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ASSESSING THE IMPACT OF OER AVAILABILITY ON THE EMERGENCE OF OPEN EDUCATIONAL PRACTICES IN SUB-SAHARAN AFRICA: THE CASE OF AN ICT-INTEGRATED MULTINATIONAL TEACHER EDUCATION PROGRAMME IN MATHEMATICS AND SCIENCE

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Assessing the impact of OER availability on the emergence of Open Educational Practices in Sub-Saharan Africa: The case of an ICT-integrated multinational teacher education programme in mathematics and science
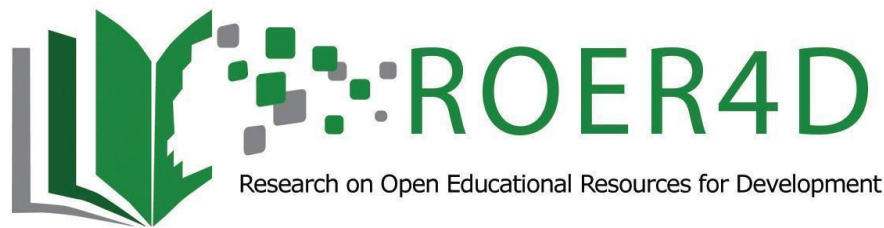
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Abstract

This qualitative case study sought to assess whether availability of the AVU OER had an impact on the emergence and extent of open education practices (OEP) at the partner institutions studied. The study focused on four of the dimensions of OEP, namely use, repurposing, creation and sharing of OER. The data collection instruments included an online questionnaire and face-to-face interviews. The findings indicated that availability of OER did have an impact on the emergence of the OEP dimensions studied, both at the partner institutions. For example, at the partner institutions, the AVU OER was being used as a resource for course development, for training, for lesson preparation, and for teaching learners at a distance and on campus. Use of the OER led to the emergence of the other dimensions and vice versa. For example repurposing of OER was done if the resource was considered useful and the resource was then contextualized to align with the standards or syllabus of the partner institution. The OER modules were also considered useful resources in the creation of other OER. This had an impact on the development of knowledge and skills in these areas. At the same time, having the appropriate skills meant that faulty were more likely to repurpose, create or share OER. There were other contextual factors that enabled or constrained use and impact, including awareness

of the existence of the OER, access to the OER, access to ICT infrastructure and tools, having an OER policy. Institutional support was considered key across all these dimensions. However, impact seemed to be felt more at the level of the individual faculty than at the institutional level. To move to a much greater extent of OEP, there would need to be integration of use of OER at a much higher level in the curriculum and institution, such as requiring their primary use for example in a degree program as opposed to supplementary use. This would also ensure that the OER stay current and are adapted and updated as needed to fit institutional as well as industry requirements.

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Introduction

For governments and tertiary institutions in Africa, the struggle continues to address the demand for trained teachers and the need for quality updated curriculum that prepares graduates for the current knowledge-driven technological society. This becomes even more pressing in light of the need to meet education for all and sustainable development goals. Organizations like the African Virtual University (AVU), have been at the forefront of leveraging technology to address issues of educational expansion and quality. Their use of Open Educational Resources (OER) is seen to have the potential to assist in addressing these challenges, notably within contexts of technology-mediated open, distance and e-learning.

In sub-Saharan Africa, the articulation of OER with the expansion of access to quality educational resources appears to form the basis of several initiatives aimed at adopting and developing OER for teacher training. One of the more visible OER projects in teacher education in sub-Saharan Africa is the Teacher Education in sub-Saharan Africa (TESSA) initiative of a consortium of 18 institutions that worked collaboratively to design and build a multilingual bank of OER with a view to improving the quality of and access to university-led primary teacher education (Wolfenden, Buckler & Keraro, 2012). The TESSA OER are essentially sets of practically focused study units aimed at directly improving teacher classroom practice (Thakrar, Zinn & Wolfenden, 2009). According to Moon (2008), the TESSA consortium model makes it possible to share "advice and expertise which plays to strengths of participating institutions and avoids some of the issues that can surround north-south or even south-south partnerships" (p. 7).

The AVU project is the other prominent sub-Saharan Africa OER initiative and is the focus of this study. The AVU Multinational Support Project was a multinational teacher education project that was funded by the African Development Bank (AfDB) and implemented between 2005 and 2011 in 12 institutions across 10 African countries (AfDB, 2011).

The project was aimed at building capacity in the participating institutions to improve the quality of teaching and learning in schools through the use of ICTs; to increase the number of mathematics and science teachers; and to train the teachers in ICT basic skills and in integrating ICT into their teaching. Other project objectives were to promote regional integration and strengthen relevant partnerships with other teacher education initiatives in Africa (Diallo, Wangeci & Wright, 2011).

The focus of the AVU project was the implementation of a teacher education curriculum in Math, Physics, Chemistry and Biology that integrated ICT into the teaching of the courses, as well as the delivery of the program through open, distance and e-learning which included a blend of online and face-to-face. A central component of the project was that the course modules were developed as OER. Seventy-three courses modules were developed, peer-reviewed and translated into English, French or Portuguese, resulting in a total of 219 modules that were subsequently released under a Creative Commons License (Diallo, Wangeci & Wright, 2011).

The developmental objective of the study is to contribute to an understanding of the impact of access to, and availability of OER on the emergence and extent of open education practices at the AVU and the six partner institutions represented in this study. Six institutions from Kenya, Tanzania, Uganda, Somalia, Zambia and Zimbabwe (one from each country) are represented in the study.

As outlined in the literature review, earlier studies (Ehlers, 2011; Camilleri, Ehlers & Pawlowski, 2014) suggest that there is a gap between the concept of giving knowledge for free and the actual use of free and open resources for teaching and learning. These studies suggest that while OER are high

on the agenda of many stakeholders, their use in higher education has yet to reach a critical threshold (ibid). Ehlers observes that OER use can be facilitated by building a culture of openness within institutions through a complementary focus on open educational practices (OEP) in addition to resources. Ehlers defines OEP as practices that support the (re)use and production of OER through institutional policies, promote innovative pedagogical models, and respect and empower learners as co-producers on their lifelong learning path. They outline this in a conceptual framework (Ehlers, 2011; OPAL, 2012) that outlines the dimension of open education practices and which is discussed in the next section of this report.

The AVU developed a set of curriculum materials (see appendix 1) to be used to offer an undergraduate program in Math and Science. Hence the importance of this study, in assessing the emergence of OEP at the institutions that participated in this project. This study is in agreement with the proposition to extend the focus of attention on open education beyond resource access to innovative open educational practices (ibid). The underlying assumption is that availability of OER has the potential to lead to the emergence of OEP. The study therefore sought to assess the impact of availability of OER on the emergence of OEP. The OEP dimensions being interrogated in this study are – using OER, repurposing OER, creating OER and sharing OER.

The study is guided by the following central research question: What has been the impact of availability of OER on the emergence and extent of OEP at the AVU partner universities?

One objective of the study is to get an in-depth understanding of the OEP conceptual framework and how its dimensions can be applied to study the impact of OER and the AVU OER in particular. At this stage, the study is more exploratory because of the need to understand and operationalize the OEP conceptual framework even as it is being used to collect and analyse data. The best way to do this is through a qualitative case study.

The findings from this study will hopefully inform policy and practice towards integrating OEP for the provision of quality and relevant teacher training via open, distance and e-learning to prepare teachers to function and teach in the digital age. Due to the exploratory nature of this initial study, the findings and issues raised can inform a more targeted and comprehensive survey on the emergence of OEP at the institutions that have participated in the AVU project.

Literature Review

The primary purpose of this review is to synthesize existing literature and to present the conceptual framework used to inform the design of this study. The conceptual framework offers a useful model for studying OEP by proposing dimensions of OEP according to which educational practices can be evaluated. The review highlights the rationale for using the conceptual framework, and the various components of the OEP model.

OER availability versus adoption

Open provision of course materials has become a growing movement. In 2007 the OECD identified over 3 000 open courseware courses available from over 300 universities worldwide (CERI/OCED, 2007). In repositories such as MERLOT, Connexions, OpenLearn and others, there are hundreds of thousands of pieces of content or materials representing thousands of freely available resources (Ehlers, 2011). The more visible initiatives in Africa include Teacher Education in Sub-Saharan Africa (TESSA) Project; OER Africa, a project of the South African Institute for Distance Education (SAIDE); and the AVU OER, the focus of this study (Adala, 2016).

Ehlers (2011) and Camilleri et al. (2014) observe that although OER are high on the agenda of social and inclusion policies and supported by many stakeholders, their use in higher education has yet to reach a critical threshold. The OPAL (2011) study, *Beyond OER: Shifting Focus from Resources to Practices*, noted that although OER in European higher education institutions are available in principle, they are not frequently used. The study found that the five main barriers to use of OER are: lack of institutional support, lack of technological tools for sharing and adapting resources, lack of users' skills and time, lack of quality or fitness of the resources, and personal issues such as lack of trust and time. The authors of the OPAL report concluded that four of these five issues relate to a lack of supporting components (i.e., organisational support; a sharing culture; lack of quality, trust, time, and skills for adaption. The other barrier was related to the lack of technological tools for sharing and adapting resources. However, none of the barriers was related to accessibility and availability of the resources per se. These observations have implications for this study because it seeks to investigate whether availability of a specific OER resource and the participating institutions' access to it, had an impact on the emergence of OEP.

Emergence and relevance of OEP

Ehlers (2011) attributes the findings of low OER usage to an undue and disproportionate focus on building more access to digital content, with too little consideration of whether access alone will support educational practices and promote quality and innovation in teaching and learning. He divides the OER movement into two phases. The first phase of OER development and diffusion has focused mainly on building access to OER, and building infrastructure, tools, and repositories. Ehlers (2011) argues that while the first phase of the OER movement has been successful in promoting the idea that knowledge is a public good, and in motivating organisations and individuals to publish OER, the potential of OER to transform practice has not been realised. He observes that little research has been done by OER projects to establish the best way to move from existing provision to better structures for open education and points out that currently emerging in the debate, literature, and policy discourse is the second phase of the OER movement.

Ehlers (2011) and Camilleri et al. (2014) explain that the second phase is about using OER to improve learning experiences and innovate educational scenarios. These comprise a combination of use of open resources and OEPs that could transform learning into 21st century learning environments in which universities, adult learners, and citizens are provided with opportunities to shape their lifelong learning pathways in an autonomous and self-guided way. They submit that the second phase:

- builds on OER and moves on to the development of concepts of how OER can be used, reused, shared, and adapted;
- goes beyond access into OEPs, and seeks ways to use OER to transform learning;
- focuses on learning by constructing knowledge assets, sharing them with others, and receiving feedback and reviews;
- follows the notion of improving quality through external validation because sharing resources is in the foreground;
- is about changing the traditional educational paradigm of many unknowledgeable students and a few knowledgeable teachers to a paradigm in which knowledge is co-created and facilitated through mutual interaction and reflection; and
- strives to understand that OER has to contribute to institutions' value chain.

They note that addressing this challenge could be facilitated by creating a culture of openness within institutions through a complementary focus on educational practices in addition to resources. Does

their observation that notwithstanding any infrastructure challenges, the issue of OER adoption faces the same challenges in developing countries hold true for this study of OER in an African context? That is the driving concern for this investigation and the underlying assumption that because of availability of the AVU OER and the engagement of the participating institutions in the creation of the OER there is the potential for the emergence of OEP at least to some extent.

Conceptualizing open educational practices

In order to facilitate the shift from OER to OEP, Ehlers (2011) and Camilleri et al. (2014) note that it is important to outline all the factors that influence the actual creation, use, sharing and reuse of OER for learners, educational professionals and organizational leaders in one common framework that would direct stakeholders towards innovative, open education where OER can improve the quality of learning experiences. Such a framework should address the whole OER governance community – policymakers, managers and administrators of organisations, educational professionals, and learners. They define OEP as practices that support the (re)use and production of OER through institutional policies, promote innovative pedagogical models, and respect and empower learners as co-producers on their lifelong learning path.

The above considerations emphasize that current OER initiatives need to extend the understanding of OER into the concept of OEP, where OER are used in innovative educational scenarios to improve quality. Research and experiences such as the ones shared in the OPAL (2012) study shows that the uptake of OER demands a culture of sharing, valuing innovative and social-network-based forms of learning, and encouraging novel pedagogical models. To develop a sustainable pathway for organizations, and for educational professionals and/or learners to grow into their role as open educational practitioners, the OPAL project, which involved over 80 case studies of open education initiatives around Europe, developed a model for OEP (Camilleri et al., 2014, p.27). The operation mechanisms and quality standards in place were studied in each case study, and the findings and conclusions led to the development of the OEP conceptual model from which the dimensions described below were derived.

Below are the identified dimensions of OEP and an explanation of how each dimension links OER access and availability to OEP. The guidelines are reproduced from OPAL (2012), *Guidelines for Educational Professionals (Deliverable 4.3), Work Package 4 - Dissemination. Open Educational Quality Initiative (OPAL).*

1. *Extent of using and repurposing OER:* Finding and using OER is often the first step towards OEP. Integrating an OER into one's own teaching and learning is called repurposing. It often involves dismantling the original resource and taking what is useful and setting aside the unnecessary.
2. *Availability of a process for OER creation:* In order for an organization to progress towards OEP it is important to define a process whereby educational resources are made available under free license schemes to become open educational resources. Only then will these resources be available for others to use and/ or repurpose internally as well as externally. A comprehensive organization-wide process for OER boosts progress towards OEP.
3. *Degree of sharing of OER and OEP:* The guidelines note that the most successful use of OER is where this is a sharing process. The openness required for sharing educational resources is hence a key success factor for OEP. In addition to a culture of sharing among practitioners and management, tools for sharing resources and experiences within the organization and with actors from other organizations must exist. It is as important to share resources, as it is to

share the experiences of what works and what does not within OEPs. Social network tools therefore play an essential role in any OEP strategy.

4. *Extent of working with open learning architectures:* O*pen learning architectures* are an important element in OEP. They support learners in becoming autonomous and acting in self-organized leaning environments in which they can share, use and /or produce educational resources (see discussion above and Figure 1 for a more detailed exposition of OEPs which is at the heart of OEP).

5. *Organizational vision for OEP:* Expressing a vision in a written strategy or guidelines is essential. A vision for OEP would include reference to the production, sharing, use and/or reuse of OER. It would also aim to provide learning opportunities in OEPs, in which the aims and objectives of learning as well as learning methodologies are developed in consultation with learners. Such a vision should be communicated and shared within the organization by all stakeholders.

6. *Existing OEP strategies and policies:* Research shows that strategies and policies are most effective in stimulating OEP across organizations in an effective way. They embody rules and regulations for how to implement OEP across a whole organization. Elements relating to OEP can be either a part of an organization's strategy (e.g., for the development of learning environments) or can even be subject to their own strategy or policy. Policymakers implement OER policy through key white papers, via inclusion in strategy documents, through funding calls, or through acting as a front to promote OER initiatives.

7. *Business model related to OEP:* An ongoing critical discourse against the OER movement is the issue of how it can be made sustainable in the longer term, and what business models might be appropriate. Downes (2007) provides a useful classification of funding models for open source type initiatives: endowment models (where the project obtains base funding), membership models (where a coalition is invited to contribute a sum), donations models (where requests are made for donations), conversion models (where initial freely made material ultimately leads to some element of paying consumer), contributor-pay models (where the contributor pays for the cost of maintaining the contribution and the provide makes it freely available), sponsorship models (such as commercial advertising), institutional models (where the institution assumes responsibility for the initiative), Government models (direct funding via Government agencies), and partnerships or exchanges (where the focus is on exchanging resources).

8. *Partnerships related to OEP:* Partnerships help organizations to develop OEP through the sharing of experiences, benchmarking of policies and strategies, and resource development. Some OEP initiatives involve more than one organization and a number of partnership models have emerged. In some cases these include different types of institution (universities, technical universities, colleges); in other cases they focus on specialist areas, each led by a senior academic in that field. Partnership models range from organizations, which involve partners, who jointly develop and operate learning content. Different types of institutions (universities, technical universities, colleges), and some partnerships are also multilingual.

9. *Perceived relevance for OEP:* For OEP to achieve circulation within a given context it is important that learners, professionals and management perceive OEP as relevant. This can be supported through strategies and policies and also through measures to raise acceptance and understanding for OEP. An important factor often proves to be the degree to which OEP successes are communicable to others.

10. *IPR and Copyright regulations:* One of the main focuses of OER lies in sharing, using and adapting resources. Copyright restrictions would negate the whole model. The four main legal issues associated with creating and making OER are copyright issues, ownership, intellectual

property rights, and permission for use. Many resources may be context-bound due to copyright issues in such a way that it is not possible to adapt the source to local prerequisites. Without the permission of the copyright holder, it is strictly prohibited to copy, reproduce or change resources.

11. *Motivational framework for OEP:* In order to use OER and turn towards the implementation of OEPs, the level of motivation from educational professionals and learners has to be high. Some social or cultural barriers are known: academics may be skeptical to the value of investing in the creation of OER, or they may lack the necessary skills (either technical or pedagogical) to create or use OER. Cultural obstacles may exist in terms of sharing or using resources developed by other teachers or institutions, and there are usually no systems to reward academics for engaging with OER initiatives. Academics may sometimes be apprehensive about taking part in such initiatives, feeling a loss of control and ownership over their teaching materials and concerns about possible misuse of any OER they produce. Achieving staff-buy in and support and making it relevant to them are key issues at this level.

12. *Tools to support sharing and exchange of OEP:* Every organization wanting to make progress in the field of OEP needs to adopt a series of tools which can be used for finding, sharing, and repurposing resources, as well as tools like social networks to share experiences and good practices. The emergence of the Creative Commons license was a major breakthrough in terms of providing a means for sharing resources openly and freely.

13. *Quality concepts for OEP:* Quality concepts for OEP often depend on the type of institution and their learning and teaching culture, the balance between the 'value' of teaching (in comparison to research activities in the institution), the degree to which OEP activities are seen as activities in their own right, the level of digital maturity of the institution, and the extent to which they had engaged with OEP work previously. QA models range from lightweight, user-defined models to strictly controlled hierarchical models.

14. *Level of knowledge and skills:* It is important to overcome educational professionals' initial concerns about OEP and to help with skills development and support. These include: mechanisms to foster and support community engagement, provision of case studies of good practice, running of parallel events and workshops, and provision of specific training materials. It can also comprise marketing materials, guidelines and tutorials on OER, an open textbook adoption worksheet, OER needs assessment surveys, policies and models.

15. *Digital literacy:* Digital literacy is especially important for the implementation of OEP as it deals with digital resources and practices. Digital literacy is often understood in a purely functional way where it is conceptualized as a person's ability to perform tasks effectively in a digital environment. However, conceptualizations that focus more on the broader cognitive skills involved are emerging, like the understanding that digital literacy is a special kind of mindset that enables users to perform intuitively in digital environments, and to easily and effectively access the wide range of knowledge embedded in these environments. Sometimes also critical thinking rather than technical competence is identified as the core skill of digital literacy.

16. *Support mechanisms for OEP:* Support for the development of OEP includes technical support for development, use and re-use, as well as re-purposing of OER, and training in order to equip teachers with the skills to design open learning environments and/or help learners to become autonomous learners.

These dimensions have helped to operationalize the concept of OEP in this study, and have been applied in the development of study instruments, data collection and analysis of data.

Assessing the impact of OER availability on the emergence of open educational practices in Africa

A three-step approach was developed by the OPAL initiative to help organizations assess the quality of their practices and learn how to strengthen OEP within their own specific context. Each of the following steps correspond to a set of specific dimensions to help with assessment (see Table 1):

- Step 1: Positioning your organization in the OEP trajectory: Use of OER and OEP
- Step 2: Creating a vision of openness and a strategy for OEP in an organization
- Step 3: Implementing and promoting OEP to transform learning

Table 1: Steps and corresponding dimensions

Steps	Dimensions of OEP
Step 1: Positioning your organisation in the OEP trajectory: Use of OER and OEPs	1. Using & Repurposing OER 2. Availability of a process for OER creation 3. Degree of sharing of OER and OEP 4. Extent of working with open learning architecture
Step 2: Creating a vision of openness and a strategy for OEP in an organisation	5. Organizational vision for OEP 6. Existing OEP strategies and policies 7. Business model related to OEP 8. Partnerships related to OEP 9. Perceived relevance for OEP
Step 3: Implementing and promoting OEP to transform learning	10. IPR and Copyright regulations 11. Motivational framework for OEP 12. Tools to support sharing and exchange of OEP 13. Quality concepts for OEP 14. Level of knowledge and skills 15. Digital literacy 16. Support mechanisms for OEP

The focus of this study has been on the dimensions found in Step 1 and has been adapted as shown. While in table 1 above use and re-purposing are combined, in the Table 2 (and this study), use and repurposing have been separated as different dimensions.

Table 2: Steps and corresponding dimensions

Steps	Dimensions of OEP
Step 1: Positioning your organisation in the OEP trajectory: Use of OER and OEPs	1. Using OER 2. Repurposing OER 3. Creation of OER 4. Sharing of OER

OEP can be influenced by actions, rules, and regulations at all levels of stakeholder involvement and identified stakeholders include policymakers, management and administrators, educational professionals, and learners (Camilleri et al., 2014). The findings reported in this study of the partner institution focus on the level of the institution and individual faculty. The study did not engage with learners.

Methodology

The Methodological Approach

This study sought to get an in depth understanding of the impact of OER on the emergence and extent of OEP in a specific context of implementation. The methodological approach chosen was case study. As Yin (2013) observes, case study is particularly suited to situations in which it is impossible to separate the phenomenon's variables from their context. By concentrating on a single phenomenon or entity (the case) the researcher aims to uncover the interaction of significant factors characteristic of the phenomenon. According to Yin, case studies can be explanatory, exploratory or descriptive. In this study the case study was both descriptive and exploratory. Yin also states that case studies are not necessarily qualitative or quantitative and can rely on a variety of methods depending on the issue being explored. The case study has more to do with the research design than with the methods of data collection. However, for this study, and considering its descriptive and exploratory orientation of this initial phase, the qualitative approach was considered more appropriate. Hence this study can be characterized as a qualitative case study. The qualitative case design is primarily focused on gaining insight, discovery, and interpretation.

Qualitative case studies have been characterized by Merriam (1998) as being particularistic, descriptive, and heuristic. She explains that particularistic means that the case study focuses on a particular situation, event, program, or phenomenon. The case itself is important for what it reveals about the phenomenon and for what it might represent. Descriptive means that the end product of a case study is a rich, "thick" description of the phenomenon under study. Thick description is a term from anthropology and means the complete, literal description of the incident or entity being investigated. The description is usually qualitative—that is, instead of reporting findings in numerical data, "the qualitative case study uses prose and literary techniques to describe, elicit images, and analyse situations…it presents documentation of events, quotes, samples and artefacts (Wilson, 1979, as cited in Merriam, 1998, p.30). Heuristic means that the case study illuminates the reader's understanding of the phenomenon under study. It can bring about the discovery of new meaning, extend the reader's experience, or confirm what is known. Additionally, previously unknown relationships and variables can be expected to emerge from the case study, leading to a rethinking of the phenomenon being studied (ibid).

Attempts to define case study often centre on delineating what is unique about the research design. The uniqueness of a case study lies not so much in the methods employed (although these are important) as in the questions asked and their relationship to the end product. Merriam (1998, p. 31-32, citing Stake, 1981) refers to Stake's elaboration of this notion which claims that knowledge learned from a case study is different from other research knowledge in four important ways:

- More concrete—case study knowledge resonates with our own experience because it is more vivid, concrete, and sensory than abstract.
- More contextual—our experiences are rooted in context, as is knowledge in case studies. This knowledge is distinguishable from the abstract, formal knowledge derived from other research designs.
- More developed by reader interpretation—readers bring to a case study their own experience and understanding, which lead to generalizations when new data for the case are added to old data. (Stake considers these generalizations to be "part of the knowledge produced by case studies" (1981, p.36).)

- Based more on reference populations determined by the reader—in generalizing as described above, readers have some population in mind. Thus, unlike traditional research, the reader participates in extending generalization to reference populations (Stake, 1981, p.35-36).

The foregoing characteristic of a qualitative case study does hold true for this study. The study is exploratory from both a contextual and methodological perspective as the initial objective was to explore the best way to study the phenomenon of interest, in the specific and unique study context. Starting off with a relatively open qualitative approach has allowed for flexibility to be able to sharpen the focus of the study and refine the research questions. However, the conceptual framework employed has helped bound the case and focus data collection, analysis and description of the phenomenon. The conceptual framework can also help orient the reader's understanding and interpretation. The study aims for a rich description of the findings, and the end product of the study can be described as concrete, contextual, and well detailed to allow for reader interpretation and generalization to their population or audience of reference. The study does have the characteristics of being particularistic, descriptive and heuristic.

The question of OEP has been operationalized using the dimensions outlined in the OEP conceptual framework (OPAL, 2012). The units of analyses are the specific dimensions of OEP being investigated, specifically the four dimensions of (i) use of OER, (ii) repurposing OER, (iii) creation of OER, and (iv) sharing of OER. The levels of analysis are also derived from the OEP conceptual framework that identified four main categories of stakeholders, including policy makers, management and administrators of educational organisations, educational professionals (such as faculty, instructional designers, course developers etc.), and learners. In the case of this study two levels of analysis have been delineated—the level of the institution and the level of the individual faculty. The institutional level focuses on activities at the level of the partner institution with a focus on faculty.

Data Collection

Data collection methods included face-to-face interviews and an online questionnaire, and was guided by the set of dimensions outlined in the OPAL (2012) OEP conceptual model.

Research sites and respondents

The tables below show the respondents of the study by nature of familiarity with the OER, and by institution. A questionnaire was developed and administered online using survey monkey, 195 emails were sent to people inviting them to participate in the study, 26 people attempted the questionnaire, but only 16 submit-ted completed responses. There was one Skype interview for this group. Six countries are represented in the study — Kenya, Somalia, Tanzania, Uganda, Zambia, and Zimbabwe — with one institution from each country. The institutions have been given pseudonyms (UA, UB, UC etc) in the study to help protect respondents' identities. The table below provides a profile of the respondents. In the report of findings respondents are referred to by the numbered identities (i.e. 1UB Tanzania, 7UC Uganda etc)

Table 3: Profile of study respondents by institution (n=26)

Institution	Respondent profile
UB Tanzania (n=6)	1. 1UB, Tanzania. Head of Dept. Psychology & Special Education. Head Assistive Special Technologies Unit. Used AVU OER for teaching & course development, & has developed an OER course.

	2. 2UB, Tanzania. Has used AVU OER to develop OER & has undergone training to develop OER.
	3. 3UB, Tanzania. Faculty Coordinator for Postgraduate Studies. Head of Department. Not familiar with AVU OER.
	4. 4UB, Tanzania. In charge of Regional Center. Has used AVU OER modules for teaching. Not familiar with terms OER&OEP.
	5. 5UB, Tanzania. Coordinator, Curriculum Design & Development Programmes. Has used an AVU OER for lesson preparation.
	6. 6UB, Tanzania. Associate Dean. Has used AVU OER for teaching though not much.
UC Uganda (n=5)	7. 7UC, Uganda (ODel Center Director). Has used AVU OER for teaching.
	8. 8UC, Uganda. Dean, Faculty of Science Has used AVU OER for teaching.
	9. 9UC, Uganda. Has used AVU OER modules for teaching. Somewhat familiar with terms OER&OEP
	10. 10UC, Uganda. Coordinator undergraduate programmes. Has used AVU OER for teaching and learning.
	11. 11UC, Uganda. Coordinator for Post graduate programmes. Author & peer-reviewer AVU OER.
UD Zambia (n=3)	12. 12UD, Zambia. Has used AVU ICT integration modules for teaching.
	13. 13UD, Zambia. HoD Quality Assurance & Research. Has used AVU OER ICT integration modules for teaching.
	14. 14UD, Author, AVU OER
UE Zimbabwe (n=1)	15. 5UE, Zimbabwe. Author & peer reviewer of AVU OER. Has used for teaching
UF Somalia (n=1)	16. 16UF, Somalia. Dean, Faculty of Computing & ICT. Was involved in setting up of Computer Laboratories for use by the AVU program at [UF].
UA Kenya (n=10)	17. 17UA, Kenya. Author AVU OER module, Prof. of Education & Coordinator of PhD programmes). Used for teaching
	18. 18UA Kenya (Director Open and Distance Learning, ODeL facilitator AVU OER), used OER for training in course development
	19. 19UA Kenya (Head of Math Department, author AVU OER)
	20. 20UA Kenya (E-learning project leader, instructor AVU ICT Basic Skills)
	21. 21UA Kenya, Author AVU OER, did not complete module
	22. 22UA Kenya, Department of Physics, Coordinator-ODeL Science (Has used AVU OER for teaching)
	23. 23UA Kenya, (Peer reviewer AVU OER), School of Mathematics

	24. 24UA Kenya Coordinator for AVU Project at UA, Former Dean, Department of Educational Studies
	25. 25UA Kenya (author AVU OER), Department of Computing and Informatics
UG Kenya (n=1)	26. 26UG Kenya (author AVU OER), Department of Educational Technology

The table below is a summary of nature of respondents familiarity with the AVU OER, however it does not show the overlap in familiarity. A number of respondents are familiar with the OER in more than one way, for example some are authors and use the OER to teach.

Table 4: Respondents by nature of familiarity with AVU OER

Profile of respondents	No of respondents
Authors	7
Author (did not complete module)	1
Peer reviewers	3
Users (Teaching etc)	12
Other (Facilitator/Coordinator)	2
Not familiar	1
Total	26

Face-to-face interviews - The face-to-face interviews formed the pilot study that helped inform the design of subsequent instruments. A semi-structured questionnaire was developed and was used in eleven interviews conducted at the University in Kenya. While the questionnaire offered some structure, follow-up questions to get in-depth understanding or clarification was used throughout the interviews. The sampling of respondents was purposive in that they were identified from AVU records, but the respondents also suggested other respondents. The respondents were representative of both the institutional level and individual level perspectives. For example, the institutional level of the partner institution was represented by respondents that were acting in some administrative capacity such as a Director of the Center for Open and Distance Learning, Coordinator of Open, Distance and eLearning (ODeL), or Head of the Mathematics Division. The individual level was represented by the individual faculty members. Those selected for the interview were in some way familiar with the AVU OER. The interview data was then transcribed.

Online questionnaire – A questionnaire was developed and administered online using survey monkey. Twenty-six people attempted the questionnaire, but only 16 submitted completed responses. There was one skype interview for this group. 195 emails were sent to people inviting them to participate in the study. The countries represented by those who completed the questionnaire included Kenya, Somalia, Tanzania, Uganda, Zambia, and Zimbabwe. The questions covered extent of use of OER, extent of repurposing OER, availability of a process for OER creation, degree of sharing of OER, and extent of working with OEPs. Under each dimension there were sub-questions on impact of AVU OER on these dimensions, barriers, institutional support, and recommendations.

Data Analysis

Face-to-face interviews - The interview data was transcribed, and the process for data analysis included reading over the interview transcripts to make sense of the data and sort through the responses to each interview question. Analysis of the data was informed by employing various coding strategies as discussed in Saldana (2009). Types of coding strategies employed included attribute coding, structural coding, and magnitude coding. For example, structural coding was appropriate for analysing data and reporting findings on the basis of the structure of the interview questionnaire. Saldana explains that structural coding applies a content-based or conceptual phrase representing a topic of inquiry to a segment of data that relates to a specific research question used to frame the interview. Some of the codes came from the questions and the conceptual framework, while others emerged from the respondents answers. The codes and sub-codes were then aggregated into meaningful thematic categories.

In using the conceptual framework, the issues of extent of an OEP dimension were determined at the level at which an activity was occurring, i.e., at the network, organizational or individual level. Hence, in the data collection and analysis, the roles of the different stakeholders were identified, and these were then linked to their level of influence with regard to the OEP dimension under investigation. The extent of the dimension was also coded using magnitude codes such as low, medium and high. These were further analysed for the reasons given by respondents for the existence or lack of certain OEP dimensions. The respondents thinking on their views on what would be the ideal status also emerged as a category of analysis.

Online questionnaire – The online questionnaire had questions which required two sets of quantitative responses – (high, medium, low, not applicable), or (yes, no, somewhat and not applicable). However for each quantitative response the respondents were always asked to provide an explanation or examples that supported their quantitative response.

The individual responses were organized into tables for each question, and depending on the question, were then categorized by those who responded high, medium, low, use or yes, no, somewhat. In some instances, the qualitative responses that fell in the medium or somewhat category, pointed in a more positive direction, or to a more negative direction. If the explanation of a response indicated a more positive aspect such as high or medium extent of use, but the explanation seemed to highlight a limiting issue such as modules need revising, then it was categorized or discussed under limitations and vice versa. It was rare for a response that indicated for example low extent of use or impact to then have a more positive explanation.

The coding and analysis of the data was done by staying as close to the data as possible. The coding mainly derived from the responses provided by the respondents, researchers on the team were able to produce relatively similar codes. Once coded then the operational parameters drawn from the dimensions of OEP, were then used to inform the analysis of the emerging themes.

Validity

When talking about issues of validity, generalizability and reliability description of persons places and events remains the cornerstone of qualitative research. Denzin and Lincoln (1998) caution that validity in the quantitative arena has a set of micro-definitions and citing Wolcott (1990) contend that the term validity which is over specified in one domain has become confusing because it is reassigned to another. "Validity in qualitative research has to do with description and explanation, and whether or not a given explanation fits a given description. In other words, is the explanation credible?" (p.50).

Wolcott (1990) provides a provocative discussion about seeking and rejecting validity. He argues for understanding the absurdity of validity by developing a case for no single "correct interpretations, (as cited in Denzin and Lincoln, 1998). They contend that the whole history of case study research stands solidly on its merits. In fact, the value of case study is its uniqueness, consequently, reliability in the traditional sense of replicability is pointless here (ibid).

With these considerations in mind and being beholden to measures that may be more applicable for predominantly quantitative studies, the overarching concern for this study when it comes to validity, is to produce a trustworthy and credible account and one that could be judged as such by the reference population that constitute the audience of this study.

Nonetheless the study has also been guided by Yin's (2003) validity measures that can be applied to case studies—construct validity, internal validity, external validity and reliability. Construct validity refers to establishing correct operational measures for the concepts being studied (Yin, 2003). In this study the test of construct validity was met by employing a conceptual framework used to operationalize the concept of OEP through the relevant dimensions. As discussed earlier and outlined in the research questions, the dimensions of OEP applicable to this study focus on use, repurposing, creation, sharing and working with OEP. These dimensions help delineate the parameters for both data collection and data analysis. These operational measures also address the issue of reliability in the sense that if one was to use the same protocols and instruments employed in this study, it would yield relatively similar data.

With regard to the external validity of the study, in the reporting of findings in a qualitative case study such as this the emphasis is more on the validity of the interpretation, such that validity ought to be judged by the extent to which an attempt has been made to fairly and accurately represent the data collected. Some of this depends on the design of the study in aiming for construct validity. To ensure validity of interpretation, the analysis also aimed for adequate and systematic use of the original data, focusing on rich descriptions, use of quotations from the different respondents and in general staying as close as possible to the original data to show readers that the interpretations presented relate closely to the data gathered.

Denzin and Lincoln (1998) note that by applying the suggestions of Lincoln and Guba (1985) and others, we may cross-check our work through member checks and audit trails, as a rule, in writing up the narrative, the qualitative researcher must decide what form the member check will take. They advise that the researcher needs to find a way to allow for the participants to review the material one way or another. For years, anthropologist and sociologists have incorporated a kind of member check by having an outsider read their field notes and interview transcripts. They noted that this current variation is a good one, for education research which is always public, open to the public and in many cases publically funded.

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Findings

The findings of the study are reported in this section. As stated above, the underlying assumption for this study is that availability of OER could potentially lead to the emergence of open education practices at the AVU partner institution. The study examined the emergence of OEP practices as a result of availability of AVU OER at some institutions that participated in the AVU Teacher Education project. The question of OEP was operationalized using the dimensions of OEP outlined in the conceptual framework outlined in the previous section and focused on four OEP dimensions in particular – using OER, repurposing OER, creating OER, and sharing of OER.

Emergence of OEP as a function of use

In the OEP conceptual framework, it is argued that finding and using OER is often the first step towards OEP. In other words, users need to be able to find and then use OER. The assumption then would be that the other dimensions of repurposing, creation and sharing should follow from there. In the case of the AVU and for its partner institutions, availability (finding) of OER happened within the context of the teacher education project. OER was availed to the network within the context of the development and implementation of the teacher education degree program in math and science. Aspects of use touch on use of the OER as a function of certification, use of OER due to content relevance of the OER for example for lesson preparation. Repurposing then happens due to use and relevance of the OER.

Use of AVU OER as a function of certification

The AVU OER was introduced to the participating institutions within the context of the development and implementation of the teacher education degree program in math and science. As has been described previously, the intended use of the AVU OER modules was as complete standalone curricula materials to be used by the participating institutions to offer a degree program in Math & Science as a blended face-face and online distance education program. To that end, the respondents were asked whether they knew if the AVU Teacher Education OER modules are being used as the primary instructional materials leading to an award for a Bachelor's degree (or any other qualification) at their institution and to name the degree or award.

The findings show that of the institutions in this study, Uganda and Zimbabwe were the only ones that indicated that the AVU OER was being used to offer a degree program in math and science. All the five respondents from UC Uganda indicated that the AVU OER were being used as the primary instructional material leading to the award of a Bachelor of Education degree with most mentioning that this was in their open, distance and eLearning (ODeL) program - which they named as B.Ed ODeL Science, see table 4 below. The respondent from Zimbabwe noted that some of the modules were being used in the B. Ed (Science and Maths) ODeL program, however, he explained that "the modules are heavily supplemented and complemented by other OER sources, sometimes to the extent that they may not necessarily take a primary position," explaining that it really depends on the particular lecturer giving the course.

Respondents from the institutions in Tanzania, Zambia, Somalia and Kenya noted incorporating use of the AVU OER in their existing programs but did not name or indicate that they were being used to offer a separate degree program in math and science based on the AVU OER as the primary instructional materials.

All respondents from Tanzania except for one indicated that the AVU OER was not being used as a primary resource in a program leading to an award of a degree. They cited various reasons for this

including - that currently they do not have OER policy to guide OER activities; that the AVU OER curriculum has been adopted, but has not been fully implemented to award a degree program; that the OER policy is still under preparation and issues of certification have not been cleared; that the university management is the one with the mandate to decide which curriculum has to be used for various awards; misalignment with the curriculum; or due to the fact that they are not integrated in the curriculum. The one respondent from Tanzania who indicated that the OER was being as a primary resource for an award never provided the name of the award. Tanzania has however offered the certificate program in ICT Basic Skills, so it is possible he was making reference to the certificate program. From Zambia, one respondent noted that in order for the AVU OER curriculum to be taken up for a degree, it could be necessary for the program organizers to express and justify the need to the institution, especially if the course content matched that of the institution.

Similarly the respondents from Kenya (except for one) indicated that the AVU OER was not being used to offer a degree program in math and science. For example, the Director Open and Distance Learning admitted that even though using the AVU OER had meant his institution did not have to develop its own degree program in that area, the limitation of the AVU program was that it was only in four broad subject areas, "they were only in four broad subject areas [Math, Biology, Chemistry and Physics], therefore, they were going to exclude several other areas." Another respondent (Head of Dept. author AVU OER) noted that when they were asked to develop the modules for the Teacher Education project, he was under the impression the AVU Teacher Education project was to be separate program at the institution. While noting that that was not the case, he said the AVU OER were being used to reinforce the distance learning program and that they recommend "the books [to] our distance learners. The one respondent from Kenya who did indicate use as a primary resource noted that it was for the Bachelor of Education program, but it seems unlikely that this was a separate or new degree program in math and science and more likely that certain modules were used in primary way in an existing program. Furthermore this respondent 17UA Kenya did author one of the teacher professional development modules and so it is quite likely to that they may select and use extensively module they were familiar with.

Table 5: Use of AVU OER as primary resource for an award

Award	Institution	Responses
Degree	1. UC Uganda	B. Ed ODeL (Science)
	2. UE Zimbabwe	B. Ed (Science and Math) ODeL program
Certificate	1. UA Kenya	ICT Basic Skills/ICT Integration
	2. UB Tanzania	ICT Basic Skills/ICT Integration
	3. UD Zambia	ICT Basic Skills/ICT Integration
	4. UF Somalia	ICT Basic Skills/ICT Integration

Besides the degree program the other award was a certificate program in ICT Basic Skills and ICT Integration in the teaching of the math and science subjects. This was offered as a joint certificate program in ICT basic skills and ICT integration in math and science with UB Tanzania, UB Kenya, UD Zambia and UF Somalia and this was confirmed by the respondents from those institutions. The respondent from Zambia noted that students in the program were those who were already trained in various sciences and mathematics content but are not conversant with ICT. He explained that "the

AVU materials gave them the basic skills of ICT, noting that the materials enabled trainees to integrate ICT in the teaching of sciences and mathematics.

Compared to the degree program, use of the AVU OER for a certificate program was pretty straightforward with a joint certificate issued between AVU and the partner institution. The degree program on the other hand was to be awarded by the institutions within their existing accreditation structures. One respondent summarized the situation noting that without a joint certification for the degree program, the AVU OER was viewed more as a supplementary resource.

So while some used the AVU OER as a primary resource, others used them to supplement their existing resources. In cases where the AVU OER was the primary resource, respondents noted that they were not used on their own, but were supplemented with other resources, or other OER with some of the ones mentioned being from TESSA or the Commonwealth of Learning. One respondent 15UE Zimbabwe while noting that the AVU OER was used as a primary resource, also stated that "the modules are heavily supplemented and complemented by other OER sources, sometimes to the extent that they may not necessarily take a primary position," explaining that it really depends on the particular lecturer giving the course.

In conclusion, whether use was primary and for an award, or supplementary, the extent of use of the AVU OER greatly depended on the nature of use, the relevance of the OER to the users, knowledge and skills, and the institutional context as described in the sections that follow

Use as a function of content relevance

Regardless of whether use was primary or supplementary, respondents indicated using the AVU OER content in a variety of ways to support their work, notably in the development of open and distance learning course materials; for lesson preparation; for student readings, and to train faculty in developing their own courses, for lesson preparation, for student readings.

Use in developing course materials for distance learning

Respondent 1UB Tanzania, 2UB Tanzania, 18UA Kenya indicated that they use OER when developing course materials. For example respondent 18UA Kenya noted the use of OER as a training resource in the development of courses for distance learning. He stated that when they are involved in training they refer faculty to OER materials…. "and we [refer] them to use these as resource areas." He noted that they use resources that "*are in familiar areas and from familiar institutions, "* including the AVU OER, the Commonwealth of Learning and TESSA, noting that compared to the other two the AVU OER were particularly the closest to their curriculum. He noted that this could be partly due to the fact that UA faculty did participate in the creation of some the OER modules.

A number of respondents cited use of AVU OER in lesson preparation. Respondent 7UC Uganda, who indicated that he [downloaded] lesson notes for his lectures; 10UC Uganda noted consulting the OER when preparing lecture notes; 5UB Tanzania pointed to the fact that the AVU OER are used as sources of information as lecturers prepare their own courses; similarly, 17UA Kenya, stated that he uses OER for lesson preparation and noted that they use OER from AVU to enrich various curricula; 4UB Tanzania noted using AVU OER for courses taught and using the modules as a guide for preparation because the contents are highly organized; and 8UC Uganda noted that the modules were very good for topic introduction and stated that the AVU OER help students understand better.

There were those who noted that the AVU OER formed part of the readings for students in the degree program. 13UD Zambia noted that "they had been used in supporting Bachelors students;" similarly

respondent 15UE Zimbabwe noted that OER form part of required reading texts for most of courses offered in the Bachelor of Education (ODeL) degree program; 9UC Uganda noted that the soft copies of the AVU OER on CD were so helpful as they avail the materials to the students before they [meet] face to face.

Limitations in use due to content

While respondents highlighted the various ways the AVU OER content was useful to their work, they also pointed to limitations in the content, with most making recommendations on the need for revisions. Respondent 8UC Uganda, noted that while the modules were good for introduction they were not adequate for the distance education degree program which was aligned to the fulltime degree program at the university. He indicated that the modules "don't provide all the content as in the curriculum." He recommended for the need to revise modules in line with the BEd curriculum; 9UC Uganda stated it was a challenge they often are required to blend the AVU materials with the university curriculum; 11UC Uganda pointed to the fact that the modules were developed about ten years ago and needed revising. He noted that, "the modules were fairly used in the first 5 years but now the lecturers have access to new information and new publications which is demanded by students." The need for revision of the OER was also cited to by 15UE Zimbabwe who stated that continuous improvement on the AVU OER is encouraged at his institution. He noted that the AVU OER modules should be considered as foundational and then there is need to "modify, refine or adapt them for ones purposes in sensitivity to the context."

There were those who pointed to low use by students, for example while 4UB Tanzania (In charge of Regional Center, has used AVU OER modules for teaching) who stated that students seemed to invest more effort in reading course materials issued by their lecturers and minimal efforts to the supplementary materials including AVU OER; 3UB Tanzania (has not used AVU OER), who noted that only few modules are being used; and 6UB Tanzania (has used AVU OER for teaching but not much) who noted that they were not being used despite the availability.

Other limitations on use did not focus specifically on content: - There were those who pointed to low use by students, for example one respondent cited that students seemed to invest more effort in reading course materials issued by their lecturers and minimal efforts to the supplementary materials (4UB Tanzania); others pointed to low use, or no use despite the availability (3UB & 6UB Tanzania)

Repurposing as a function of contextualizing OER

Repurposing was defined in the study as integrating an OER into one's own teaching and learning is called and often involves dismantling the original resource and taking what is useful and setting aside the unnecessary (OPAL, 2012). The following section describes the impact of the AVU OER on the dimension of repurposing at the partner institution. A theme that came through was repurposing as a function of contextualizing the AVU OER.

Respondents cited the need and effort to repurpose or adapt the OER to certain contextual conditions or standards, and the reasons provided are as follows: Respondent 5UB Tanzania noted that adaptation is done in recognition of differences in local contexts. He noted that the AVU OER modules provided insight for development of his own modules and that he freely uses them when developing courses; 7UC Uganda indicated that the teaching staff has customized modules to suit the university's standard, and that they customized the modules to conduct lessons; 17UA Kenya stated that depending on industry and stakeholder requirements "repurposing OER to align with the syllabus is certain," indicating that they picked the relevant content and methodologies and improved by

"inserting new developments in our syllabuses;" 18UA Kenya explained that in the development of courses, the OER were not being used as is, but were being repurposed by the course writers when developing their own instructional materials; and 8UC Uganda cited adapting the modules by adding supplementary content to the AVU OER. Certain limitations as far as content were also noted, for example respondent 7UC Uganda indicated that while at his institution they customized modules to conduct lessons, the customized modules still bear less practical lessons.

There were cross-cutting themes that had implications for repurposing and the other dimensions such as awareness, access to ICT, knowledge and skills, and these are discussed below.

Emergence of OEP as a function of knowledge and skills

Knowledge and skills emerged as a recurring category. The themes that emerged included impact of the AVU OER on knowledge and skills such as being able to find new content online; being able to customize (repurpose) OER, create OER content and becoming ICT literate. A number of recommendations also focused on the need for training, workshops and collaboration.

Use and repurposing as a function of knowledge and skills

Respondent 17UA Kenya pointed to the fact that most lecturers customize AVU OER modules and use at his institution, noting that any lecturer who is ICT compliant has no problem using OER; 11UC Uganda indicated that he now has experience in searching for relevant information on the web and pointed to finding new content on the internet, "there is now new OER content available on the internet in Genetics and Evolution;" 16UF Somalia, explained that teaching and learning has become more fun, effective and up to date with current trends and the latest information coming through OER content, noting that in the field of computing one cannot effectively teach without OER content in this time and age.

12UD Zambia noted that the AVU OER had an impact on him becoming ICT literate, "I write … in Word, I do any calculations and plot graphs in Excel, I prepare lectures and present them in PowerPoint. He noted using OER content from AVU and TESSA and stated that since he has access to relevant online materials and no longer worries about text books.

Creation as a function of knowledge and skills

Respondents cited the various ways in which the AVU OER was having an impact on their process for creation. Respondent 15UE noted that "the OER had an inspiring effect and opened the possibility that was never apparent to me before that." Respondent 1UB indicated having developed an OER, while 2UB was in the process of developing OER. A few respondents cited that they use AVU OER to write other modules for their distance education program, to update courses, while others referred to having developed "e-content" or "e-resources," and developing an interest in designing an OER module. On the question of whether there was an institutional process for creation, respondent 1UB outlined the following steps—training of course developers, developing courses outlines, developing the courses and piloting the modules; respondent 2UB pointed to his institutions intention to transform all courses to OER, while 15UE noted that "individuals are free, actually heavily encouraged to create and utilize OER… it really is left to individual will and skill." The AVU OER having an impact on the process for creation was cited mostly at the individual level, than at the institutional level.

Respondents were asked whether they had ever created OER, and table 5 below shows the responses. Ten respondents indicated yes (seven were authors was in the AVU project), twelve no, 3 somewhat and 1 not applicable.

Table 6: Have you ever created OER by respondents (n=26)

	UA KE (n=10)	UC TZ (n=6)	UB UG (n=5)	UD ZM (n=2)	UE ZI (n=1)	UF SO (n=1)	Total
Yes	4	2	2	-	1	-	10
No	5	3	2	2	-	-	12
Somewhat	1	1	1	-	-	-	3
NA						1	1
Total	10	6	5	2	1	1	26

Conversely, not having the appropriate knowledge and skills was considered a barrier to the emergence of the OEP dimensions. Respondent 1UB Tanzania identified low ICT literacy as a barrier to use including for students with disability; 8UC Uganda, identified, little knowledge on the use of modules; 16UF Somalia indicated that the Faculty of Education is limited in capacity and human resource expertise to exclusively handle programs such as OER noting that "participants do not appreciate technology to the full extent….and this shows in the slow uptake of the program by students from the department." He suggested that there needed to be a change in strategy to include Faculty of Computing and ICT in the program, "to a greater extent to achieve better results;" 10UC Uganda noted that facilitation was inadequate; 12UD Zambia indicated not having created OER, so did 4UB Tanzania who noted that he had not come across of any procedures for creating OER, stating that he was not exposed to the necessary information for creating OER content.

Recommendations focused on developing relevant knowledge and skills

A number of recommendations provided by the respondents focused on the need for training if OER is to be used effectively. The themes that emerged included organize workshops, train staff and avail more resources for training. Barriers related to lack of ICT literacy skills was highlighted especially by respondent 1UB Tanzania who recommended the need for ICT facilitators and the need to support institutions to teach ICT courses to all. The need for training of teachers and staff, information sharing on the importance of using, writing and publishing OER modules was cited by (1UB Tanzania, 3UB Tanzania, 7UC Uganda, 11UC Uganda); 16UF Somalia recommended the need to involve the department of ICT to train teachers on the job, "most importantly engage Faculty of Computing and ICT to play a major role at [the] institutional level." 2UB Tanzania indicated that the institution should organize workshops on AVU OER. Some respondents noted that there is lack of regular training and resources, indicating that more training and resources was required (11UC Uganda). Some respondents pointed out that staff training was being carried out, or that more training materials were being organized for the lecturers (7UC Uganda, 10UC Uganda). When the AVU OER were developed, only a select few faculty were involved in the writing of the OER modules. A number of the recommendations noted that all course instructors or faculty should undergo training on creation of OER; that each person should be trained to write self-instructional content. Another recommendation pointed on the need to train staff on the use of the LMS. The recommendations also touched on aspects of peer training, with a respondent noting that this could be provided by those who had already gained these skills in the AVU project.

Collaboration and stakeholder involvement

Collaboration and stakeholder involvement was a theme that emerged when respondents pointed to the need to engage with other stakeholders, whether from the industry, or fellow faculty from other institutions in repurposing or creating. Respondent 10UC Uganda identified low involvement of the key stakeholders as a barrier and recommended that key stakeholders to be involved in the repurposing of the OER; 5UB Tanzania recommended that there was need to arrange for joint review to update some materials; 7UC Uganda recommended that inter university physical visits be encouraged; 12UD Zambia recommended that the AVU program organisers at their institution should work with instructors to begin the process of repurposing which in turn can spread to others; 17UA Kenya indicated that they are given the liberty to fit industry and stakeholder proposals into the syllabuses and recommended that stakeholder and industry recommendations be included; 16UF Somalia made a case for interdepartmental collaboration. He attributed the slow uptake of the AVU OER program to Faculty of Education not appreciating the full extent of technology, and suggested a strategy to include Faculty of Computing and ICT in the program, to play a major role at [the] institutional level."

Emergence of OEP as a function of access to OER and ICT

While there were other factors that had implications for access to OER, ICT infrastructure, tools and resources were the most significant. Adoption of ODeL mode of delivery is discussed in this section because it was also a function of deploying ICT. Ease of access to AVU OER, appeared to have implications for extent of use as well as the other dimensions. It was observed that those who indicated high or medium extent of use pointed to being able to access the OER. The OER is on the university website for all to access (1UB Tanzania); available electronically in the university library (5UB Tanzania); has access to OER content on the internet (11UC Uganda, 16UF Somalia); easily accesses the online materials when WiFi is working (12UD Zambia); and WiFi has been provided on the university campus (7UC Uganda). Access to print copies of the AVU OER was also cited, for example, 20UA Kenya noted that at the start of the project students received the original hardcopy textbooks, but for subsequent groups photocopies were reproduced and given to students. He also noted that providing the modules as CD ROM was not useful if students did not have computer skills. Some respondents indicated access by mentioning specific modules such as basic chemistry and inorganic chemistry (9UC Uganda); all the biology modules, the environmental chemistry module; and the educational research module (4UB Tanzania) etc.

Repurposing as a function of access to OER which was in turn a function of access to technology was a theme that emerged when respondents indicated either high or low extent of repurposing. Respondent 1UB Tanzania pointed to the fact that the AVU OER were on the university website for members to access; 5UB Tanzania indicated that materials are freely available in the university library as a matter of policy; 12UD Zambia indicated that he has facilities from the institution that can enable him to access and adapt the OER. Conversely 8UC Uganda indicated that accessibility of online resources is not easy; 1UB Tanzania identified lack of bandwidth was a barrier; 7UC Uganda noted extent of repurposing as low, noting that his "university has not bought computers to control scarcity of media," and recommended that they buy computers.

Being able to access OER online had implications for the dimension of creation as indicated by respondents who cited either high or low impact on creation. Respondent 1UB Tanzania who indicated a high impact of AVU OER on process for creation pointed to the fact that all members have access to the materials; 17UA also noted that there were no barriers to the process of creating OER, noting that all [faculty] members have access to the materials; 7UC Uganda (ODeL Center

Director, has used AVU OER for teaching) noted that his university had built an LMS and he developed e-content and uploaded it on the built LMS platform.

ICT tools, infrastructure and policies were found to have implications for the dimension of sharing, where ICT access enabled or lack of access constrained extent and impact of sharing. The following themes were identified – existence of a platform for sharing, such as a repository or LMS, social network tools, internet connectivity, ICT learning facilities and access to computers. Respondent 12UD Zambia indicated that they are free to share the OER using any social network tools; noted that the university is creating repository for sharing OER; 13UD Zambia indicated that they share [OER] through the institutional repository online; 7UC Uganda highlighted his institutions support, noting that his university has built an LMS, he also pointed to free WiFi provision. He indicated that he has shared the OER on his university LMS platform; 9UC Uganda indicated that recently, there was the introduction of e-campus, so it is possible to share some materials; 20UA Kenya noted that he was able to redistribute the AVU OER because the use of social media tools such as YouTube videos, Facebook, email and blogs which support sharing and exchange of information about OER. Furthermore, he noted that use of such social media tools that support sharing and exchange about OER are a widespread reality amongst his colleagues and himself.

OEP constrained by limitations in connectivity and ICT tools

Conversely, poor connectivity and lack of access to computers was seen to constrain access to OER and consequently limited the OEP dimensions of use, repurpose, creation and sharing. On the dimension of creation, respondent 9UC Uganda noted that even the existing OER content was not readily available to the lecturers. 8UC Uganda cited not enough copies of the AVU OER module and also indicated that accessibility of online resources is not easy; similarly, 4UB Tanzania indicated that AVU materials are in limited supply, thus only few could get access of them and 1UB Tanzania recommended that the AVU OER be made available to all.

Limitations in access to technology including internet connectivity and computers was cited by 7UC Uganda who cited internet failure; 8UC Uganda, identified poor infrastructure; 10UC Uganda noted there is inadequate supply of network in the university especially in lecture rooms and computer labs; similarly, 1UB Tanzania also identified poor internet connectivity; 10UC Uganda indicated that the process [to integrate OER] is still slow because, "in most cases the teaching is conventional due to inadequate facilities for internet services in the directorate;" 9UC Uganda indicated that they have challenges with internet being on and off, and that the band width was also very low; 11UC Uganda noted limited connectivity, citing limited access to web based materials as a barrier; 12UD Zambia indicated that sometimes there is a challenge with the internet facility and so he cannot access the OER when he needs it; 16UF Somalia, cited unavailability or high cost of basic resources such as internet connectivity.

The other ICT limitation was the lack of access to computers. Respondent 1UB Tanzania identified lack of computers as a barrier to use; 7UC Uganda indicated that some lecturers do not own computers, and are not connected in their homes; he also stated that "many students still do not have computer[s] and e-devices;"17UA Kenya, noted that most people use personal laptop computers, but not everyone has them; 13UD Zambia stated that lack of computer facilities to support the students in their homes and schools was a barrier to use.

Respondents offered recommendations to facilitate access to technology. These included, the need for adequate ICT learning facilities, improved internet connectivity, computers for students, promote use of online repository and open-up access beyond registered students and even to general public.

Respondent 17UA Kenya recommended that there is need to empower each lecturer to own or have access to a laptop or desktop computer; 13UD Zambia indicated that there is need for institutions to partner with AVU and his institution to provide adequate computer facilities in provincial centres for all distance students to benefit now that they are using the eLearning platform for teaching and learning purposes. It is worth pointing out here that the partnership of the AVU and the partner universities included the installation of computer labs to provide access to ICT facilities needed to facilitate delivery of the teacher education program and the partner universities.

Besides internet connectivity inability to pay to access the learning management system also emerged as an issue of access to the OER. 5UB Tanzania noted lack of access to courses on the learning management system and pointed to the fact that the course modules which are posted on Moodle are not open to everyone wanting them but only to those who pay; similarly, 7UC Uganda indicated that the impact on process for creation was low because many of his students are yet to be registered on the LMS platform. He had noted that there was insufficient funding to enable all the teaching staff of his university to access the built LMS platform.

Adoption of ODeL mode of delivery

Adoption of ODeL mode of delivery is discussed here because it was also a function of deploying ICT. The AVU teacher education program was developed to be delivered as a distance education program that could be a blend of online and face-to-face delivery. This ODeL mode of delivery and the ICT integrated nature of the AVU OER had implications for the emergence of OEP. Respondent 24UA Kenya explained that initially the Faculty of Sciences was hesitant to adopt an online and eLearning teaching mode for the science courses, as they felt that science courses could not be taught through ODeL. This changed however, when they participated in AVU project and the creation of the OER modules, admitting that it led to a paradigm shift at the management level of the institution. They came to appreciate and believe that online and distance teaching of science courses was feasible.

> "…To that extent, AVU had the greatest impact on the science faculty as was the intention, really. And that's why we were even able to start our B.Ed Science [in distance. This was because our mentality had been changed to accept this. The people now appreciated that this could be done." Resp. 24UA

Similarly, 15UE Zimbabwe stated that [the AVU OER], "initiated the idea and practice of pedagogy," and was inspirational to the idea of ODeL mode of learning at the institution. ICT integration was highlighted by other respondents. 18UA Kenya stated that, ICT integration was the strongest impact the AVU had, "*that [ICT] integration element is the strongest aspect of AVU.*" He highlighted how integrating technology in teaching to bring instruction to life was important. He elaborated that animation was important in teaching and gave the example of how "*when you are teaching about the blood system, now with integrating technology they [students] can see the flow of the blood system.*" He noted that following the lead of the AVU, his institution had now incorporated the aspect of ICT integration in the development of courses; 12UD Zambia stated that the institution "encourages the staff and students who are trained to integrate ICT in their lectures and lessons and 13UD Zambia indicated that "the certificate program in ICT where about 90 teachers have been trained across the country to integrate ICT in their teaching subjects has transformed their teaching skills in class and pupils are appreciating learning process."

Conversely, there were instances that ICT integration was low as cited by 10UC Uganda who indicated that in most cases the teaching is conventional due to inadequate facilities for internet

services, noting that impact on use is still slow because, "in most cases we are using the ordinary way of teaching."

Emergence of OEP as a function of institutional support and policies

The need for OER policy was seen to pertain to all the issues discussed prior and in this section. These include facilitate access to OER, ICT infrastructure and tools, intellectual property etc. Conversely, lack clear policies and strategies seen to constrain the emergence of OEP. Workload, time and motivation were other factors that were cited especially for the dimensions of repurposing and sharing. Awareness of the OER and freedom to use OER were also cited under institutional support. Recommendations also cited the need to avail more resources and for more institutional involvement.

Under institutional support and policy a number of factors were seen to have implications for the emergence of OEP – the responses were varied from the existence of policies, policies being in development, unclear or non-existent. Other factors included the need for more resources and institutional involvement. For example with regards to institutional support and policies for repurposing, 3UB Tanzania indicated that the institution highly supports staff to adapt OER materials, and that an OER policy would be launched soon; similarly, 11UC Uganda also indicated that development of policies and strategies was in progress. Conversely, 4UB Tanzania stated that there were no policies, and that the AVU OER are used as any other supplementary material, noting that in many instances they have to abide with the requirement of the university; 8UC Uganda indicated that repurposing is done as a lecturer with minimal institutional involvement; 10UC Uganda attributed low repurposing to low commitment from university managers; while 11UC Uganda indicated that there had been low follow-up on the project for a long time. 7UC Uganda while noting that his university had built an LMS, indicated that that there was insufficient funding to enable all the teaching staff of his university to access the LMS platform.

When it came to institutional support for the dimension of creation, respondents pointed to a number of factors. There is a move by the university to transform all its courses into OER (2UB Tanzania); there is an effort to institutionalize the use of online materials (10 UC Uganda); that the university encourages that each course have an OER module (17UA Kenya); and 9UC Uganda recommended that content created should not deviate from the university curriculum. Others focused on the benefit that OER can bring to the institution. 18UA Kenya explained that the adoption of the AVU OER modules did influence the institution into wanting to create and make their resources open. He cited academic visibility as a benefit of making resources open when you show the academic content being provided to students in the various programs. He noted that such transparency can mean promotion of staff members, and also opportunities to consult and collaborate. He saw this as a big benefit to the institution generally and to the individual if you are known to be an expert in an area, then other people wanting to benefit from your courses can link up with you. However, he noted that opening up the institution's courses required addressing issues of intellectual property.

The issue of intellectual property was mentioned by 13UD Zambia who indicated that there is an institutional policy on intellectual property related to OER. On the other hand 18UA Kenya, explained the steps need to be taken to address the issues of intellectual property at his institution. He shared that there was a policy statement stating that the institution would like to have OER materials. However, he noted that to implement the policy required the acceptance of the lecturers, *"implementation required the acceptance of the owners of the academic information—the lecturers. The owners are the lecturers."* According to him in the existing institution terms and conditions, course authors *"surrender the courses to the institution to use but [the authors] retain the intellectual property right.* He explained that if his institution wanted to open and share its resources, it would require a change in

the current policy. This policy would have to be revised to allow for the institution to open up its resources globally. So while the institution has a process for creating courses, and making them accessible online, for registered students both on campus and at a distance, what is not in place is a process for releasing these resources as OER, or developing these materials in a way that they can be made open. A policy to make resources open is considered especially important for process for OER creation. As outlined in the OEP dimension, in order for an organization to progress towards OEP it is important to define a process whereby educational resources are made available under free license schemes to become open educational resources. Only then will these resources be available for others to use and/or repurpose internally as well as externally (OPAL, 2012)

Motivation, time, attitude - Motivation and time, and resources were the other institutional factors considered to have implications for the OEP dimensions, especially for repurposing and creation. Factors highlighted included user attitudes for example, negative attitudes in favor of personal emoluments was cited by 13UD Zambia; 7UC Uganda also cited user attitudes; 10UC Uganda, identified negative attitude as barriers to use; and 16UF Somalia, cited lack of interest on the part of some lecturers. Another factor was teaching staff overwhelmed with work (7UC Uganda, 15UE Zimbabwe) with 15UE stating "we just do not have meaningful time to do that due to work overloads."

Lack of time was also cited by (2UB & 3UB Tanzania, 10UC & 11UC Uganda) as well as lack of funds and need for more resources (2UB Tanzania, 11UC Uganda). Some of the recommendations relating to the aspects above included, teachers need to be motivated to prepare OER content and materials produced should be considered in staff promotion (3UB Tanzania); university should provide funds for course instructors who transform courses into OER (2UB Tanzania); and more time be provided by reduction of work overloads (15UE Zimbabwe).

Emergence of OEP as a function of awareness: - was one of the themes that emerged especially in response to level of institutional support. Those who cited high extent of use, creation or sharing cited having access to or being aware of the AVU OER. This has been discussed above, where they indicated being able to access and use the AVU OER.

Conversely, lack of awareness had implications for emergence of OEP. Respondent 16UF Somali stated that the administration supports AVU OER programs fully, the materials are available, but that awareness is not at the desirable level; 2UB Tanzania stated that he has never been officially informed of AVU OER; 4UB Tanzania stated that he found the AVU OER on the bookshelves and started using them, but was never informed by his institution of their availability; 3UB Tanzania stated that few instructors use OER modules for teaching explained that the reason for this may be lack of proper and adequate information on the OER modules available.

Respondents made recommendations on the need to create awareness and promote use of the AVU OER. There is need to use these materials in teaching (6UB Tanzania); lecturers should be encouraged to use the materials in everyday life both online and off line (10UC Uganda); university should inform course instructors on the availability of OER materials that can be used in their courses (2UB Tanzania). 12UD Zambia noted the need to popularize the modules so that more people at the institution can know about them and use them in lessons. He recommended trying out the OER in various classes of pre-service students of biology, chemistry, physics and mathematics not part of the select groups in the AVU Teacher Education project. If the OER are found to be helpful to the learners, then recommendations be made to the institution to make them part of the materials used in teaching and learning.

Freedom to use OER - Emergence of OEP as a function of freedom to use OER was another finding that emerged especially in relation to questions on barriers to use. Most respondents indicated having freedom to use OER although some limitations were noted related to interest and motivation. Respondent 4UB Tanzania stated that they are free to use the AVU OER modules; 5UB Tanzania noted that they [the AVU OER] are freely used provided appropriately acknowledged;   15UE Zimbabwe noted that use of OER is left to the discretion of the individual lecturer; 17UA Kenya stated that each lecturer has the liberty to [use] OER from AVU and other recognized institutions to enrich the learner experience; 16UF Somali indicated that like in most other universities, faculty are very autonomous in their operations. He stated that the administration fully supports AVU OER modules but noted a lack of implementation capacity which needs to be addressed for impact of OER AVU modules to be truly felt; 4UB Tanzania stated that they are free to use the AVU OER modules.

Study Limitations

This study was exploratory and qualitative in nature and does not make any claims to the generalizability of the findings. It was focused on what would emerge from the data with regards to the dimension of OEP. A follow-up study could focus on a narrower theme like knowledge and skills and its implications for the emergence of OEP within a specific course or subject area such as Physics, Chemistry, Biology, Mathematics or the Education Professional courses. Considering the challenges identified in the curriculum for a degree program on the AVU OER, focusing on the certificate program such as ICT basic skills and ICT integration courses could also yield important information about primary use of the OER.

Conclusion

This study confirms some of the findings in the OEP literature (Ehlers, 2011; OPAL, 2012), that without a concerted effort availability of OER will not necessarily translate into the emergence of OEP. Similar issues found in the OPAL study were also found in this study, such the need for institutional support, the need for appropriate knowledge and skills, and the need for access to technology and resources. Time, workload, motivation and OER content does not always align with the institution's curriculum were also issues raised. Institutional context and policies need to be supportive for availability of OER to fully translate into OEP.

Despite these findings, still the availability of OER did lead to the emergence of some OEP, but this was found to be more at the level of the individual faculty than at the level of the institution. These included impact on knowledge and skills such as finding and using OER, considered the first dimension in OEP. Using the AVU OER has also led to users repurposing the OER to suit the instructional context. Involvement in authoring the AVU OER modules also help build capacity in those who participated, however recommendations cited the need to involve all faculty as well as the need to for collaboration, training, and workshops for to exchange knowledge and learn from each other. Institutional support for these activities is considered key and this can only happen with full integration of use of OER for instruction at the institutions.

The findings have implications for policy and practice of the AVU and across its network of partner institutions and beyond to be able to extend the use of OER by strengthening the different dimensions of practice for purposes of improving the quality of teaching and learning in the digital age, and particularly for future teacher training purposes which was the underlying motivation of this study. While it was found that there were some institutions that have developed or are working to develop and OER policy, this will be an important area to help integrate and mainstream going beyond use of

OER to advancing OEP. The development of policy should cover aspects of knowledge and skills such as appropriate training and partnerships, widening access and availability of OER to faculty and learners, strengthening the ICT infrastructure such as connectivity and access to computers, addressing aspects of motivation and rewards for OEP.

In conclusion, for availability of OER to lead to OEP, there needs to be a higher level of integration of into the curriculum. This would require integration at the institutional level as well as the level of the individual faculty. Appropriate policies supporting this would need to be developed.

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Appendices

Appendix 1: The AVU Teacher Education OER Courseware Modules

Table 6: Modules/Subjects		
ICT Integration in Education		Teacher Education
ICT Integration in Chemistry		Classroom Management and Supervision
ICT Integration in Biology		Comparative Education
ICT Integration in Mathematics		Contemporary Issues in Education
ICT Integration in Physics		Curriculum Studies
		Developmental Psychology
ICT Basic Skills		Educational Communication
Multimedia Design and Applications		Educational Evaluation and Testing
Graphics & Information Management Systems		Educational Management
Text-Based Productivity Tools		Educational Research
Introduction to ICT		Introduction to General Psychology
		History of Education
Physics		Introduction to Guidance and Counseling
Mathematical Physics I		Learning Psychology
Mechanics 1		Managing a School's Educational Resources
Electricity and Magnetism 2		Philosophy of Education
Quantum Mechanics		Reflective Teaching
Geometrical Optics and Physical Optics		Sociology of Education
Atomic Physics		Special Needs Education
Electricity and Magnetism		Teaching Methodology
Electronics		
Mathematical Physics II		Biology
Mechanics II		Animal Diversity
Nuclear Physics		Cell Biology and Genetics

Properties of Matter		Diversity of Algae and Plants
Solid State Physics		Ecology and Environment
Statistical Physics		Evolution Biology
Thermal Physics		Microbiology and Mycology
		Plant and Animal Physiology
Mathematics		
Analysis 1		Chemistry
Analysis 2		Environmental Chemistry
Basic Mathematics		Industrial Chemistry
Differential Equations		Inorganic Chemistry
Linear Algebra		Introductory Chemistry 1
Mechanics		Introductory Chemistry 2
Geometry		Macromolecules in Biological System
Calculus		Organic Chemistry 1
Probability and Statistics		Organic Chemistry 2
Linear Programming		Physical Chemistry 1
Numerical Methods		Physical Chemistry 2
Number theory		Separation, Electroanalytical & Spectrochemical Techniques
		Volumetric Chemical Analysis

Appendix 2: Profile of Study Respondents

Table 7: Profile of study respondents by institution (n=26)	
UB Tanzania (n=6)	27. 1UB, Tanzania. Head of Dept. Psychology & Special Education. Head Assistive Special Technologies Unit. Used AVU OER for teaching & course development, & has developed an OER course.
	28. 2UB, Tanzania. Has used AVU OER to develop OER & has undergone training to develop OER.
	29. 3UB, Tanzania. Faculty Coordinator for Postgraduate Studies. Head of Department. Not familiar with AVU OER.
	30. 4UB, Tanzania. Has used AVU OER modules for teaching. Not familiar with terms OER&OEP. In charge of Regional Center)
	31. 5UB, Tanzania. Coordinator, Curriculum Design & Development Programmes. Has used an AVU OER for lesson preparation.
	32. 6UB, Tanzania. Associate Dean. Has used AVU OER for teaching though not much.
UC Uganda (n=5)	33. 7UC, Uganda (ODel Center Director). Has used AVU OER for teaching.
	34. 8UC, Uganda. Dean, Faculty of Science Has used AVU OER for teaching.
	35. 9UC, Uganda. Has used AVU OER modules for teaching. Somewhat familiar with terms OER&OEP
	36. 10UC, Uganda. Coordinator undergraduate programmes. Has used AVU OER for teaching and learning.
	37. 11UC, Uganda. Coordinator for Post graduate programmes. Author & peer-reviewer AVU OER.
UD Zambia (n=3)	38. 12UD, Zambia. Has used AVU ICT integration modules for teaching.
	39. 13UD, Zambia. HoD Quality Assurance & Research. Has used AVU OER ICT integration modules for teaching.
	40. 14UD, Author, AVU OER
UE Zimbabwe (n=1)	41. 5UE, Zimbabwe. Author & peer reviewer of AVU OER
UF Somalia (n=1)	42. 16UF, Somalia. Dean, Faculty of Computing & ICT. Was involved in setting up of Computer Laboratories for use by the AVU program at [UF].

UA Kenya (n=10)	43. 17UA, Kenya. Author AVU OER module, Prof. of Education & Coordinator of PhD programmes)
	44. 18UA Kenya (Director Open and Distance Learning, ODeL facilitator AVU OER)
	45. 19UA Kenya (Head of Math Department, author AVU OER)
	46. 20UA Kenya (E-learning project leader, instructor AVU ICT Basic Skills)
	47. 21UA Kenya, Author AVU OER, did not complete module
	48. 22UA Kenya, Department of Physics, Coordinator-ODeL Science (Has used AVU OER for teaching)
	49. 23UA Kenya, (Peer reviewer AVU OER), School of Mathematics
	50. 24UA Kenya Coordinator for AVU Project at UA, Former Dean, Department of Educational Studies
	51. 25UA Kenya (author AVU OER), Department of Computing and Informatics
UG, Kenya	52. 26UG Kenya (author AVU OER), Department of Education and Technology