Pedagogical and Conceptual Design of An E-learning Environment for HIV/AIDS Education

Bada Joseph Kizito, Jarkko Suhonen

In this paper, we present the pedagogical and conceptual design of an e-learning environment, NetAIDS, for HIV/AIDS education in Uganda. We also identify the first concrete design solutions for the NetAIDS environment, which will be later implemented and evaluated. Our focus is to analyse the first steps towards the design of the NetAIDS environment following a development research methodology. Four important design aspects for the NetAIDS environment are identified. First, the design of the environment should be based on sound pedagogical principles. In our case, we suggest a constructivist approach. Second, the design and development of technological solutions is based on the development research method for generation of a prototypical e-learning environment, which uses scaffolds and new web technologies (e.g. web 2.0) to support Ugandan youth to learn about HIV/AIDS. Thirdly, we present a framework for designing NetAIDS environment in the context of Ugandan schools. Finally, a formative evaluation scheme is presented to provide early feedback from the users so that the designed NetAIDS environment can be modified to suit better suit the needs and requirements of the users. The conceptual and pedagogical design principles for HIV/AIDS e-learning environment can also be applied in other contexts.

1. Introduction

ICT-based HIV/AIDS education and counseling services have been developed in various African countries, such as Uganda and Tanzania [Bloome 2001; Duveskoq 2008]. The existing e-learning approaches for HIV/AIDS education provide limited educational services to children with most solutions presenting static online content, carton-based stories and social networks using email as a means of communication [Bada and Suhonen 2008]. In this paper, we present a conceptual and pedagogical design of NetAIDS e-learning environment, which is aimed to provide a fresh perspective to the HIV/AIDS education and counseling services for Uganda youth. The pedagogical and conceptual design of the environment consists of three main components namely the pedagogical design component, NetAIDS system design and cognition design. Computers are nowadays commonly used in Uganda. There is a need to design novel e-learning solutions for HIV/AIDS education to impart the knowledge of the epidemic to the children so that they can protect themselves against the deadly virus. The contemporary Web2.0 tools and social media offer a lot of opportunities for building motivating and inspiring e-learning environments in which children have a variety of approaches to learn new things using different media such as text, graphics, audio, video and animation. The present paper is a first concrete step towards utilizing the possibilities of novel ICT solutions in Ugandan schools. The paper is constructed
as follows. In Chapter 2, we present the pedagogical perspectives and requirements for the design of the NetAIDS environment. Chapter three includes a conceptual design of NetAIDS environment including three main components human-computer interaction, digital resources as learning objects and technological requirements for the implementation of the environment. In Chapter 4, we discuss about the future work including implementations and formative evaluation plans. Finally, in Chapter 5 we provide a summary and conclusion for the paper.

2. Pedagogical Design Of NetAIDS Environment

One of the most fundamental aspects of any ICT-based educational environment is the theoretical perspective behind the design solutions to support the learning processes of learners. Different learning theories establish a philosophical and conceptual framework for learning. According to Gredler [1997], learning theories can work as guidelines for planning educational support for learners, like e-learning environments.

We choose a constructivist approach for the NetAIDS environment for two major reasons: First of all, the children in high schools today are growing up in an environment which is affected by AIDS epidemic, they can share ideas on the effects of AIDS on society using online social networks and they can construct stories to educate fellow children. Secondly, children can learn better from their fellow children as compared to passively receiving knowledge from teachers without the active participation of the children.

2.1 Constructivism as a theoretical foundation to the pedagogical design of NetAIDS

Hadjerrouit [2005] affirmed that constructivism has its roots in the constructivist philosophy. Its central figures are Bruner [1999] and Piaget [1969]. The defining characteristic of constructivism is that knowledge can not be transmitted from the teacher to the learner, but it is an active process of construction. A pedagogy that relies on the constructivist philosophy requires a set of pedagogical guidelines and strategies that can be translated into practice:

- **Construction**: Knowledge is actively constructed by the learners through their interactions with the environment, not passively transmitted by teachers [Booth, 2001]. Knowledge is constructed by using the learner’s prior knowledge as foundation. Teachers serve primarily as collaborators, guides and facilitators of learning, not as transmitters of knowledge [Crowther, 1997].

Relevance for NetAIDS

Children are able to construct poems and drama for AIDS education. The educational content for AIDS prevention can be accessed by other children via an e-learning environment.

- **Cognitive skills**: In order to be useful for problem solving, knowledge needs to be related to each other. The process of constructing interrelated knowledge structures
requires cognitive skills that learners do not possess, such as analysis and reasoning skills, analogical thinking, reflection, and self-evaluation. Thus in order to scaffold their performance, instructors should identify problem-solving skills that are specific to the subject matter. The development of a personal growth requires learners to think about their knowledge, understanding, ideas, and beliefs about learning [Avraamidou, Zembal-Saul 2002].

**Relevance for NetAIDS**

It is necessary to introduce children to basic AIDS education with an assessment either in form of questions or puzzle games to test their understanding. The assessment in NetAIDS environment is based of computer games which children can perform to test their understanding of basic AIDS knowledge.

- **Authentic Tasks**: To get students actively involved in knowledge construction, learning activities should focus on realistic, intrinsically motivating problems that are situated in real world tasks [Wilson, 1997]. Rather than applying knowledge to solve abstract problems, knowledge must be constructed in real and useful contexts.

**Relevance for NetAIDS**

Since the teenagers in Uganda today are growing up in societies devastated by AIDS epidemic, they can be in position to construct AIDS prevention knowledge based on real world experiences.

- **Related cases**: Learners should have access to a set of related experiences and cases from previous learners that a student can draw on to represent their deficient knowledge. Analogical reasoning is the key skill of reusing related cases. It includes a search for similarities and differences between the related cases and the new problem to be solved [Hadjerrouit, 2005].

**Relevance for NetAIDS**

Debates and drama are common practices in high schools, so the students have skills to organize AIDS preventive education in form of drama and poems from the experiences they have in school drama and debates.

- **Collaboration**: Learning occurs not in isolation but by means of people working together, and as they exercise, verify, and test their knowledge through discussion, dialogue, and playing computer games. Hence learning should take place in an environment that supports collaboration, social negotiation and interaction, because as a learner gains experience in social situation, this experience may verify a learner’s knowledge constructions [Bolhuis, 2003; Duffy and Cunningham, 2001].

**Relevance for NetAIDS**

This practice of collaboration for learning purpose is well facilitated by web 2.0 technologies being proposed for HIV/AIDS education and counseling services.

- **Information Technology**: The design of a constructivist learning environment goes far beyond the computer material itself, but well-designed web-based technology may facilitate constructivist learning when it provides learners the information they
need.

**Relevance for NetAIDS**

The vision here is to use web 2.0 tools for students to exchange messages in group discussion on issues to do with fight against AIDS epidemic. Students also need to evaluate their own knowledge by playing an online computer game on HIV/AIDS prevention education.

**2.2 Other pedagogical requirements**

We can also identify practical requirements for the pedagogical design of the NetAIDS environment. First, the children should contribute and share information freely on preventive actions, they should freely communicate among themselves on how to cope up with the trauma AIDS might have caused in affected families. Second, a variety of approaches should be used for communicating preventive information to the children using different media, e.g. instruction as online text and graphics, multimedia lessons recorded from HIV/AIDS instructors and counselors, real world stories constructed by children to educate fellow children and an automated online database for provision of counseling services by fellow students and teachers or AIDS counselors. Thirdly, the NetAIDS environment should be designed to support learning principles suitable for the main audience of the environment, e.g. teenagers and online teacher’s tasks. The following pedagogical design aspects are also taken into consideration during the design and implementation of the NetAIDS environment [Vrasidas 2004]:

- Planning and identifying goals and objectives,
- Standards and content for the course,
- Conducting learner and audience analysis,
- Identifying technology requirements,
- Reviewing other similar courses,
- Facilitating the content analysis,
- Reviewing samples of evaluation activities to match objectives and content,
- Examining templates for syllabus design for a variety of levels and selecting the appropriate activities and;
- Choosing the right media attributes to support the objectives of the learning experience.

**2.3 Use of scaffolds in the NetAIDS environment**

Scaffolding is one of the concrete educational construct based on the constructivist learning theories. The concept of scaffolding is closely linked to the idea of the zone of proximal development [Gredler, 1997; Vygotsky, 1978]. Scaffolding refers to the change of level of support. When a student is learning something for the first time, a skilled person may use direct instruction, but as the student's competence continues to grow the amount of guidance given becomes less. Scaffolding is in most cases used to support students to reach the upper limits of their zone of proximal development.
We have analysed some of the existing web technologies that can be used to scaffold children in HIV/AIDS education. We eventually identified design principles for using scaffolds in the NetAIDS environment.

The evaluation approach we have presented in Table 1 describes how effective the NetAIDS environment achieves the objectives of learning and how learners benefit from it in terms of quality of instruction, usability issues and motivation to use NetAIDS.

**Table 1: Learning principles and theories for designing and evaluating content for AIDS Education**

<table>
<thead>
<tr>
<th>Learning Principles</th>
<th>Scaffold design in NetAIDS</th>
<th>Evaluation approach</th>
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<tr>
<td>1. Cognitive development has limitation to a certain range at any given age. 2. Social interaction is the foundation for full cognitive development.</td>
<td>Provision of online chatting services for children to ask questions to teachers and HIV/AIDS counselors so that they get replies to challenging issues they experience in real life that can lead them in getting HIV/AIDS infection.</td>
<td>1. The type of instructor’s response and the time to respond when the student has a question to ask or is experiencing difficulty. 2. Effectiveness of the variety of support in the forms explanation, example, question, summary, suggestion or encouragement</td>
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<tr>
<td>1. Knowledge needs to be presented in an authentic context, i.e., settings and applications that would normally involve that knowledge. 2. Learning requires social interaction and collaboration.</td>
<td>Online participation by children through demonstrations that educate fellow children to keep away from temptations that leads to HIV/AIDS infection.</td>
<td>Video content analysis. Evaluation of video education in form of interview to children. Questionnaires to assess the learners’ knowledge of the interactive stories.</td>
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<tr>
<td>1. The instruction should address the experiences and contexts that motivates the students to learn (readiness), 2. The instruction should be well organized so that the student can learn from it with minimum difficulty 3. The instruction should be designed in such a way that a student goes beyond the given information to come up with new discoveries.</td>
<td>Children should build stories constructed from their real world experiences. These stories can educate other children. Introduction of online educational resource for access by children (youth) for awareness creation and to impart HIV/AIDS knowledge in them.</td>
<td>Children can be interviewed to find out the points they get from stories in HIV/AIDS preventive education and counseling support services. Provision of computer games for NetAIDS education to evaluate children’s basic knowledge in HIV/AIDS education.</td>
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3. Conceptual Design Of Netaids

3.1. A conceptual design framework for NetAIDS

The proposed conceptual design framework (see Figure 1) for the NetAIDS environment in the Ugandan school context has three main components namely: (1) the human computer interface that describes the physical interaction between the user (high school student/teacher) and the computer, (2) the digital resource which is the actual educational material and the content generated as a result of interactive activities between the learners and the instructors, and (3) the technological requirements for implementation of the NetAIDS environment. The purpose of the conceptual design framework is to provide a comprehensive picture of the socio-technical innovations for supporting HIV/AIDS e-learning environment. The framework can be used to design NetAIDS learning activities, such as creation of locally relevant educational material in HIV/AIDS, sharing of experiences and best practices in HIV/AIDS prevention, collaborating and interacting with peers nationally and internationally and supporting the actions of various actors in changing roles (e.g., student, teacher, facilitator, learning coach, human resource or education manager).

3.1.1 The human computer interface

The human computer interface depicts the interaction between the computer and the user (student/teacher). A user interacts with the computer in the NetAIDS environment when accessing instructional materials for AIDS basic knowledge, playing NetAIDS game, interacting with the social network consisting of peer learners and teachers, exchanging text messages with other users in NetAIDS environment, and accessing multimedia educational content and counseling services.

3.1.2 Digital resources

An important aspect of the conceptual design framework for the NetAIDS environment is the provision of educational content and support services in the form of learning objects and learning tools. A learning object can be defined as” a resource, usually digital and web-based, that can be used and re-used to support learning. Learning objects offer a new conceptualization of the learning process: rather than the traditional “several hour chunk”, they provide smaller, self-contained, re-usable units of learning” [Jenny 2006]. A learning tool is a small application designed to support learning, studying and teaching activities. The conceptual design framework proposes that various learning objects and tools should be created to provide a variety of different services for HIV/AIDS education;

• Learning modules which should be designed for the NetAIDS environment emphasizing the origin of AIDS, ways of spreading, preventive education, positive living, care for AIDS orphans, etc
• Application of Web2.0 tools for creating social networks between children and teachers of high schools. For instance, a wiki tool could be used by children to communicate, discuss, and generate preventive HIV/AIDS knowledge.
- Activating user created educational content – this can be created by building children stories and recorded teachings for online access.
- Counseling services by automating responses to frequently asked questions using web database and online counselor’s services accessible by use of chat tools and Skype.
- Mobile phone messaging by use of mobile phones.
- NetAIDS games for evaluation of children’s knowledge.

3.1.3 **Technological requirement**

The technological requirements define the implementation solutions and technologies which are used to create the NetAIDS environment. The technological solutions include web 2.0 tools for social networks, Eden windows environment for computer games and database management system. The exact decision concerning the implementation decisions will be made during the later stage of the development process.

**Figure 1: The conceptual design framework for NetAIDS environment**
3.2. Use scenarios to illustrate the added value of NetAIDS to Ugandan Schools

The following user scenarios provides a concrete picture of how the NetAIDS environment would function in practice:

1. Introductory instructional materials provide an introductory lesson to HIV/AIDS education explaining to children ways of getting AIDS disease and ways of avoiding it, this could also extend to ways of taking care of people infected with AIDS. After the users have taken the introductory session, an online assessment is used to evaluate the knowledge of the children. Another approach to instruction delivery and counseling services can be by providing an online multimedia content in which recorded instructions from teachers and counselors is accessed by school children.

2. At any time children can ask questions or the system can prompt the children to ask questions related to HIV/AIDS. The automated frequently asked questions service would compile a response to the questions.

3. Networking among children can be supported by the wiki in which specific discussion topics, for example “HIV/AIDS epidemic: Advice to the children”, can be presented to children to contribute ideas.

4. Use of mobile phones can also promote communication among youth although this is limited as mobile phones are prohibited for children to use in Ugandan schools, but this can still serve children who are having vacation at home.

5. Various NetAIDS games are used to motivate and enhance learning of the AIDS/HIV knowledge. The games can also be used to assess the students’ knowledge of the basic AIDS/HIV concepts.


4.1 Implementation plans of NetAIDS

Educational data has been collected from selected high schools in Uganda. This data collected includes students’ drama and poems. Learning modules have been developed with corresponding computer games for evaluating students’ understanding. The first prototype of NetAIDS is being developed and will be ready by mid July 2009.

4.2 Role of formative evaluation in future development

Formative evaluation is a continuous process throughout the design and use of the digital learning environment. This evaluation seeks to find out the parts of the digital environments that work and the justification that they work [Van Den Akker, 1999; Reeves 2000]. The main purpose of the formative evaluation is to change the functionality and design of the environment based on the feedback received from the expected users of the environment. Hence, the formative evaluation feeds back into the development process of a e-learning environment. The aim is also to identify other success factors as the popularity of the environment among learners and usability issues. A formative evaluation enables collection of information from the users of the e-learning environment for the purpose of redesigning the system in order to improve
on it. According to [Reeves and Hedberg 2003], formative evaluation should start at the early stages of the development of an e-learning environment. This can be done by gathering learners’ opinions, responses and suggestions to practical problems in order to get guidance for future development. The proposed methods for formative evaluation for NetAIDS are user reviews, usability testing, alpha, beta and field tests of prototyped NetAIDS environment with a wide representative of potential users.

5. Summary And Conclusion

An e-learning environment for HIV/AIDS education has a lot of potential of increasing AIDS education outreach to children in Uganda many schools have computer labs with Internet connectivity. When building an e-learning for educating children, the design should not only focus on technology alone but pedagogical and cognitive aspects of the children should be incorporated in the design process. Children can be motivated to learn online when the online content is logically organized. We propose to use constructivist learning principles in the pedagogical design of the NetAIDS e-learning environment for HIV/AIDS education. Additionally, we propose a conceptual design for the NetAIDS environment. The next step in the design and development process is to apply the pedagogical and conceptual design framework in a creative way in order to implement an evolutionary prototype for the NetAIDS environment. Formative evaluation of the early prototype will provide also valuable information related on how to improve and refine the conceptual and pedagogical design of the NetAIDS environment. The pedagogical and conceptual design of the NetAIDS environment presented in this paper can also be applied in other contexts to implement e-learning environments for HIV/AIDS education.

References


