to it, to inform the user as to whether it:

- had been downloaded already and was available on his or her SuperMiro;
- was available on the local network and could be downloaded (estimated time, etc.); or
- was not currently available on his or her network.

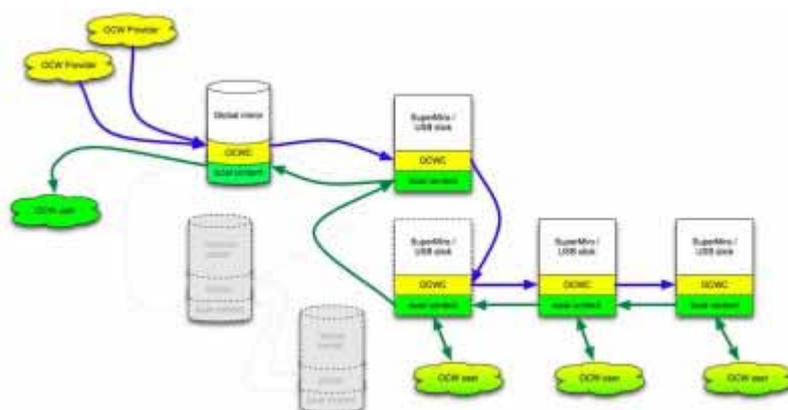


Figure 6. Peer-to-peer content distribution

Mobile access

Finally, a more organized presentation of OER content would make it possible to provide better mobile access. For instance, there could be a SuperMiro application for mobile phones, including for basic phones with support for Java. There may also be a need to provide access for even more basic phones, via voice and/or SMS. This may be particularly relevant for OER produced as bespoke resources for a certain community.⁶³

The proposal

How could such an infrastructure be realised?

Initially, a small consortium of stakeholders (such as content providers, NRENs and content users) would need to come together and carry out action research to find out whether the system outlined above would be acceptable to and work in schools and other educational institutions in developing countries. Following this, the consortium would need to develop guidelines for content providers (e.g. to explain how to make their resources automatically downloadable by SuperMiro), as well as to raise awareness about the system and obtain support from widely used content repositories (including Wikipedia, WikiEducator, Wikiversity, Connexions, installations of EduCommons, Le Mill, Kewl/Chisimba, OER Commons, and many more).

A strong feature of this proposal is that it would place very little strain on the actual OER user. All they would need to do is to download SuperMiro. The rest would be taken care of by the application and content providers.

It should also be noted that this proposal has not been plucked out of thin air. Related work is being carried out at the moment by the eGranary and the Global Grid for Learning, and similar ideas are being explored in the OpenCourseWare Consortium and OpenCast community. Nevertheless, there is still a need to bring these efforts together in a way that works for developing countries.

Certification

Such a proposal might be helped by promoting OER accessibility standards, through which content could be marked as accessible. There are already criteria in some areas, such as licensing and disability access, from which a comprehensive accessibility rating for OER could be derived.

In the classification of access issues in Week One, the community discussed issues qualitatively, rather than looking at how different elements of accessibility might be measured or assessed in a formal way. A nice application of the OER classification was provided by Stephen Downes, who used it to assess the accessibility of the CCK08 open course (see previous chapter). Another example can be found in a blog post by Jared Stein.⁶⁴ In it, he develops criteria for estimating reuse and remix value, and applies this to a number of existing OER projects, including the Open University's OpenLearn, Carnegie Mellon Open Learning Initiative, MIT OCW, webcast.berkeley and Connexions. The following criteria were used to evaluate resources:

- technical openness of media (e.g. Java applet vs. Javascript);
- quality of source;
- variety of media sources;
- semantic/standard structure (e.g. HTML tables vs. semantically-correct XHTML, IMS);

⁶³ For more information about mobile access see the OER exchange proposal talk page (http://oerwiki.iiep-unesco.org/index.php?title=Talk:Access2OER/OER_exchange#Mobile_access_to_the_major_OER_repositories_via_text-to-speech_and.2For_telephony).

⁶⁴ <http://flexknowledge.learningfield.org/2009/02/05/estimating-reuse-remix-value-of-7-oer-projects/>

- Creative Commons license compatibility;
- hosted tools and support for remix.

The ratings process was to some extent subjective, but the criteria could be used to devise a more formal measure of accessibility that covers more than just legal openness. Bandwidth is another area that would lend itself well to objective accessibility criteria.

Finally, certification could be used in a top-level domain structure (e.g. oer.org/oer.int). All content within this domain would have to meet the criteria that had been established (such as Creative Commons licensing, a minimum amount of metadata, resource discovery, etc).

Conclusion and next steps

The OER freedoms

The discussion ranged widely over many different aspects of access, at times going into a great deal of detail on specific issues or solutions. In the conclusion of this report it is helpful to take a step back and return to some of the broader ideas – the concept of access as a capability, and the freedoms that are embodied in ‘open’ with regard to Open Educational Resources. Reflecting on the classification of issues presented in Chapter 2, we may draw out three essential freedoms:

- legal freedom,
- technical freedom, and
- cultural freedom.

Legal freedom embodies licensing: How free am I to make use of the OER? Does that freedom include the freedom to make profit to support my livelihood? Is the license used a standard license that is easy to understand? Or is the license bespoke and hard to understand?

Technical freedoms include the freedom to download, to disaggregate easily, to move an OER around and to obtain different versions that are suitable for different contexts: low bandwidth versions for poorly connected areas; documents without images to save ink in printing; content formatted for different devices – whether these are used out of preference or due to need.

Finally, the **cultural freedom** of an Open Educational Resource is perhaps harder to express. It might well be called **educational freedom**. Does the resource travel well? Is it written in a way that supports human rights and human needs? Does it support Sen and Nussbaum’s capabilities?⁶⁵ Does it encourage engagement and participation? Is it pedagogically meaningful and easy to integrate into the curriculum? Does it make sense as a resource for a lifelong learner?

These freedoms build on each other: legal freedom is needed to exercise technical freedom, but legal freedom is not sufficient to give technical freedom. Similarly, cultural or educational freedom can only be exercised once the conditions of legal and technical freedom have been met, at least to some extent. As a community, we may ask to what extent we have realised these freedoms – and where further work is needed.

The way forward

While good progress has been made in terms of defining frameworks for legal freedoms (especially through the work of Creative Commons), there are other areas where there is still much to be done. Coming back to the original aims of the discussion, the idea was to add perhaps a novel element: the concrete focus on proposals and “do-able” projects as outcomes, rather than simply to arrive at a better understanding of the issues.

Following the close of the discussion on the main UNESCO OER mailing list, a second mailing list was set up to take potential proposals further. The work on proposals is available on the wiki.⁶⁶

⁶⁵ See Wikipedia articles on the capability approach (http://en.wikipedia.org/wiki/Capability_approach) and Martha Nussbaum (http://en.wikipedia.org/wiki/Martha_Nussbaum).

⁶⁶ <http://oerwiki.iiep-unesco.org/index.php?title=Bridge>

A final word

In conclusion, I hope that this report gives a good overview of the state of play regarding access to Open Educational Resources – and is a fair reflection of the UNESCO OER Community discussion. That discussion was as insightful as ever and shed light on a great range of issues.

It was clear from the discussion is that there is no one overarching access problem; nor is there one solution. Rather, there are groups of issues, with various local solutions. Solutions have to be tailored locally to each particular set of circumstances. It is also important to remember that the access issues that concern the developed world are not necessarily the most pressing and important issues for the developing world. Thus, it is imperative to adopt a participative approach to increasing access to Open Educational Resources in order to develop truly appropriate solutions – solutions that provide viable paths for improving access to Open Educational Resources even in the most disconnected areas of the world.