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Collaborative design of educational digital libraries for African higher education

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Collaborative Design of Educational Digital Libraries for African Higher Education

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Abstract

This thesis will develop a model that can be used to guide collaborative design of educational digital libraries that are relevant to the learning objectives and are appropriate to African Higher Education. Factors affecting connections between educational digital library capabilities, learning processes and learners' needs in higher education will be identified and used to develop the model. These factors will be identified through qualitative studies with the key players (i.e. academics, information professionals, digital library technical designers and students). The model will be iteratively developed and later evaluated for correctness by some of the key players. So far a preliminary literature review has been done to locate related work and identify knowledge gaps. In addition, a pilot study has been carried out and identified some temporal factors that will be pursued further in the proposed study.

Categories and Subject Descriptors

H.1.2 [**User/Machine Systems**] *Human factors*; H.3.7 [**Digital libraries**] *User issues, system issues*; H.5.2 [**User Interfaces**] *User-centered design*

General Terms

Design, Human Factors, Experimentation

Keywords

Digital library design, Collaborative digital library designs, Digital libraries in Higher education, Participatory design, Cross-cultural digital libraries, African Context of Use

1. Introduction

In the past few decades, institutions of higher education (HE) have witnessed unprecedented transformation brought about by developments in information technology. At the heart of this development is the emergence of educational digital resources, including digital libraries and Open Educational Resources (OER). HE institutions in Africa are making efforts to participate in this development in order to overcome challenges of access to tertiary education, and affordable and quality educational resources. However, these institutions are struggling with the innovative adaptation of these technologies to suit their contexts.

Borgman et al. [5] have emphasized that educational digital resources are critical in improving the quality of teaching and learning. Unfortunately, libraries

particularly in African HE have been criticized for not showing appropriate leadership and commitment in adopting innovation [23]. In order for these libraries to make a positive contribution to teaching and learning, in African HE as well as globally, they must be designed innovatively by integrating the instructional functionality in the design process [10]. The design process must also involve key players (i.e. academics, librarians and students) and their needs and contexts [22]. This research proposes to investigate and produce a model that can support the process of designing educational digital libraries that are appropriate to the African HE context. This model should align digital library resources with the learning objectives and collaboratively bring key players to the design platform.

2. Research Problem

Certain designs of digital libraries make them end up being 'passive warehouses' [7] because they do not take advantage of emerging web technologies and are also not user-centric. Such digital libraries fail to connect with end users and instead remain isolated from their intended purpose. Some traditional educational digital libraries can be perceived as belonging to this category, thus discouraging students and academics from using them and instead opting to use web-based digital resources [2, 3, 13]. However, new initiatives in the design of digital libraries, i.e. [8], have highlighted the benefit of including end-users in the design and development process. A recent policy report for the 'American Library Association' [18] also highlighted the importance of participatory design within digital libraries. Besides, Web 2 technologies such as social tagging [20, 16] are moving digital libraries into a new era of end-user control and engagement. This is in addition to studies on participatory designs [25] and user centered designs [32] that have for a long time supported the design of systems according to user needs. These studies help us to understand how digital libraries can be collaboratively designed with users on board. Unfortunately, they do not offer guidance on how to apply such collaborative design approaches in educational digital resources that integrate instructional functionalities.

Collaborative design of digital libraries that integrate learning processes is, however, complex. Firstly, designing learning technologies is often masked by mainstream technology as noted by Dong and Agogino [10]. Secondly, it is difficult to include educators, information professionals and learners in a collaborative design process because of their diverse expertise, characteristics, needs and contexts. In the first place, they appear to be disconnected with each other in their engagement with digital resources [28]. This is confirmed by a study carried out in Kenya [26], which identified that students tend to engage more with their lecturers in accessing and using digital resources while librarians were left out of the process. But how different is each player from the other? The following subsection highlights their different perspectives in relation to their engagement with digital libraries.

2.1 Different perspectives

Academics usually approach information resources from a learning perspective. Their concern is the learning process and how digital resources can match with learning objectives. When they are designing courses, it would be expected that

they integrate library resources into their course designs as it used to happen with the traditional print-based libraries. However, academics now have a range of resources to choose from and there is often ambiguity in how they collaborate with the library as they design courses. Also, in their eagerness to provide support to the learning process, academics often direct students either to their own information collections or web resources which they deem appropriate, as was confirmed in Ngimwa's study [26]. They also provide scaffolding so that students are able to use these resources more effectively. In so doing, they appear to isolate students from the wealth of resources available in university digital libraries.

Academics are also interested in knowledge sharing, and hence the massive development of learning object repositories, particularly OER. However, despite these repositories being digital libraries in the broader sense, academics fail to make the connection between them and the university library systems. For example, they would benefit from information organization skills of their library colleagues in order to categorize and tag these resources, but they fail to notice these skills [28].

Librarians approach digital libraries from an information perspective and in so doing produce quality educational resources, which unfortunately are rarely aligned to the learning objectives. Their main concern is how to produce quality and credible resources that can easily be searched and retrieved. They rarely use learning terminologies such as scaffolding, learning objects and OER. Although they have quality programs, i.e. information literacy skills that can provide scaffolding to learners, integrating them into the learning process is usually the decision of academics. They also often fail to connect with the learning object repositories because they perceive them as being learning resources and not digital libraries. However, failing to make the connection with the learning process means that these resources are not always relevant to the needs of the learners and educators. Consequently, these digital libraries tend to remain isolated from the learning process and user's experience with them becoming less engaging [31].

Students have their unique characteristics and needs when it comes to using digital resources. Institutions of higher learning are now populated with 'Net Generation' learners who are self-directed in their learning. They combine their IT skills and independence to explore the universe of knowledge on the Internet. Ngimwa's study [26] established that these students are becoming content creators and are interested in ownership of the design process as well as usage of the resources. These learners have very strong collaborative qualities and maximize on the benefits of the Web 2.0 resources to create collaborative networks so as to share their resources [27]. Their first point of information discovery is the Internet and they perceive Google as the most effective searching tool to explore it. However, they see the library as a sophisticated and time consuming facility [19, 24]. Besides the Internet, these students depend heavily on resources recommended by their lecturers. In other words, students' information resources usage is directed by learning objectives set by academics. However, these students are often weak in critical and evaluative skills that are required in mining quality information from the internet. They would benefit

immensely from the library's information literacy programs, but as already highlighted, they are not keen on using the library. Such students require scaffolding and support to guide them to appropriate use of the technology rich environment.

Finally, students entering higher education come with different cultural and technological backgrounds [14]. Some of them access educational digital libraries for the first time when they enter university, while others would be coming from cultures that perceive digital libraries differently.

3. Research Questions

The previous section and subsection have clearly demonstrated that although there are benefits of participatory designs of educational digital libraries, the complexity involved demands that there be guidance in designing such libraries. Brandt [[6] agrees that organizing such a design process that involves people with different expertise, interests and professional languages is uncommon and therefore designers need a framework that can help organize participation in such a way that various competencies are utilized in an inclusive manner. Consequently, the proposed thesis intends to develop a design process model that can be used to support digital library designers in designing a collaborative educational digital resource design (CERD) for an African HE context. To this end, the thesis will seek to answer two main research questions:

i. *What is the relationship between existing digital library design process and teaching and learning in Higher Education in Africa?*

ii. *What are the design processes and factors necessary for the development of a collaborative educational digital library in Africa and generally?*

In addition, three subsidiary research questions include:

i. *At what stage in the design process can learning objectives be incorporated?*

ii. *Who has ownership of the digital library resources in the design process?*

iii. *Which design processes and factors are African context-specific and which ones are generic?*

4. Literature Review

Several projects have been carried out on participatory designs of educational digital libraries. The National Science Foundation (NSF) for instance, through its National Science Digital Library (NSDL) program has evaluated models of how digital libraries can grow through participants' interactions and involvement [12]. Their main focus has been on growing communities of practice around digital libraries in which the communities also develop their own collections. Other examples of projects that have focused on user involvement include studies carried out by Abdullah & Zainab [1] and Theng et al., [31]. Abdullah and Zainab used the Zachman Framework for Enterprise Architecture to systematically identify stakeholders' needs and contexts to be included in a collaborative digital

library design for a Malaysian secondary school. End users were involved in developing their own content. Like NSDL's projects, Abdullah and Zainab's work did not focus on the linkage between the learning processes and the library design process. Theng's work, however, centered on children designing their own digital library through a process in which learning activities were integrated and support provided. Children were allowed to engage among themselves to identify their needs and preferences and then make decisions of how they wanted their library to appear. This led to a dynamic digital library environment in which end-users were involved as design partners and had ownership and control of the library. While this is an excellent example of a successful educational digital library through collaborative design, it only focused on lower education learners and did not directly include teachers. A study that focuses on higher education and includes other stake holders is necessary to test if similar success can be achieved.

The issue of co-ownership of digital library designs is crucial to successful digital libraries as revealed in Theng's study. Davis and Dawe [8] experimented on the collaborative design of educational digital libraries using two design methods: a task-centered method that drew on a group's strength for eliciting and formulating tasks, and a use-case design that required a focus on defining an explicit process for tasks. The task-centered method that focused on first understanding the user and the user's situations, and facilitating their participation throughout the design process, worked well. However, the use-case approach was problematic as it assumed collaborators' readiness to commit to a pre-formatted sequence of design steps. The collaborators had no direct ownership or buy-in to the process and hence lacked readiness to commit to the process. Although this experiment underscores the importance of ownership of the collaborative design process by collaborators, it does not extend to other factors necessary for the design of digital libraries that integrate the learning process.

Examples of projects that have integrated learning principles in the design of educational digital libraries include studies carried out by Dong and Agogino [10] and Grierson et al. [13]. Dong and Agogino conducted an evaluative study of principles that distinguished designing digital libraries for education and designing those for information retrieval in general. To do this, they introduced a contextual design approach around the constructivist view of learning, which focused on instructional-driven rather than technology-driven goals. Grierson et al's study took a similar approach of integrating learning theories in the design of a digital library (LauLima) for Engineering Design students. These are students who learn through project-based and problem-based approaches and therefore depend largely on content that is of informal and tacit nature such as sketches, reflective logs, etc. To meet this need, they designed a library system that combined an informal wiki-supported workspace where students could create dynamic wiki pages and share, with a formal searchable and browsable section. Quality students' content was selected by academics for inclusion in the formal collection. Information professionals provided expert input in metadata and copyright issues. A workflow model was used to evaluate the development of the digital library and ensure quality. These two studies offer some useful insights into factors relevant for designing educational digital libraries, such as

the integration of learning theories and social networking tools in the design process. However, they do not extend beyond one culture. In addition, while the workflow model in the LauLima library is a good example of how key players can contribute to a collaborative design, it does not elaborate the process involved in achieving such collaboration for the sake of replication in other contexts.

With the international usage of digital resources one important and often overlooked design aspect are cultural issues. However, Tibenderana and Ogao's [30] pilot study on the acceptance and use of electronic libraries in Uganda provides a good example of cultural design issues. This study established that relevancy and awareness of electronic resources are vital in the acceptance and use of electronic library services in developing countries where technology is still emerging. Duncker's [11] study on Maori people's acceptance of digital library is useful in understanding cross-cultural usability of digital libraries as it revealed how cultural values of a community can affect acceptability and usage of a digital library. While such studies are important in understanding the development of electronic libraries in different cultures, they focus on issues of acceptability and usability rather than collaborative designs that incorporate the learning aspects.

5. Prior Work: A Pilot Study

As a way of focusing the research topic, a small-scale pilot study was carried out in a UK university. A selected number of academics and informational professionals participated in unstructured interviews that aimed at understanding how digital information resources support learning. The following main themes emerged and these will be pursued further in the proposed study:

i.   Existence of unclear collaboration models between the university library system and the learning process.

ii. It is not clear at what stage in the learning process to integrate digital information resources and how to get them integrated.

iii. A general lack of awareness of how educational digital libraries can contribute to the learning process.

iv. End-user ownership and control of digital resources: academics and students create their own content using web 2.0 tools such as social bookmarking tools.

6. Research Approach: A HCI research perspective

This research seeks to establish a design process model for supporting the development of a collaborative educational digital library for a particular context (i.e. African HE). This model will be formulated by defining the design processes and factors necessary for development of such a digital library. Specifically, this will be a descriptive model and not a predictive one because it aims at defining a process where little is none. Descriptive models are suitable for qualitative studies as they provide a framework for discussing a problem or situation, as compared to predictive models which are used for hypothetical testing [21]. A hypothetical testing type of study is suitable where much is known about a

phenomenon in question [33]; very little is known about the phenomenon under investigation in the proposed study. Case studies across different African HE contexts will be used to formulate the model, highlighting design processes and factors that are context-specific (i.e. within African HE context) and those that are generic and can apply to any context.

This process advocates for collaborative design approaches. It will therefore be guided by principles of participatory design. Several authors i.e. [9, 6, 4, 33] agree that participatory design approach incorporates users in the design process as active collaborators. They further emphasize that this design approach is iterative as the design is subject to evaluation and refinement at every stage of development. The final product is open and flexible to allow for future emerging knowledge [17, 15]. Consequently, the proposed model development follows three stages through an iterative process as illustrated in Figure 1. The first stage consists of a review of relevant existing literature and the pilot study that was carried out based on a single case study. These two processes provide initial ideas for the model development. Some of these ideas may be applicable in other case studies, others may not. This will lead to the second stage, comprising of further in-depth studies of more case studies intended to produce a rough model, through a process that continuously goes back and forth between stage 1 and stage 2. The rough model will then be subjected to expert evaluation (stage 3) in order to come up with a more refined model, still through an iterative process between the three stages. The end product should be open and flexible as it can be modified and developed further in future research.
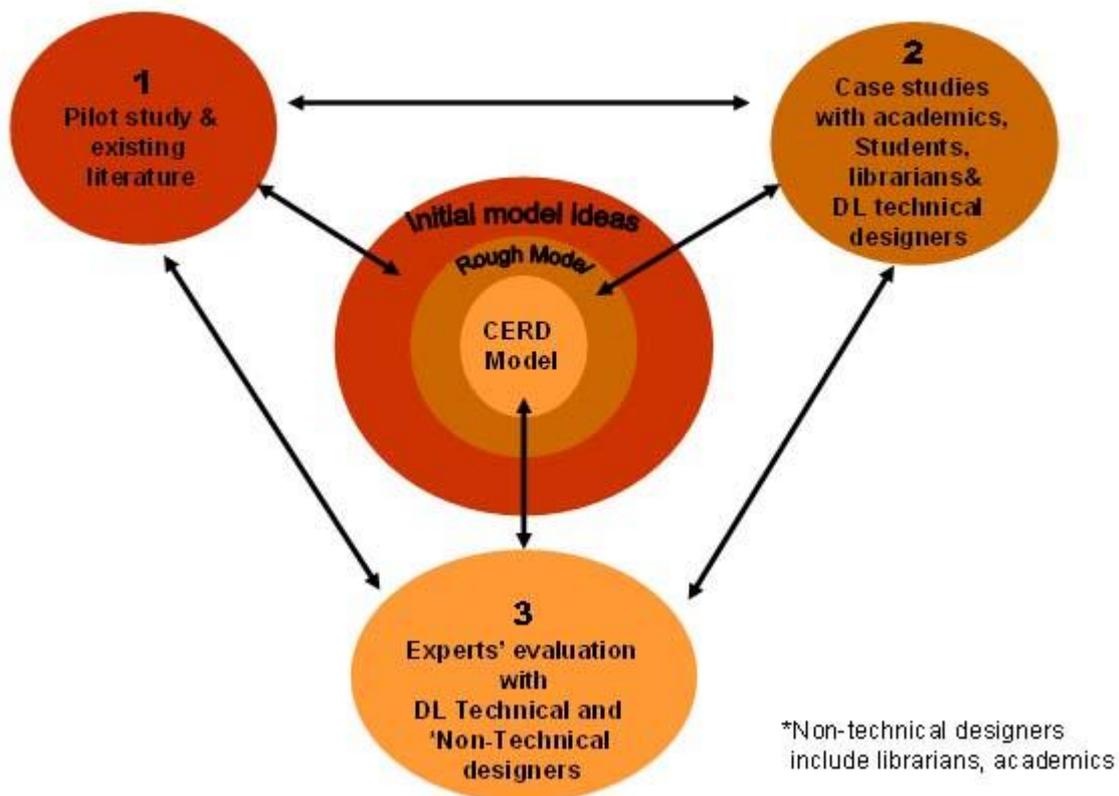

Figure 1: CERD Model development process

From the above background, this thesis is largely informed by Human Computer Interaction (HCI). However, in order to make the proposed model building valid, this thesis borrows from other related domains of knowledge, namely information sciences, e-learning and African Higher Education.

7. Research Methodology

This section presents a sketchy outline of the proposed research methodology. A mixed method approach will be adopted to identify processes and factors for the CERD model development. This will involve qualitative data obtained from in-depth interviews and focus groups with key players (i.e. academics, information professionals, students, and digital library technical designers), partial ethnographic observations, and documentations. Quantitative data from user logs and statistical reports will also be gathered in order to triangulate qualitative data. Qualitative data will be analysed thematically in line with the first stages of grounded theory analysis following open coding and synthesis of all the data into common themes [29]. This approach has been chosen because compared to other social science methodologies, it allows themes to emerge from the data, thus uncovering previously unknown issues. The SPSS statistical software will be used to analyze the quantitative data.

The research will be carried out within a case study research strategy. Three case studies will be identified from three universities in Africa in order to bring out the context specific issues. Study participants will be identified through purposive sampling so as to select people who have directly interacted with digital libraries.

In order to verify the developed model, experts' reviews of the correctness of the model will be solicited. The researcher will aim at getting experts from Africa as well as other contexts like UK in order to provide suitable evaluation for both the generic and context-specific model factors.

8. Anticipated Contribution

It is anticipated that this thesis will make the following contribution:

i. Provide a model that

    a. defines the design process and factors necessary for the development of a collaborative educational digital library for higher education institutions with a particular focus in Africa, but could also apply globally;

    b. provides design support for various educational digital library designers in the form of:

        ▪ design process guidance notes for technical designers

        ▪ templates that can be used by learning designers and librarians, detailing for example how they interact and engage with other, and the stage for incorporating resources in the learning processes, etc.

ii. Could potentially inform policy making in educational technology use in African HE as well as contribute towards curriculum reform at schools of information sciences in regards to emerging skills that are required for today's information professionals;

iii. Add to the body of knowledge in the field of digital library research.

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